Antimicrobial Stewardship: A Thai Case Study of Nursing Roles

by

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Submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

Deakin University

December, 2017
I am the author of the thesis entitled

‘Antimicrobial Stewardship: A Thai Case Study of Nursing Roles’

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Acknowledgement

First of all, I would like to express my special thanks to Assistant Professor Jariya Wittayasuporn, who was the Director of Ramathibodi School of Nursing, Mahidol University when I commenced my candidature, for giving me the opportunity and supporting me to study in Australia.

I wish to express my sincere thanks to Professor Mari Botti for accepting me as her student. Thank you for your patience with me along the journey especially for your support for me as an international student. You are my role model for academic, professional and critical thinking.

To Professor Julie Considine and Professor Andrea Driscoll, I appreciate your kind support in academic writing, thinking and for acting as sounding boards to ideas and concepts along the way.

To Associate Professor Ana Hutchinson, I have learnt so much from you and attribute my success to your generous assistance along the way.

To Dr. Kumthorn Malatham, your support and guidance have been second to none and it’s a pleasure working with you.

I am indebted all the participants who were involved in my study. Your generous participation not only assisted me in this work but also contributes to better quality of care for patients in Thailand.

I would like to thank all my friends in Melbourne, my life is so much richer because of your friendship.

To Mum, Dad and my sister Funn, I cannot imagine how I could live without all of you. Thank you for your unconditional love and all your encouragement and support.

To my husband John, thank you for making me a part of your life. I would have been completely lost without your support emotionally and mentally, especially during the stressful and challenging times.
List of publications, conference proceedings and awards arising from the thesis


Recipient of the Deakin University, School of Nursing and Midwifery Annual Student Award (2017). This is an award for outstanding research scholarship to an international student enrolled in the PhD Doctoral program at the School of Nursing and Midwifery, Deakin University, Melbourne, Australia.
Abstract

Background

Antimicrobial resistance (AMR) is a global healthcare problem with significant negative consequences, particularly in Thailand where antibiotics are sold without prescription. Inappropriate use of antimicrobial medications is a major cause of AMR worldwide. Antimicrobial stewardship (AMS) was initiated in response to the growing problem of AMR and to ensure optimal antimicrobial use that minimises AMR. A multidisciplinary approach is considered best practice in AMS, however, not all AMS programs involve nurses, despite nurses comprising the largest and only group of healthcare professionals that provide 24-hour care in acute hospital environments. In addition, the role and contribution of nurses to AMS has not been fully described or evaluated in the Thai or international research literature.

Aims and Methods

This research program used a single institution, case study approach to explore the current and potential roles of nursing in AMS, within the broader context of clinical governance in the acute healthcare setting in Thailand, and, to describe the attitudes and perceptions of key stakeholders to antimicrobial resistance and stewardship. The research was conducted in four phases using multiple methods: survey, in-depth interview and focus groups. Methodological triangulation was used to fulfil the aims of the research. The case hospital was a 1,000-bed university healthcare facility in Bangkok, Thailand. The specific aims of the study were to:

I. Explore the perceptions and attitudes toward AMS among clinicians in acute healthcare in Thailand;

II. Identify strengths and weaknesses of AMS clinical governance structures and activities as perceived by organisational leaders (executives and clinical leaders) and nurses working in acute healthcare in Thailand, using the CDC recommendations as a framework for the analysis;

III. Explore current and potential for patient participation in AMS in Thailand; and
IV. Explore how organisational leaders and nurses perceive potential future roles for nurses in AMS in Thailand within the current governance, educational and practice context.

Results

The perceptions and attitudes towards AMR and AMS were explored in a survey of 1087 participant clinicians who worked in acute healthcare in Thailand (62% response rate), comprising 392 doctors, 613 nurses and 82 pharmacists. The majority of participants agreed that improving antimicrobial prescribing would decrease antimicrobial resistance (AMR) and should be a priority of hospital policy. Doctors were significantly less likely to agree with policies that limit antimicrobial prescribing ($p<0.001$) compared with nurses or pharmacists, and doctors were significantly less likely than other clinicians to be interested in participating in AMS education ($p<0.001$). Pharmacists indicated highest agreement with statements recommending that a specialist team provide individualised antimicrobial prescribing advice ($P<0.01$) and that feedback improves antimicrobial selection ($p<0.001$). Nurses were less likely than other participants to agree that community antibiotic use ($p<0.001$) or patient pressure for antibiotics contributes to AMR ($p<0.001$). It was also noted that the results of the clinician survey identified that fewer nurses than doctors and pharmacists had heard of AMS terminology in English (10.9% vs. 20.4% vs. 48.8%, $p<0.001$).

Similarly, the themes emerging from organisational leader interviews and focus groups with nurses were that AMR was a substantial problem across all sectors of Thailand and within the study hospital. The findings highlighted the potential barriers and facilitators to effective implementation of AMS programs in Thai hospitals. Semi-structured interviews were used to identify the strengths and weaknesses of AMS clinical governance structures and activities; there were 15 interviews with organisational leaders and 18 nurses in three focus group discussions. A major finding in relation to clinical governance was that although there was executive level endorsement of AMS projects at the study hospital and a strong, recognised clinical champion who provided leadership for AMS activities across the organisation, the AMS program had not been fully integrated into the
clinical governance structures of the organisation. Other findings highlighted the limited engagement of clinicians with the AMS program resulting in variable implementation of the program in clinical practice. Participant recommendations to improve the AMS program in the study hospital included: 1) the development and use of formal AMS policies, 2) increasing organisational investment in personnel, 3) development of information management systems, 4) provision of staff education, and, 5) establishing a multidisciplinary approach to AMS.

A total of 205 patients were surveyed and 24 nurses participated in focus groups or interviews to explore the current and potential for patient participation in AMS in Thailand. The main findings were that in the Thai community, both patients and nurses perceived that antibiotics are commonly used, and that there was a misconception by patients that antibiotics are useful to treat viral infections. Patients also reported that they relied on health professionals for information about antibiotic use in the community and they wanted more information about the best way to use antibiotics. When in hospital, patients were not sure if they needed antibiotics and they expected health professionals to manage their antibiotic use. However, patients also wanted to participate in AMS during their hospitalisation. There was limited explicit recognition by clinical nurses of the potential to engage patients in AMS or the possibility for patients to take an active role in the process. Further work is required to promote patient participation as an active process in AMS and to foster decision-making in antibiotic use that is a shared process involving clinicians, patients and their families.

The potential future roles for nurses in AMS in Thailand within the current governance, educational and practice context were explored in interviews with 15 organisational leaders and in focus groups with 18 nurses. Findings were that nurses’ role in AMS in acute healthcare is to support AMS system processes by monitoring: patient safety, assessing optimal antibiotic use and by providing relevant patient education. Specialty nurses provide specific advanced and extended roles in AMS in both the acute and primary health care settings. However, the lack of existing policies that formally describe the scope of practice and responsibilities of nurses in relation to AMS, existing professional hierarchies that limit the scope of nurses’ role
within the context of a poorly defined overall role for nurses in AMS in the Thai healthcare system, and inconsistent engagement of nurses in AMS were perceived barriers to the full involvement of nurses in the process of AMS. Moreover, these factors limited nurses’ involvement in managing AMR. Potential future roles for nurses that were discussed included the strengthening of existing roles by integrating nurses into the multidisciplinary team and the development of advanced and extended existing roles.

**Conclusions**

The findings of this study identify that organisational support is needed if nurses are to engage AMS programs consistently in order to support hospital quality and safety framework. The implications of a clear clinical AMS governance structure and a policy for clinical nurses, integrating AMS knowledge into undergraduate nursing curriculum, providing in-service educational programs about AMS for nurses, and developing a leadership role in AMS for infection control nurses in acute care along with advanced practice roles for nurses in the regional areas of Thailand are suggested. Further research is needed for a broader perspective by exploring the current and potential role of nurses in different acute care settings in different level hospitals and in remote or provincial areas in Thailand.
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Chapter 1

Introduction

1.1 The research problem

Antimicrobial resistance (AMR) is a major healthcare problem worldwide (WHO, 2014a). Patients with antimicrobial resistant infections are more likely to be at risk of worse clinical outcomes, recurrent infection, and death, than infected patients without AMR (Huttner et al., 2013). In addition, AMR creates a massive financial burden to healthcare systems (WHO, 2011b). AMR is a problem in both developing and developed countries (Lestari, Severin, & Verbrugh, 2012). The South-East Asia (SEA) region faces unique problems related to antimicrobial usage (WHO, 2010a). In more than half of South-East Asian countries including Thailand, people have easy access to antimicrobials without a doctor’s prescription (WHO, 2015b). In Thailand, as many as 90,000 patients are affected by AMR annually and the cost of the therapeutic use of antibiotic medications is over $US 200 million per year. The increase in AMR has resulted in approximately 3.24 million extra days of hospital stay and accounted for 38,481 deaths annually in Thailand (Pumart et al., 2012).

Antimicrobial stewardship (AMS) is important to ensure optimal antimicrobial medicine use and minimise antimicrobial resistance (MacDougall & Polk E., 2005). A multidisciplinary approach is considered best practice in AMS (Lin et al., 2013b), however not all AMS programs include nurses (Edwards, Drumright, Kiernan, & Holmes, 2011c). Nurses are the largest group of healthcare professionals and are the only healthcare professionals with patients 24 hours a day in acute care environments (Mensik, 2014). Nurses are therefore in a unique position to educate patients and family regarding safe use of antimicrobial medicines, ensure evidence-based administration of antimicrobial medicines, monitor the effectiveness of antimicrobial medicines, identify unnecessary antimicrobial medicines and contribute to multidisciplinary plans of care (Edwards et al., 2011c; Galvin & Fennell, 2012; Gillespie, Rodrigues, Wright, Williams, & Stuart, 2013b; Ladenheim, Rosembert, Hallam, & Micallef, 2013b; Lim, 2010; Storr, 2012).

Although nurses may not be direct prescribers of antibiotics, they have the potential to influence the prescription and use of medicines by monitoring
prescription decisions (Castledine, 2006; Jutel & Menkes, 2010b) and ongoing therapy. In addition, actively educating patients is a key strategy in reducing AMR to which nurses can make a major contribution (WHO, 2014b). Despite the important role that nurses may play in the safe and effective use of antibiotics, little is known about nurses’ contribution to AMS (Edwards, Loveday, Drumright, & Holmes, 2011e). In particular, the current and potential role of nurses in AMS in Thailand needs further investigation in order to understand how nurses can contribute to safe use of antimicrobial medicines and reduction in AMR.

1.2 Background

Since the accidental discovery of penicillin by Alexander Fleming in 1928, antimicrobials have been used widely in the treatment of infections (Paskovaty, Pflomm, Myke, & Seo, 2005a); however, in the 1940s and 1950s, clinicians began to recognise the emergence of AMR (Owens Jr, 2008). In 1945, Alexander Fleming’s Nobel Prize interview with The New York Times included a warning that penicillin was being over prescribed and misuse would lead to a drug resistance problem (Paskovaty, Pflomm, Myke, & Seo, 2005b).

1.2.1 Antimicrobial resistance

AMR is a growing public health problem worldwide and is considered by the World Health Organization (WHO) to be a global crisis and a major issue in healthcare (WHO, 2017a). The WHO defined antimicrobial resistance (AMR) as ‘the ability of a microorganism (like bacteria, viruses, and some parasites) to stop an antimicrobial (such as antibiotics, antivirals and antimalarials) from working against it. As a result, standard treatments become ineffective, infections persist and may spread to others’ (WHO, 2017b).

Antimicrobial resistance can make treatment of patients more difficult or even impossible, or reduce the effectiveness of antibacterial, anti-parasitic, antiviral and antifungal drugs (WHO, 2017a). The incidence and prevalence of AMR is growing worldwide and the consequences are significant. The European Center for Disease Prevention and Control (ECDC) reported that 25,000 people in Europe die every year because of antibiotic resistant microorganisms (Anguita, 2012). The Center for Disease Control and Prevention (CDC) in the United States of America (USA) has
estimated that more than two million people are infected by antibiotic-resistant pathogens resulting in 23,000 deaths annually in the USA (CDC, 2013). According to the CDC, more than 20 bacterial species are resistant to available antibiotics (CDC, 2013). Tuberculosis (TB) is a case in point. In 2014, WHO reported that each year 480,000 people develop multi-drug resistant TB worldwide. Only about half of multi-drug resistant TB patients were treated successfully, so around 250,000 people die annually of resistant TB infections (WHO, 2017a). A further example of widespread resistance is related to infection with gonorrhea where treatment failure with third generation cephalosporin has been identified in at least 10 countries (Australia, Austria, Canada, France, Japan, Norway, Slovenia, South Africa, Sweden and the United Kingdom of Great Britain and Northern Ireland) (WHO, 2017a).

Inappropriate use of antibiotics not only leads to AMR but also increases the risks for serious adverse events with no clinical benefit. In US hospitals for example, it is estimated that 50% of antibiotics prescribed are unnecessary or inappropriate (CDC, 2013) and a point prevalence study in a tertiary hospital in Australia found that 47% of antibiotic use was inconsistent with antimicrobial guidelines or patients’ microbiological results (Ingram, Seet, Budgeon, & Murray, 2012). Compounding this problem in the last two decades, is the dramatic increase in the rate of AMR while the development of new antimicrobial drugs has slowed down (Kelkar & Galwankar, 2013). The US Food and Drug Administration reported that the rate of approval of new antimicrobials dropped a significant 56% from 1983 to 2002 (MacDougall & Polk E., 2005). MacGowan and Macnaughton (2013) argue that the tendency for inappropriately short courses of antibiotics, and AMS practices of reserving the use of new antimicrobials to prevent AMR have financial implications for pharmaceutical companies resulting in a reduction in antimicrobial research and development and manufacturing.

1.2.1.1 Antimicrobial resistance in South-East Asia and Thailand

Infectious diseases are a major public health problem in the South-East Asia (SEA) region. Each year, approximately 40% of all causes of death are related to communicable diseases in SEA (WHO, 2010b). In 2010, the WHO reported that about 3.5 million SEA people currently live with HIV/AIDS while 34% of all TB patients are
from this region; many of these people have multidrug-resistant TB requiring high consumption of drugs that are not only expensive but also toxic. Limited regulatory environments increase the potential for the spread of AMR in SEA (WHO, 2010b) exacerbating the problem of AMR in this region.

In Thailand, as many as 90,000 patients are affected by AMR annually and the cost of the therapeutic use of antibiotic medications is over $US 200 million per year. The increase in AMR has resulted in approximately 3.24 million extra days of hospital stay and accounted for 38,481 deaths annually in Thailand (Pumart et al., 2012) costing 0.6% of national GDP (WHO, 2016c). It is estimated that an additional 19,000 deaths are caused by multidrug resistant bacteria in Thailand each year. Mortality attributed to multidrug resistance (MDR) was highest for hospital-acquired multidrug-resistant *Acinetobacter* bacteremia (41%) (Lim et al., 2016; MOPH, 2012).

There are many factors influencing the occurrence of AMR in Thailand in particular. These factors include the availability of antimicrobial drugs without prescription, inappropriate prescribing of antimicrobials by medical practitioners and inappropriate practices related to prevention and control of the spread of antimicrobial resistance overall (Moongtui, Picheansathian, & Senaratana, 2011). Antimicrobials are being consumed increasingly in Thailand and, since 2000; antimicrobial medicines have been the most produced and imported drug (Sumpradit et al., 2012b). Over 5,200 antimicrobial medications are registered with the Thai Food and Drug Administration of which two thirds are used in humans (Sumpradit et al., 2017). In 2010, the Bureau of Drug Control, Thailand found the total value of antimicrobial use amounted over US$ 430 million (Thongmuang, 2014). The top three classes of antibiotics used in Thailand are penicillins, cephalosporins and carbapenems in that order (Sumpradit et al., 2017). In Thailand, antibiotics are available over the counter. An example of antibiotic availability without prescription is the finding that 84.5% of grocery stores in Mahasarakarm province, one of the larger provinces in Thailand, sell antibiotics over the counter (Arparsrithongsagul, 2010). A study of antibiotic use and AMR in communities in Thailand found that the availability of antibiotics and their inappropriate use in the Thai community affect the occurrence of AMR (Khamsarn et al., 2016).
1.2.2 Antimicrobial stewardship

Antimicrobial stewardship programs were initiated in response to the growing problem of AMR worldwide. Antimicrobial stewardship (AMS) is a practice to ensure the optimal selection, dose, and duration of antimicrobial treatments to ensure the best clinical outcomes of treatment or prevention of infection while decreasing toxicity effects to patients and providing the lowest risk for subsequent resistance (Gerding, 2001). In essence, these programs aim to improve patient care quality and safety through increased infection cure rates, reduced treatment failures, and correct prescribing for therapy and prophylaxis. The overall benefits are a reduction in AMR, length of hospital stay and healthcare-related costs (CDC 2014). In Australia for example, the Australian Commission on Safety and Quality in Health Care defined AMS as ‘an ongoing effort by a health care institution to optimise antimicrobial use among hospital patients in order to improve patient outcomes, ensure cost-effective therapy and reduce adverse sequelae of antimicrobial use including antimicrobial resistance’ (Duguid & Cruickshank, 2011, p. 4). Similarly, the Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Pediatric Infectious Diseases Society (PIDS) refer to AMS as “coordinated interventions designed to improve and measure the appropriate use of antimicrobial agents by promoting the selection of the optimal antimicrobial drug regimen including dosing, duration of therapy, and route of administration” (SHEA, IDSA, & PIDS, 2012, p. 323).

In the late 1970s and 1980s, Hartford Hospital in CT, USA was among the first hospitals to formally recognise the importance of AMS and established a committee that included an infectious diseases physician and clinical pharmacists to undertake some of the first prospective audits and establish what is now referred to as an antimicrobial stewardship program (Owens Jr, 2008).

In 1995, the Centers for Disease Control and Prevention (CDC) launched the Get Smart campaign to focus on reducing the inappropriate use of antimicrobials in the outpatient setting (Doron & Davidson, 2011). In 1998, the World Health Assembly adopted a resolution urging Member States to take action against AMR and, in 2001, WHO published the WHO Global Strategy on Containment of
Antimicrobial Resistance to empower a response to the AMR problem (Leung, Weil, Raviglione, & Nakatani, 2011).

In 2004, the CDC initiated the Get Smart for Healthcare program to promote collaboration across healthcare settings and mobilise national and local health officials in educating patients (Moody et al., 2012). In 2005 the World Health Assembly emphasised the importance of the antimicrobial resistance problem and called for the optimal use of antimicrobial agents by both healthcare providers and consumers (Leung et al., 2011). The Infectious Disease Society of America (IDSA) and the Society for Healthcare Epidemiology of America (SHEA) then published guidelines for the development of programs to enhance AMS in hospital settings in 2007 (Dellit et al., 2007). In 2010, the CDC released a revised Get Smart for Healthcare campaign for improving antibiotic use in inpatient healthcare facilities to prevent antimicrobial overuse and promote AMS. In 2011, the WHO identified AMR as a major public health concern for the global health agenda and the No Action Today, No Cure Tomorrow project was launched to prevent the development and spread of AMR worldwide (WHO, 2011b).

In 2015, WHO revealed a report ‘Worldwide country situation analysis: Response to antimicrobial resistance’ which addressed significant gaps in controlling the AMR problem across the world (WHO, 2015b). At this point, WHO and the sixty-eight member World Health Assembly have developed a draft Global Action Plan to combat AMR.

In 2016, world leaders committed, at the UN General Assembly, to act on AMR issue by addressing the root causes of AMR across multiple sectors, particularly human health, animal health and agriculture (WHO, 2016d). Leaders in this meeting called on WHO, the Food and Agriculture Organisation of the United Nations (FAO) and the World Organisation for Animal Health (OIE) in collaboration with the World Bank to coordinate their planning and actions to report back to the UN Assembly in 2018.

Thailand is also facing the challenge of treating and preventing infections while reducing the emergence and spread of future AMR. In response to the growing problem in Thailand, the National AMR Surveillance of Thailand (NARST) center in the Ministry of Public Health (MOPH) was established in 1998 to inform and evaluate
AMR surveillance. In 2005, NARST was established as a WHO Collaborative Centre for Antimicrobial Resistance Surveillance and Training (Keatyingaungsuri, Kadsomboon, & Maleewong, 2011). In 2007, the MOPH translated its activities into the campaign known as Antibiotic Smart Use initiated to promote rational antibiotic use and support infection control surveillance in Thai hospitals (MOPH, 2012). To encourage Thai hospitals to implement AMS programs, the National Health Security Office also within MOPH will financially compensate hospitals that have standards for appropriate antibiotic prescribing in upper respiratory tract infections, acute diarrhoea, and simple wounds (Sumpradit et al., 2012b). Since 2013, an antibiotic awareness day has been held to promote public awareness for appropriate antibiotic use (Sumpradit et al., 2017).

Recently in late 2016, the National Strategic Plan on AMR 2017-2021 was launched by the Royal Thai Government that included the WHO Country Cooperation Strategy on AMR, with the purpose of establishing goals for reducing morbidity and economic effects of AMR (Sumpradit et al., 2017). The strategies that have been established to achieve the national plan include: a) an AMR surveillance system using the One Health approach, b) regulation of antimicrobial distribution, c) infection prevention and control and AMS in humans, d) AMR prevention and control and AMS in agriculture and pets, e) strategies to increase public awareness of AMR and appropriate use of antimicrobials, and f) governance mechanisms to implement and sustain AMR actions (Sumpradit et al., 2017).

1.2.3 Antimicrobial usage in the 21st century

1.2.3.1 Antimicrobial usage worldwide

Antimicrobial consumption is on the rise worldwide. Van Boeckel et al. (2014) who studied global antibiotic consumption between 2000 and 2010 showed that antibiotic use increased significantly by 36% from 54,083,964,813 standard units in 2000 to 73,620,748,816 standard units in 2010. India was found to be the biggest consumer of antibiotics; China and the USA were the second and third largest antibiotic users respectively, and broad-spectrum penicillins were the most consumed antimicrobial in 2010 (Van Boeckel et al., 2014). Carbapenams, which are
broad spectrum and expensive antibiotics, are being used increasingly in Pakistan, Egypt and India.

Antimicrobial consumption is a major driver of antimicrobial resistance. It has been shown that the prevalence of resistance increases about 1.5% following an increase in antibiotic use by one daily dose per one thousand people (Albrich, Monnet, & Harbarth, 2004; Davies & Verde, 2013) (Figure 1). A systematic review by Morgan, Okeke, Laxminarayan, Perencevich, and Weisenberg (2011a) concluded that 19% to 100% of antimicrobial consumption worldwide excluding northern Europe and North America, was not by prescription. In Nigeria and Palestine for example, 100% of antimicrobials were sold without prescription (Morgan et al., 2011a). The problem with the use of non-prescription antimicrobials is that the antimicrobials and doses are often inappropriate, and the course of treatment is too short (Morgan et al., 2011a).

Figure 1.1 Correlation between antibiotic use and antibiotic resistance
(Source: https://nanoporetech.com/resource-centre/posters/real-time-detection-antibiotic-resistance-genes-using-oxford-nanopore)

1.2.3.2 Antimicrobial use in the USA

In the USA, antibiotics are regularly prescribed in hospitals (Hadler et al., 2014); and in 2010 the USA was the third largest consumer of antibiotics in the world (Van Boeckel et al., 2014). A study of outpatient antibiotic prescribing in the US from 2000 to 2010 found that 1.4 billion antibiotics were used over the study period; while antibiotic consumption among children and adolescents decreased by 18 %, it
increased steadily in adults and by 30 % in elderly people (Lee et al., 2014). It is estimated that 50% of antibiotics prescribed in US hospitals are unnecessary or inappropriate (CDC, 2013; Hadler et al., 2014). In addition, approximately 30% of antibiotics used in the treatment of adult patients were used for longer than recommended by prescription guidelines (Hadler et al., 2014).

1.2.3.3 Antimicrobial use in Europe

High antimicrobial consumption is also a vital issue in healthcare systems in Europe. According to the European Centre for Disease Prevention and Control (ECDC) that collects information from all EU countries (WHO, 2011a), antibiotic consumption in Europe varies widely depending on the country. Countries in the east and south usually report much higher antibiotic resistance rates than in the north where consumption of antibiotics is lower (ECDC, 2014; WHO, 2011a). Penicillins are the most frequently consumed antibiotics in Europe overall (ECDC, 2014).

In the period between 2008 and 2012, data for antimicrobial consumption showed increasing use of antimicrobials in Belgium, Latvia, Norway, Spain and the United Kingdom (ECDC, 2014). However, the consumption of beta-lactamase-sensitive penicillins decreased significantly in 11 countries: Austria, Belgium, Bulgaria, Denmark, Estonia, Italy, Latvia, Luxembourg, the Netherlands, Norway and Spain. In 2012, Greece was the highest consumer of antimicrobials for systemic use. In contrast, the Netherlands were the lowest antimicrobial-consuming country of Europe in 2012 (ECDC, 2014).

In order to raise awareness of antibiotic use in Europe, European countries have launched strategies and implemented programs to control antimicrobial resistance. These include campaigns to promote prudent use of antimicrobials in communities and providing information about antimicrobial consumption and resistance. The WHO in the European Region organizes the *European Antibiotic Awareness Day* (EAAD) on the 18th of November each year (WHO, 2011a).
1.2.3.4 Antimicrobial use in Australia

Australia has one of the highest rates of antimicrobial consumption in the developed world (Rawlins, McKenzie, & Mar, 2013). Over the last 10 years, antimicrobial consumption has increased by approximately 10%; rising to 24/1000 population/day (Hardy-Holbrook, Aristidi, Chandnani, DeWindt, & Dinh, 2013). In Denmark, the Netherlands and Sweden, antimicrobial consumption is less than 15/1000 population/day (Rawlins et al., 2013). The report ‘Antimicrobial Utilization Surveillance in Australian Hospitals, September 2008 to August 2012’ presented antibiotic usage in defined daily dose (Shaban, Cruickshank, Christiansen, & Committee, 2013). Penicillin was the most frequently dispensed antimicrobial in Australian hospitals over this time.

A point-prevalence study of antibiotic use at an Australian tertiary hospital found that 47% of antibiotic use was outside Australian guidelines (Ingram et al., 2012). Surveys by the Australian Group on Antimicrobial Resistance (AGAR) reported the continuing trend for the use of antibiotics to treat upper respiratory tract infections such as colds and acute bronchitis or bronchiolitis over the past 20 years (Hardy-Holbrook et al., 2013). Reports of antibiotic-resistant bacteria in hospitals, nursing homes and community settings are on the rise. For example, the incidence of Methicillin-resistant Staphylococcus aureus (MRSA) infection in the community between 2001-2010, increased by 10 to 20 % (Rawlins et al., 2013).

1.2.3.5 Antimicrobial use in South-East Asia and Thailand

AMR is a problem in both developing and developed countries (Lestari et al., 2012). The South-East Asia (SEA) region is a mix of developed and developing countries (www.unctad.org). SEA faces unique problems related to antimicrobial usage; most prominent is the availability of antibiotics without prescription. An additional, related concern is the poorly regulated use of antimicrobials in animals for prophylaxis and growth promotion (WHO, 2010a).

The review of AMR among pathogenic bacteria in South-East Asia from 1995 to 2007 showed that the antimicrobial resistance problem has been increasing continuously in SEA (Lestari et al., 2012). A study of tuberculosis (TB) in the WHO SEA region in 2010 found that 34% of all TB patients were resistant to antimicrobials
in this region (Nair, Wares, & Sahu, 2010) while more than 50% of Staphylococcus aureus infected patients are now methicillin-resistant (Ray, Gautam, & Singh, 2011). In addition, Escherichia coli resistance to third generation cephalosporins and fluoroquinolones has been on the increase and Klebsiella pneumonia resistance to third generation cephalosporins is increasing and widespread in SEA (WHO, 2014a).

Inappropriate prescriptions and overuse of antimicrobials is a pressing healthcare problem in Thailand. In the National Antimicrobial Resistance Surveillance Center, Department of Medical Sciences, Ministry of Public Health report, Acinetobacter baumannii was identified as a major bacteria associated with hospital-acquired infection in Thailand and Enterobacteriaceae (such as Escherichia coli), Staphylococcus aureus and Pseudomonas aeruginosa were the organisms most likely to be associated with AMR (MOPH, 2012). Since 2000, the prevalence of colonisation and infection with Carbapenem-resistant Acinetobacter baumannii has increased sharply by up to 80% in Thai hospitals (Apisarnthanarak, Buppunharun, Tiengrim, Sawanpanyalert, & Aswapokee, 2009). Colonisation and infection with Methicillin-resistant Staphylococcus aureus (MRSA) was found in approximately 65% of intensive care patients in 2009 (Mootsikapun, Trakulsomboon, Sawanpanyalert, Aswapokee, & Suankratay, 2009).

In 2011, in response to the AMR problem in the region, the Health Ministers of Member States, South-East Asia Region initiated a commitment to combat drug resistance through the Jaipur Declaration (WHO, 2014d). Improvement of public health by adopting a multidisciplinary approach to the problem is a priority of the work of the WHO in the region (WHO, 2014c).

1.2.4 Significance of antimicrobial resistance and inappropriate use of antimicrobials

Antimicrobial resistance has significant severe consequences both from a human and economic perspective (WHO, 2014a). Patients with antimicrobial resistant infections have a higher risk of worse clinical outcomes, recurrent infection and death than infected patients without AMR (Huttner et al., 2013). It has been estimated that more than 500,000 people worldwide die every year as a result of AMR (CDC, 2013). A recent study predicted that 10 million people would die every
year because of AMR by 2050 if no proactive global action to respond the AMR problem (de Kraker, Stewardson, & Harbarth, 2016).

The economic implications of AMR are significant. Less effective antibiotics require prolonged and augmented treatments, extended length of hospital stay and higher healthcare use. In 2014, WHO estimated that antimicrobial resistance reduced real gross domestic product (GDP) by 0.4% to 1.6% resulting in a loss of billions of dollars worldwide (WHO, 2014c). For the USA health system, this cost amounts to about US$21 to $34 billion dollars annually while each year, drug-resistant bacteria costs Europe € 1.5 billion, including loss in productivity (ECDC, 2009). In Thailand, it is estimated that there are about $70-$170 million in economic losses annually from antimicrobial resistance (Pumart et al., 2012). In addition, in 2013, the World Economic Forum (WEF) emphasised that AMR represented a global risk for food shortage as a result of livestock infection (WEF, 2013).

1.3 Chapter summary

The incidence and prevalence of AMR is growing worldwide and the consequences are significant. The overuse and misuse of antibiotics contribute to AMR while the development of new antimicrobial drugs has slowed down. WHO emphasised that the emerging of AMR is a global health crisis. In Thailand, the availability of antibiotics without prescription and inappropriate use of antibiotics in both community and healthcare settings are the main factors influencing the occurrence of AMR.

Several organisations worldwide have reacted to the AMR health crisis. In Thailand in particular, the National Antimicrobial Resistance Surveillance center was established to inform and evaluate AMR surveillance. In 2007, the Antibiotics Smart Use (ASU) program was introduced as a model for promoting the rational use of medicines, starting with antibiotics. Recently in late 2016, the National Strategic Plan on AMR 2017-2021 was launched with the goal of reducing morbidity and the economic effects of AMR.

A multidisciplinary approach is an important element for initiating and sustaining AMS programs. Nurses are in a key position to collaborate within an AMS
team although their role is not established or consistent. The role of nurses in AMS within the unique context of healthcare and antibiotic availability in Thailand requires further in depth investigation.

1.4 Aims of the study

The purpose of this research program was to explore the current and potential roles of nursing in AMS in acute healthcare in Thailand within the broader context of clinical governance and attitudes and perceptions of antimicrobial resistance and stewardship using a single organisational case study.

In order to understand the current and potential role of nurses in AMS, the specific aims of this study were to:

I. Explore the perceptions and attitudes toward AMS among clinicians in acute healthcare in Thailand;

II. Identify strengths and weaknesses of AMS clinical governance structures and activities as perceived by organisational leaders (executives and clinical leaders) and nurses working in acute healthcare in Thailand, using the CDC recommendations as a framework for the analysis;

III. Explore current and potential for patient participation in AMS in Thailand;

and

IV. Explore how organisational leaders and nurses perceive potential future roles for nurses in AMS in Thailand within the current governance, educational and practice context.

To meet these aims, a multiple methods approach was used in a single organisational case study design. Understanding the current and potential role of nurses in AMS is necessary to inform nursing education and professional development in relation to AMS, health service AMS governance, and strategies to engage patients both within the hospital and the community through education and health promotion.
1.5 Overview of thesis structure

This thesis is presented in eight chapters. In Chapter 2, a review of the literature is presented in four major sections. The first section presents the general framework of AMS programs through a review of worldwide guidelines and the CDC recommendations. In the second, third and fourth sections, the current state of knowledge relating to nurses’ role in AMS, clinicians’ perceptions and attitudes towards AMS, and patient participation in AMS are explored through a narrative review of the literature.

The research program was conducted in four phases. In Chapter 3, the design and methods used to address the aims of the research are described in detail for each of the four phases. This is followed by a discussion of the ethical considerations associated with the conduct of the research.

The findings of the study are presented over four chapters addressing each of the four aims of the program. In Chapter 4, the findings related to the investigation of multidisciplinary clinicians’ perceptions and attitudes towards AMS are described. The findings relating to the current AMS clinical governance structures and activities and perceived strengths and weaknesses of these governance structures are reported and discussed in Chapter 5. In Chapter 6, the integrated findings relating to current and potential patient participation in AMS are presented and, in Chapter 7, are the findings relating to how organisational leaders and nurses perceive current and potential future roles for nurses in AMS in Thailand within the current governance, educational and practice context.

Finally, in Chapter 8, the integrated findings are discussed in terms of their contribution to our understanding of strategies for sustainable and multidisciplinary AMS, implications for practice, limitations and strengths of the study, and future research.
Chapter 2 `  
Literature Review

In order to explore the current and potential role of nurses in antimicrobial stewardship (AMS) in acute care in Thailand, the current research and professional literature was reviewed and is presented in four major sections commensurate with the research aim to understand the status of AMS in healthcare in Thailand. In the first section, the general framework of AMS programs is described by reviewing worldwide guidelines for AMS. In the second, third and fourth sections of this review, the current state of knowledge relating to nurses’ role in AMS, clinicians’ perceptions and attitudes towards AMS, and patient participation in AMS are explored.

2.1 A framework for antimicrobial stewardship programs

Antimicrobial stewardship (AMS) has been defined as ‘...an ongoing effort by a health-care institution to optimise antimicrobial use among hospital patients in order to improve patient outcomes, ensure cost-effective therapy and reduce adverse sequelae of antimicrobial use including antimicrobial resistance’ (Doron & Davidson, 2011, p. 4). Importantly, AMS programs are a multifaceted approach with the potential to prevent and reduce the emergence of antimicrobial resistance (AMR). Antimicrobial stewardship programs aim to promote the use of the right antibiotic, at the right dose, at the right time, and for the right duration during hospitalisation (CDC, 2010). The Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Pediatric Infectious Disease Society (PIDS) refers to antimicrobial stewardship programs as ‘coordinated interventions designed to improve and measure the appropriate use of antimicrobial agents by promoting the selection of the optimal antimicrobial drug regimen including dosing, duration of therapy, and route of administration’. (SHEA et al., 2012, p. 323)

There is evidence that AMS programs help to improve patient clinical outcomes, reduce adverse effects of antibiotics, prevent antimicrobial resistance (Owens Jr, 2008) and reduce financial costs for health services (Dellit et al., 2007).
In this section, the overall framework of AMS programs based on a review of guidelines from organizations including the Center for Disease Control and Prevention (CDC, 2014), the Center for Disease Control and Prevention (CDC) and Institute for Healthcare Improvement (IHI) (CDC&IHI, 2012), the Infectious Disease Society of America and Society for Healthcare Epidemiology of America (Dellit et al. 2007), Antimicrobial Stewardship in Australian Hospitals by Australian Commission on Safety and Quality in Healthcare (Duguid & Cruickshank, 2011), Antimicrobial Prescribing Policy and Practice in Scotland (Nathwani, 2006) and the United Kingdom Antimicrobial Framework (SACAR, 2007) is outlined.

This composite review has identified the core elements of hospital AMS programs as: leadership commitment; accountability; drug expertise; action to support optimal antibiotic use; antimicrobial stewardship intervention strategies; tracking and reporting of antibiotic use and outcomes; and education. These core elements of AMS are discussed in the sections to follow.

2.1.1 Leadership commitment

Leadership support is essential to the success of an AMS program. Hospital administrators have the responsibility for ensuring the implementation and outcome evaluation of AMS policy (Duguid & Cruickshank, 2011). Hospital management support should also provide dedicated resources for AMS activities and finance the necessary infrastructure to support antimicrobial use and monitoring, such as resources for information technology (CDC, 2014; Dellit et al., 2007; Duguid & Cruickshank, 2011). The Australian Commission on Safety and Quality in Healthcare recommend that hospital leaders express their explicit support for AMS programs by allocating an executive sponsor, identifying AMS as a strategic goal of an organisation, communicating to staff and other leaders about the AMS programs, setting a time schedule to review progress and provide suggestions, allocating high-performing staff to the team and providing sufficient resources (Duguid & Cruickshank, 2011).

Several reports show that multidisciplinary AMS is beneficial in reducing antibiotic costs and consumption and patient length of hospital stay (Bantar et al., 2003; Lin et al., 2013b). Multidisciplinary AMS programs involve processes for
understanding patterns of antibiotic usage and resistance within an organisation, selecting the appropriate AMS strategies needed, and seeking the support of hospital administration (Paskovaty et al., 2005b). Hospital leaders therefore, should organise multidisciplinary AMS teams and allocate time and resources for team members including training and education (CDC, 2014; Duguid & Cruickshank, 2011). Gap analysis of antimicrobial use requires participation and communication from many professional groups, including as appropriate: infection control personnel; hospitalists; intensivists; emergency department physicians; microbiologists; pharmacists; nurses and infectious disease experts (CDC&IHI, 2012).

Antimicrobial stewardship is a component of overall clinical governance for quality improvement and patient safety. The implementation and management of an AMS program should include clear lines and links of accountability between the AMS team, hospital executive, director of clinical governance, drug and therapeutics committee, and infection prevention and control committees (Duguid & Cruickshank, 2011; Nathwani, 2006). The process and outcome of AMS indicators should be measured and reported to the hospital executive (Duguid & Cruickshank, 2011). The recommendation of an AMS team framework of a Scottish hospital is an example of a pathway to monitor and influence antimicrobial prescribing within a hospital governance structure (Figure 2.1). The commitment of hospital management and senior medical staff is critical for the success of AMS programs within a patient safety framework.

![Figure 1.1 Model of antimicrobial prescribing pathway and organization](image)

Figure 1.1 Model of antimicrobial prescribing pathway and organization in an acute hospital in Scotland (Nathwani, 2006, p. 1191)

APP&P = antimicrobial prescribing policy and practice
2.1.2 Accountability and drug expertise

Multidisciplinary involvement is a significant component of AMS programs (CDC, 2014; Dellit et al., 2007; Duguid & Cruickshank, 2011; Nathwani, 2006). A study of the impact of AMS programs in a community public teaching hospital in Taiwan found that a stewardship intervention with multidisciplinary management was associated with a decrease in antimicrobial costs by 43% and savings of approximately $US 2.5 million in 3 years (Lin et al., 2013b). The minimum core members of a multidisciplinary AMS team include an infectious disease physician and an infectious disease-trained pharmacist (Dellit et al., 2007; Duguid & Cruickshank, 2011). In the USA, the recommendation for achieving successful stewardship is that for every 150 acute beds, there should be designated, one full-time pharmacist and a part-time physician in the AMS team (Owens, Fraser, & Stogsdlill, 2004). Meanwhile, physicians who are practicing in AMS programs in Australian hospitals suggest that for every 100 beds, a senior pharmacist should dedicate 10 hours per week and a lead physician 3.5 hours per week to antimicrobial stewardship activities (Duguid & Cruickshank, 2011). For hospitals without on-site infectious disease physicians, it is recommended that the AMS team should be led by an interested clinician with a clinical pharmacist. In small hospitals where on-site pharmacists are not available, advice from a clinical pharmacist should be sought (Duguid & Cruickshank, 2011).

Other key support groups required for AMS programs include the following staff:

Physicians who play an important role as the prescribers of antibiotics (CDC, 2014).

Infection and hospital epidemiologists to coordinate monitoring and prevention of healthcare-associated infection, organise policies to contain the transmission of resistant organisms, analyse and report the pattern of antibiotic use and trends in bacterial resistance, and educate staff in antibiotic use (CDC, 2014; Paskovaty et al., 2005b).
Quality improvement staff to collaborate in AMS programs to focus on quality and patient safety issues (CDC, 2014);

Laboratory (Microbiology) staff to provide appropriate tests such as patient-specific culture and susceptibility data, be involved in resistant organism surveillance and update local antibiograms. In addition, the laboratory staff should present laboratory results to support optimal antibiotic use (CDC, 2013; Dellit et al., 2007).

Information technology staff to supply electronic decision support systems, which must be integrated into the clinical workflow to guide antimicrobial prescribing in electronic health records. Moreover, AMS teams should assess data of patient administration, microbiology and drug use for monitoring and reporting (CDC, 2014; Duguid & Cruickshank, 2011).

Nurses who play a role as the one of the key members of the professional team and have the potential to influence the prescription and use of medicines; for example by monitoring prescription decisions (Castledine, 2006; Jutel & Menkes, 2010b). Nurses routinely review medication charts and play a major role in medication administration. Nurses can also ensure laboratory culture reports are available before starting antibiotics, and review medication orders, indications and duration of antibiotic treatment (Edwards, Drumright, Kiernan, & Holmes, 2011b).

A multidisciplinary team of physicians, pharmacists, nursing, microbiology and administration staff should discuss and consider aspects of antibiotic use together with the goal of improving AMS outcomes (CDC&IHI, 2012). In addition, the AMS management team should collaborate with existing committees, such as therapeutics committees and infection prevention and control committees, and seek endorsement of the hospital executive for formal structural arrangements (Dellit et al., 2007; Duguid & Cruickshank, 2011).

2.1.3 Actions to support optimal antibiotic use

Antimicrobial stewardship involves a multifaceted approach in order to improve antibiotic prescribing (Tamma & Cosgrove, 2011). Hospital AMS programs should include an updated antimicrobial prescribing and management policy (Duguid & Cruickshank, 2011; Nathwani, 2006) that should be developed by the AMS team.
and authorised by an appropriate drug and therapeutics committee (Duguid & Cruickshank, 2011). Prescribers should be required to document the indication, dose, route and duration of antibiotic therapy in medical records for all antibiotic prescriptions to ensure the appropriate use of medications (CDC, 2014). In addition, clinician teams should provide feedback to prescribers to improve processes (Paskovaty et al., 2005b). The Australian Commission on Safety and Quality in Health Care (Duguid & Cruickshank, 2011) for example, recommend that as a minimum, antimicrobial prescribing and management policies should include:

- The latest version of the national antibiotic guidelines that include evidence-based practice recommendations and local susceptibilities for optimising antimicrobial prescribing;
- A list of antimicrobials and procedures that have been restricted;
- Guidelines for prescribing, including local clinical guidelines; and
- Reference to the hospital’s policy on liaising with the pharmaceutical industry.

### 2.1.3.1 Antimicrobial stewardship intervention strategies

There are three core stewardship strategies categorised by the Centers for Disease Control and Prevention (CDC) though Core Element of Hospital Antibiotic Stewardship Programs (CDC 2014): broad interventions; pharmacy-driven interventions; and infection and syndrome specific interventions. However, the CDC emphasised that hospitals should not implement too many interventions at once (CDC 2014). The chosen AMS interventions should be based on the requirements of each organisation as well as the availability of resources to support the successful implementation of these initiatives (CDC 2014).

Broad AMS interventions include antibiotic “time outs”, prior authorisation, and prospective audit and feedback. The aim of antibiotic “time outs” is to review the appropriateness of all antibiotics 48 hours after the initial orders. At that time prescribers will have more information such as results of cultures and other laboratory tests, and the clinical status of patients to answer key questions including (CDC, 2014):
• Does this patient have an infection that will respond to antibiotics?
• If so, is the patient on the right antibiotic(s), dose, and route of administration?
• Can a more targeted antibiotic be used to treat the infection (de-escalate)?
• How long should the patient receive the antibiotic(s)?

The aim of prior authorisation is to control prescribing of specific antimicrobial agents. The expertise in antibiotic use of physicians or pharmacists will be sought to approve the use of certain antibiotics based on the spectrum of activity, cost and toxicity before dispensing (CDC, 2014).

Prospective audit and feedback involves strategies such as prior authorisation with feedback to the prescriber before antimicrobial prescribing (Duguid & Cruickshank, 2011). A strategy with direct interaction and feedback to the prescriber by an infectious disease physician or a clinical pharmacist, can reduce inappropriate use of antimicrobials (Dellit et al., 2007). An AMS team should be responsible for reviewing and giving feedback in high volume prescribing wards (for example, intensive care units, oncology units); however, specialist nurses or clinical pharmacists can also be trained to support this process (Nathwani, 2006).

Pharmacy-driven interventions include automatic changes from intravenous to oral therapy, dose adjustments, dose optimisation and detection and prevention of antibiotic-related drug interactions. Many physicians cannot remember the bioavailability of medications that may be achieved by intravenous and oral administration (Doron & Davidson, 2011). Many hospitals therefore, encourage pharmacists to change antimicrobial orders from the intravenous to oral route for stable patients. Automatic changes from intravenous to oral antibiotics can save money and improve patient safety by avoiding intravenous access.

At some hospitals, pharmacists have the responsibility to calculate and adjust for dosing and monitoring of vancomycin and/or aminoglycoside levels (Doron & Davidson, 2011), particularly, in cases of organ dysfunction (CDC, 2014). Dose adjustment by pharmacists can decrease the length of hospital stay and reduce unnecessary prescribing (Bond & Raehl, 2007). Dose optimisation depends on
individual patient characteristics, renal function, causative organism, site of infection, and the pharmacokinetic and pharmacodynamics characteristics of the drug (Dellit et al., 2007). Because pharmacodynamic parameters are correlated with achieving efficacy of tissue concentration, dose optimisation is a strategy to optimise antimicrobial action and reduce the risk of antimicrobial resistance (Doron & Davidson, 2011). Further, pharmacists can also detect and prevent antibiotic-related drug interactions. For example, interactions between some oral fluoroquinolone therapies and certain vitamins (CDC, 2014).

Infection and syndrome specific interventions are largely guidelines for antimicrobial prescribing. Guidelines for antimicrobial prescribing are essential components of AMS programs. Hospitals should develop antimicrobial guidelines for the treatment of specific common infections. In addition, the local AMR data and prophylaxis for surgical practice in hospitals should be available (Duguid & Cruickshank, 2011). In the US Core Elements of Hospital Antibiotic Stewardship Programs, CDC, it is suggested that hospitals provide specific procedures to ensure optimal use of antibiotics to treat the following common infections (CDC, 2014): community-acquired pneumonia; urinary tract infections (UTIs); skin and soft tissue infections; empiric coverage of methicillin-resistant Staphylococcus aureus (MRSA) infection; Clostridium difficile infections; as well as targeted therapy for culture-proven invasive infections (CDC, 2014). The United Kingdom Specialist Advisory Committee on Antimicrobial Resistance (SACAR) also recommends minimum guidelines for treatment or prophylaxis (Tables 2.1).
Table 1.1 The minimum guidelines for treatment or prophylaxis (SACAR, 2007, p. i89)

<table>
<thead>
<tr>
<th>Guidelines for treatment</th>
<th>Guidelines for prophylaxis use</th>
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<tbody>
<tr>
<td>• Urinary tract infections</td>
<td>• Prevention of bacterial endocarditis (procedure-specific criteria should be agreed to identify which patients should receive prophylaxis)</td>
</tr>
<tr>
<td>• Upper respiratory tract infections</td>
<td>• The details of endoscopic procedure should be given of which individuals, considered at high risk, should receive prophylaxis (for example neutropenia patients)</td>
</tr>
<tr>
<td>• Lower respiratory tract infections including, community and hospital acquired pneumonia and exacerbations of chronic obstructive pulmonary disease</td>
<td>• Surgical prophylaxis (recommendations should be made for all common surgical interventions including timing of initial dose and exceptional circumstances for repeat doses)</td>
</tr>
<tr>
<td>• Soft tissue infections including injuries or bites, cellulitis, chronic ulcers and necrotizing fascitis</td>
<td>• Splenectomy patients (provide details of both the immunization and antimicrobial prophylaxis requirements).</td>
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<tr>
<td>• Central nervous system infections: bacterial meningitis, viral encephalitis</td>
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<tr>
<td>• Gastro-intestinal infections: food poisoning and intra-abdominal sepsis</td>
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<tr>
<td>• Genital tract infections</td>
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<tr>
<td>• Blood stream infections</td>
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<tr>
<td>• Eye, ear, nose and throat infections</td>
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<tr>
<td>• Sepsis of unknown origin</td>
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<tr>
<td>• Specific confirmed infections: for example, treatment regimens for methicillin-resistant Staphylococcus aureus and Clostridium difficile and tuberculosis</td>
<td></td>
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<tr>
<td>• Endocarditis</td>
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2.1.4 Monitoring and reporting antibiotic use and outcome

To measure the effectiveness of AMS interventions, monitoring and analysis of antimicrobial usage are required (Duguid & Cruickshank, 2011). Antimicrobial consumption and expenditures are common outcome measures (Doron & Davidson, 2011) and should be integrated into the hospital stewardship policy (Dellit et al., 2007). Monitoring and analysis of antimicrobial usage requires infrastructure including information systems to measure and monitor antimicrobial use and outcomes of AMS programs (Dellit et al., 2007; Duguid & Cruickshank, 2011). The outcomes from AMS monitoring need to be reported to prescriber groups and
The measurement of process performance is fundamental to antimicrobial prescribing improvement. Effective antibiotic consumption measures may include intermittent auditing of items such as guideline adherence rate, correct diagnosis criteria for infection, dose, duration and indication of antibiotic therapy, consideration of cultures and relevant tests before initial treatment, and appropriate antibiotic adjustment in response to microbiological results (CDC, 2014). The Australian Commission on Safety and Quality in Health Care (Duguid & Cruickshank, 2011) recommends the use of indicators developed by the NSW Therapeutic Advisory Group for Medicine Quality Use in Australian Hospitals, published in 2007 (NSW Therapeutic Advisory Group, 2007, p. 20). These indicators relate to antimicrobial prescribing as a percentage of:

- Patients undergoing specified surgical procedures that receive an appropriate prophylactic antibiotic regimen.
- Prescriptions for restricted antibiotics that are concordant with drug and therapeutics committee approved criteria.
- Patients with a toxic or sub-therapeutic aminoglycoside concentration whose dosage has been adjusted or reviewed prior to the next aminoglycoside dose.
- Patients presenting with community acquired pneumonia that are prescribed guideline concordant antimicrobial therapy.

Antibiotic use measures should also be a feature of antibiotic use monitoring. The World Health Organisation (WHO) publishes defined daily dose (DDD) per 1000 patient days as a unit of measurement for calculating the total number of grams of an antimicrobial agent used divided by the number of grams in an average daily dose. For example, the DDD of oral cloxacillin is 1000 mg, so a patient receiving 500 mg every eight hours for five days consumes 7.5 DDD. This measurement is useful for comparing antimicrobial use with other similar hospitals and is an indicator of the potential need for adjustment. However, it is not suitable for patients with renal
impairment or for paediatric patients because DDD is based on adult dosing (Dellit et al., 2007; Doron & Davidson, 2011; Nathwani, 2006).

Another measure of antibiotic use is day of therapy (DOT). Day of therapy is used to monitor the volume of antimicrobial use as the prescribed daily dose. For example, administration of amoxicillin as one 1000 mg dose or as four 1000 mg doses given six hours apart would both represent one DOT. When a single patient is prescribed both amoxicillin and vancomycin, the recording is two DOTs (Polk, Fox, Mahoney, Letcavage, & MacDougall, 2007). The DOT measure disregards the actual number of doses administered or dosage intensity.

Outcome measurements are defined as ‘the degree to which these outcomes are achieved’ (Dellit et al., 2007, p. 171). To determine improvement as a result of an AMS program, several ways to investigate outcomes include cost saving; AMR rates and Closidium difficile rates (Dellit et al., 2007; Patel, Lawson, & Guglielmo, 2008). While, the overall cost of the AMS intervention is less likely to be reported (Patel et al., 2008), changes in adverse event rates associated with administration of antimicrobial drugs, and antibiotic expenditure may be useful outcome measurements of AMS programs (Dellit et al., 2007; Patel et al., 2008).

2.1.5 Health professional education in antimicrobial stewardship

Hospital management has a responsibility to provide AMS education to all healthcare professionals (Duguid & Cruickshank, 2011). The Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America emphasised the importance of prioritising education as a supplement to the core strategies of AMS programs (Dellit et al., 2007). Antimicrobial Prescription Policy and Practice in Scotland (Nathwani, 2006) recommends that any professionals who are involved in antimicrobial prescribing or administration should receive AMS training with appropriate content in both undergraduate and post graduate curricula. Web-based education resources should be provided to educate both healthcare providers and patients for improving antibiotic use to promote awareness (Pagani, Gyssens, Huttner, Nathwani, & Harbarth, 2009).
2.2 Nurses’ roles in antimicrobial Stewardship

In this section, a search and narrative review of the literature related to nurses’ role in AMS is presented to explore what is known about the current and potential role of nurses in AMS worldwide.

The CINAHL and MEDLINE electronic databases were searched to September 2017 with no set, earlier cutoff date. The databases were searched using the following terms: “nurse* and “antibiotic stewardship” or “antimicrobial stewardship” or "antibiotic management" or "antimicrobial management" or "antibiotic involvement" or "antimicrobial involvement". Additionally, Google (Scholar) databases were also searched using the term “role of nurses in antimicrobial stewardship” in this literature review. Qualitative and quantitative research, clinical reviews, editorials, guidelines, and recommendations, which were published in English, were included in the review.

The review process revealed 45 relevant research papers; most of which were published in the USA and the UK. The papers were categorised according to the specialisation of nurses in relation to infection control nurses (ICNs) or clinical ward nurses (RN) (Figure 2.2). Of the 42 papers that focused on expert opinion, they reviewed clinical nurses’ role in AMS in general; 24 were expert opinion reviews, 13 were research papers, three editorials, two of guideline/white paper. There were three papers that identified that ICNs contributed in AMS, one guideline paper, published in Ireland addressed the need for ICNs to be members of AMS teams and another two research papers reported the positive outcomes of ICNs engaging in AMS. A summary of RN papers is presented in Table 2.2 and the ICN papers in Table 2.3 in chronological order beginning with the most recent publications. Key themes derived from a narrative review of these papers are presented in the section to follow.
Figure 2.2 Categories of selected papers of nurses' role in AMS

- RN = 42
- ICN = 3
- Selected papers = 45
- Expert opinion reviews = 24
- Guidelines/ White paper = 2
- Editorial = 3
- Research = 13
- Guidelines = 1
- Research = 2
Table 2.2: Summary of published papers related to clinical nurses’ role in antimicrobial stewardship (AMS) (n=42)

<table>
<thead>
<tr>
<th>Author, Publication year, Country, Title</th>
<th>Type of paper</th>
<th>Nurses’ roles in antimicrobial stewardship</th>
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| 1. Olans, Olans, and Witt (2017a), USA Good nursing is good antibiotic stewardship | Expert opinion review | • Nursing activities are connected to AMS initiatives, as nurses are the primary bedside advocates and monitors of patient safety and progress.  
• Nurses are the central source of facilitation and communication among all the participants in AMS.  
• Nurses have a role in infection control management  
• Nurses should view AMS as an integral part of nursing |
| 2. Roberts et al. (2017), USA A survey of critical care nurses’ practices and perceptions surrounding early intravenous antibiotic initiation during septic shock | Research | • Aim: To evaluate the knowledge, practices and perceptions of critical care nurses regarding antibiotic initiation in patients with newly recognised septic shock.  
• Findings: 98% of participants recognised the existence of the sepsis protocol and nurses perceived they initiated early intravenous antibiotics to manage septic shock in a timely manner |
| 3. ANA and CDC (2017), USA ANA and CDC white paper on nurses’ role in antibiotic stewardship | White paper | • Nurses’ role in patient safety is through 1) improving antibiotic use at bedside; 2) improving participation in antibiotic use activities; 3) improving education and training; and 4) engaging in a leadership role in the AMS. |
| 4. Witts (2016), USA Antibiotic Stewardship: The Nurse’s Role in Making a Difference | Research Poster Abstract | • Being aware of the national goals, clinical microbiology concept.  
• Being able to assess and accurately report changes in patients conditions |
| 5. Schellack, Pretorius, and Messina (2016), South Africa Esprit de corps’: Towards collaborative integration of pharmacists and nurses into antimicrobial stewardship programmes in South Africa | Expert opinion review | • Monitoring compliance with institutional guidelines and best practice  
• Monitoring for drug allergies and side-effects  
• Obtaining and reporting therapeutic levels, management and administration of medicines with mixed dosages, e.g. insulin, and ensuring timely and correct administration of antimicrobials. |
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<th>Author, Publication year, Country, Title</th>
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| 6. Safdar et al. (2016), USA Management of ventilator-associated pneumonia in intensive care units: a mixed methods study assessing barriers and facilitators to guideline adherence | Research        | • Aim: To understand barriers and facilitators to the adoption of the IDSA/ATS guidelines.  
• Results: Nurses worked in a multidisciplinary team in-patient rounding and being aware of IDSA/ATS guidelines. |
| 7. Olans, Olans, and DeMaria (2016), USA The Critical Role of the Staff Nurse in Antimicrobial Stewardship—Unrecognized, but Already There | Expert opinion review | • Nurses’ role can be at many levels with different activities related to AMS:  
  ○ At Patient admission e.g. triage and isolation, accurate allergy history, early and appropriate culture, timely antibiotic initiation, medication reconciliation  
  ○ Daily clinical progress monitoring e.g. monitor and report progress, preliminary antibiotic adjustment, administering antibiotics, checking antibiotic dosing and de-escalation  
  ○ Patient safety & quality monitoring e.g. monitoring adverse events, reporting changes in patient condition, final culture and antibiotic adjustment, identifying antibiotic resistance  
  ○ Clinical progress/ patient-education/discharge via IV to PO antibiotic administration, outpatient antibiotic therapy |
| 8. Manning, Pfeiffer, and Larson (2016), USA Combatting antibiotic resistance: The role of nursing in antibiotic stewardship | Expert opinion review | • Administering and monitoring antibiotic therapy at bed side  
• Evaluating antibiotic use on a daily basis with other members in the patient care team  
• Being antibiotic first responders, coordinating care including monitoring patient condition and response to antibiotic therapy  
• Educating patients, family members and relevant bodies on the appropriate use of antibiotics |
| 9. Manning (2016), USA Antibiotic stewardship for staff nurses: five key ways you can influence antibiotic use | Expert opinion review | • Identifying AMR by participating in hospital AMS activities.  
• Making decisions regarding safe antibiotic administration and monitoring clinical processes and practice. |
| 10. Gregory (2016), USA A Brief History of Antibiotics in the Neonatal Intensive Care Unit: From Routine Prophylaxis to Antimicrobial Stewardship | Expert opinion review | • Neonatal nurses play a role on AMS teams.  
• Neonatal nurses identify changes in vital signs or subtle symptoms that may indicate a new infection or problem associated with current antibiotic therapy. |
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| 11. Dyar, Beović, Vlahović-Palčevski, Verheij, and Pulcini (2016), Sweden | Expert opinion review | - Nurses and pharmacists should contribute to AMS in primary care  
- Nurses, with appropriate training, can contribute to patient education on appropriate use of antibiotics |
| How can we improve antibiotic prescribing in primary care? |
| 12. Brink, Van den Bergh, Mendelson, and Richards (2016), South Africa | Expert opinion review | - Nurses can potentially play important roles in antimicrobial prescribing in South Africa  
- Nurses can take an AMS role in intensive care units |
| Passing the baton to pharmacists and nurses: New models of antibiotic stewardship for South Africa? |
| 13. Tyer-Viola and Kelly (2015), USA | Research Poster | - Aim: To create a surgical site infection prevention bundle  
- Results: Nurses initiated an evidence-based care bundle e.g. patient education on wound care, hand hygiene, and signs and symptoms of infection which decreased surgical site infection |
| Using Best Evidence to Reduce the Rate of Surgical Site Infection |
| 14. Spruill and Folh (2015), USA | Research Poster Presentation | - Aim: To ensure antibiotic prophylaxis compliance in scheduled cesarean births  
- Results: The results of 99% compliance was met by changing practice of nurses e.g. eliminating time in finding blood collection tubes and antibiotics so that nurses could focus on the woman in labour without leaving the bedside. |
| Improving Antibiotic Prophylaxis Prior to Cesarean Birth |
| 15. Peate (2015), Spain | Editorial | - Pre-registration nursing programmes should include the topic of AMR, supporting multidisciplinary engagement of AMS  
- Nurses should be present at a global forum e.g. World Health Assembly/WHO summits |
<p>| Antimicrobial resistance: the nurse’s essential role |</p>
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| 16. Manning and Giannuzzi (2015), USA  | Expert opinion review  | • Applying “antibiotic time-out” strategy including 1) reassessing antibiotic therapy after 2-3 days and deciding management based on culture results; 2) monitoring [Clostridium difficile](https://en.wikipedia.org/wiki/Clostridium_difficile) and ceasing of all unnecessary antibiotics; 3) reappraising antibiotic therapy; 4) assessing blood cultures to ensure that serious infection is treated in a timely manner; and 5) pre-discharge evaluation to avoid unnecessary antibiotic use at a critical transition of care.  
• Nurses can play an executive role in AMS teams e.g. spearheading strategic nursing engagement, raising awareness among nurses regarding the importance of antibiotic use, demonstrating how nursing can be incorporated in AMS. |
| 17. Fehily, Stuart, Horne, Korman, and Dendle (2015), Australia | Research               | • Aim: To identify the extent of healthcare workers’ (HCW) awareness of their patients’ ADR, and antibiotic use in hospital.  
• Results: Majority of nurses were more likely to be aware of their patient’s penicillin ADR compared with doctors and pharmacists. |
| 18. Bruce, Maiden, Fedullo, and Kim (2015), USA  | Research               | • To (1) evaluate the impact of a nurse-initiated ED sepsis protocol on time to initial antibiotic administration, (2) ascertain compliance with 3-hour Surviving Sepsis Campaign (SSC) targets, and (3) identify predictors of in-hospital sepsis mortality.  
• Results: Implementation and adherence to the ED Sepsis protocol initiated by nurses significantly reduced time to initial antibiotic administration and improved compliance with serum lactate level collection. The impact of the protocol implementation did not lead to significant change in the in-hospital mortality rate |
| 19. McGoldrick (2014), USA     | Expert opinion review  | • Identifying signs and symptoms that may indicate an infection  
• Applying the SBAR (situation, background, assessment, recommendations) approach to communicate with the prescriber  
• Avoid requesting unnecessary antibiotic prescriptions for patients  
• Ensure that a specimen culture is obtained prior to commencing antibiotic therapy  
• Requesting an order for a C. difficile test if the patient had at least three episodes of watery diarrhea within a day.  
• When a new antibiotic is prescribed: administering antibiotics according to the prescription, ensuring full compliance and completion of the course of treatment.  
• Reassessing the patient 48-72 hours after starting an antibiotic and taking an “antibiotic timeout”  
• Documenting and communicating with prescribers regarding patients’ clinical response  
• Medication reconciliation and medication monitoring activities |
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<th>Type of paper</th>
<th>Nurses’ roles in antimicrobial stewardship</th>
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| 20. Gallagher (2014), UK Cutting antibiotic use | Expert opinion review | - Educating patients and the wider public  
- Playing a role in reducing the demand of antibiotics and enhancing the effectiveness of prescribed antibiotics |
| 21. Curry, Gallagher, and Donovan (2014), UK Antimicrobial resistance | Guidelines | - Obtaining specimens when clinically indicated and transferring the specimen to a laboratory in a timely manner  
- Ensuring the antibiotic prescribing processes are clearly communicated, implemented and monitored  
- Dispensing antibiotics in the right time, under optimal circumstances  
- Educating patients and their carers about how to take antibiotics appropriately, observe and report any worsening sign/symptoms |
| 22. Charani, Castro-Sanchez, and Holmes (2014), UK The role of behavior change in antimicrobial stewardship | Expert opinion review | - Introducing evidence-based AMS role by applying evidence to ensure optimal antibiotic use and application in nursing practice.  
- Introduce new role as AMS consultant and supporting the role in AMS as a core competency in educational qualification. |
| 23. Amalia (2014), South Africa Changing Southern African Nurses’ Roles in Antibiotic Stewardship: An Innovative Pedagogical Approach Research Poster | | - Qualitative description of the current roles of nurses in Mozambique, Malawi and South Africa related to:  
  - Antibiotic prescription  
  - Antibiotic administration  
  - Antibiotic management  
  - Patient education |
| 24. Ladenheim, Rosembert, Hallam, and Micallef (2013a), UK Antimicrobial stewardship: the role of the nurse | Expert opinion review | - Prescribing  
- Questioning and highlighting suboptimal antibiotic therapy.  
  - Ensuring doctors’ prescribing in line with recommended guidelines.  
  - Reviewing medication chart, blood cultures.  
  - Ensuring appropriate switch of intravenous antibiotic therapy to oral.  
- Allergy status confirmation  
- Considering and confirming drug allergy, side effects before administration.  
- Timing of antimicrobial administration  
  - Ensuring appropriate time of antibiotic administration.  
  - Continuation of drug treatment |
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<th>Author, Publication year, Country, Title</th>
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| Ladenheim, Rosembert, Hallam, and Micallef (2013a), (cont.) | Research | • Ensuring appropriate administration and continuation of treatment  
• Outpatient parenteral antimicrobial therapy  
• Monitoring antibiotic treatment, adverse effects and complications of treatment when there are intravenous antimicrobial therapies in the outpatient or community setting |
| Gillespie, Rodrigues, Wright, Williams, and Stuart (2013a), Australia | Research | • Aim - To assess nursing attitudes and knowledge of AMS before and after an education intervention that focused on nursing involvement in AMS  
• Findings - IV antibiotic use reduced in three of six wards, Reduction in Staphylococcus aureus bacteremia related to IV lines (3 to 2). Nurses were more likely to raise questions with the treatment team about appropriateness of treatment. |
| Aziz (2013), UK | Expert opinion review | • Reviewing antibiotics history with patients on admission, at handover, and when they are being discharged.  
• Vigilance about how wards and departments use antibiotics; cooperate with infection prevention and control teams.  
• Always administer antibiotics on time and avoid missing doses.  
• Checking laboratory results of patients; blood cultures, specimen cultures and sensitivity then informing the doctor to encourage a narrow-spectrum antibiotics.  
• Monitoring standard precautions and implementing infection prevention and control measures when nursing patients with antibiotic drug resistance.  
• Participating in unit-based surveillance studies to learn about trends in antimicrobial resistance.  
• Participating in antibiotic committee meetings and learning about the hospital strategy to address antibiotic resistance. |
| Dryden et al. (2012), UK | Research | • Aims: To assess the impact of an infection team (doctor, nurse and antibiotic pharmacist) review of patients receiving antibiotics in six hospitals across the UK and to establish the suitability of these patients for continued care in the community.  
• Findings: Ninety-nine (23%) patients (including 26 on IV antibiotics) had their antibiotics stopped immediately on clinical grounds. The other 330 (77%) patients (including 139 on IV antibiotics) needed to continue antibiotics, although 47 (34%) could be switched to oral. Eighty-nine (21%) patients were considered eligible for discharge, comprising 10 who would have required outpatient parenteral antibiotic therapy (OPAT), 55 who were suitable for oral outpatient treatment and 24 who had their antibiotics stopped.  
• Conclusions: Infection team review had a significant impact on antimicrobial use, facilitating IV to oral switch and a reduction in the volume of antibiotic use, possibly reducing the risk of healthcare-associated complications and infections. |
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| 28. Storr and Gallagher (2012), WHO Cutting levels of antimicrobial resistance | Expert opinion review | • Professional responsibilities  
  o Researcher  
  o Care providers  
  o Infection prevention and health protection specialists  
  o Clinical specimen  
  • Responsible prescribing  
  o Good administration practice; correct route, time.  
  • Education and collaboration  
  o Public health education  
  o Patient education in antibiotic use  
  o Hygiene practices  
  • Infection prevention and control  
  o Infection prevention practices |
| 29. Galvin and Fennell (2012), Ireland Antimicrobial stewardship rounds in a general hospital in Ireland | Research Poster | • Aim – To determine the number of interventions that resulted from weekly multidisciplinary rounds by an AMS team including nurses.  
  • Findings – Seven AMS rounds were undertaken. Course length recommendation was the most common type of intervention (29%). The following AMS interventions were implemented: cease course of antimicrobials, guide further treatment, guide alternative agent, IV to PO switch, dose recommendation, add antimicrobial to regimen, therapeutic drug monitoring. |
| 30. Gallagher and Storr (2012a), UK Nurses can lead drive to minimize antibiotic use | Expert opinion review | • Public health education and teaching people about hygiene practices.  
  • A leading position in infection prevention control, and prevention of the spread of antibiotic resistance. |
  • Public health education on antimicrobial resistance.  
  • Infection prevention and control practices. |
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<tr>
<td>32. Daniels (2012), UK Antibiotic resistance: a crisis in the making</td>
<td>Expert opinion review</td>
<td>• Monitoring antibiotic prescribing including treatment, duration, administration routes and timing</td>
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| 33. Crombie (2012a), UK Nurses can help prevent antibiotic resistance | Expert opinion review | • Raising awareness of patients in antibiotic use and provide clear written information on self-management of common infections.  
• Providing clear advice about correct antibiotic use along with minor side effects, influenza vaccination uptake |
| 34. Edwards, Loveday, Drumright, and Holmes (2011d), UK Should nurses be more involved in antimicrobial management? | Editorial | • Patient advocates and education such as helping patients to understand the need of prudent antibiotic prescribing. |
| 35. Edwards et al. (2011c), UK Covering more territory to fight resistance: considering nurses' role in antimicrobial stewardship | Expert opinion review | • Ensuring antibiotic treatment is in line with microbiology results and minimise broad-spectrum antimicrobial prescribing.  
• Ensuring appropriate duration of antimicrobial treatment.  
• Monitoring intravenous antimicrobial treatment to oral therapy.  
• Ensuring timing of administration and duration of surgical prophylaxis.  
• Stimulating an awareness of nurses in prompt and timely antimicrobial administration.  
• Monitoring blood results to ensure that treatments are following antimicrobial guidelines.  
• Encouraging suitable outpatient antibiotic therapy. |
| 36. Lim (2010), USA What nurses need to know about antibiotic resistance | Expert opinion review | • Participating in Pharmacy committee meetings to discuss antibiotic resistance.  
• Administering antibiotics on time and avoiding missed doses.  
• Monitoring patients’ laboratory result and informing the physician to encourage narrow-spectrum antibiotic use.  
• Participating in surveillance studies to learn trends in resistant infections. |
| 37. Shimoni et al. (2009), Israel Empowering surgical nurses improves compliance rates for antibiotic prophylaxis after caesarean birth. | Research | • Aims: To report the effect of empowering surgical nurses to ensure that patients receive antibiotic prophylaxis after caesarean birth.  
• Findings. The compliance rate was increased from 25% in 2006 to 100% in 2007 (chi-square test, P < 0.001). Suspected wound infection rates decreased from 16.8% (186/1104) to 12.6% (137/1089) after the intervention (relative risk 0.75, 95% confidence interval, 0.61–0.92). |
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<td>Shimoni et al. (2009), Israel (cont.)</td>
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<td>Conclusion. Surgical nurses can ensure universal compliance for antibiotic prophylaxis in women after caesarean birth, leading to a reduction in wound infections.</td>
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| Turkoski (2005), USA                    | Expert opinion review | • Colleting culture/sensitivity of specimens before beginning antimicrobial therapy.  
| Fighting infection - An ongoing challenge, part 2 – Antibacterial | | • Evaluating patients’ allergy history before starting antimicrobials  
| | | • Practicing and teaching hand hygiene and standard precautions  
| | | • Monitoring signs of extravasation for patients with IV antimicrobials.  
| | | • Monitoring hypersensitivity reactions during and after IV administration.  
| | | • Monitoring and educating patients to observe for severe diarrhea, signs of renal impairment and any specific side effects of antibiotics. |
| Pagaiya and Garner (2005), Thailand    | Research     | Aims: To examine whether clinical guidelines improved the quality of care (antibiotic use, diazepam prescribing, drug costs per patient, and a composite process index for diabetes care) by nurse-led health centres  
| Primary care nurses using guidelines in Thailand: a randomized controlled trial | | Results: Baseline prescribing was high for antibiotics (37% of all attendees), and no difference between intervention and control sites was detected at follow-up for this variable. In children (0–5 years old), antibiotics were widely used for acute respiratory tract infection (34%), and fell within guidelines (intervention: 42% at baseline to 27% at follow-up; control: 27–30%, P = 0.022), with an associated fall in drug costs per patient. Antibiotics were widely prescribed for diarrhoea in children (91%), but no change was detected with guidelines.  
| | | Conclusion: Staff at primary health centres over-prescribe antibiotics in children and tranquilizers in adults. Clinical guidelines implemented with workshops and educational outreach visits improved some but not all aspects of prescribing in the short-term. |
| Glover (2000a), USA                     | Expert opinion review | Administering antibiotics appropriately  
| How drug-resistant microorganisms affect nursing | | Teaching patients how to use antibiotics  
| | | Obtaining cultures before beginning antibiotics  
| | | Reviewing culture results and reporting to physicians for appropriate antibiotics  
| | | Monitoring adherence of physicians to guidelines for antibiotic use  
<p>| | | Collecting cultures using appropriate method |</p>
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| 41. Clark (2000), P.228, UK Antibiotic resistance: a growing and multifaceted problem | Expert opinion review | • Improve public awareness of antibiotic resistance  
• Educate patients/members of the public about infection where antibiotics are not indicated and promote palliative remedies for common colds  
• Ensure, where possible, that samples are sent to the laboratory as appropriate for culture and antibiotic sensitivity.  
• Provide supportive information of the patient’s clinical signs and symptoms of infection; a positive isolate from a swab may not necessarily mean the patient needs antibiotics, the patient may be colonized as opposed to infected with the bacteria  
• Ensure compliance with treatment regime where antibiotics are prescribed  
• Ensure doctors review the patient’s antibiotic therapy at regular intervals  
• Ensure antibiotics are reviewed in the light of microbiological culture and sensitivity results where patients have been recommend on broad spectrum antibiotics empirically |
| 42. Ashurst (1994), UK Role of nurses in antibiotic therapy | Expert opinion review | • Nurses have traditionally been involved in the administration of antibiotics and assessment of their efficacy.  
• Nurses are in an ideal position to overview and participate in the appropriate use of antibiotics.  
• Nurses can make significant contributions to the correct use of antibiotics by ensuring that:  
  o Doctors adhere to an antibiotic policy and, where possible, use the most appropriate narrow-spectrum antibiotic  
  o A sensible prescribing policy is used, especially for surgical prophylaxis  
  o The most appropriate route of therapy is used  
  o The complete course of prescribed therapy is taken  
  o Antibiotic administration is not continued indefinitely  
  o Any untoward effects, such as profuse diarrhoea, are reported immediately and specimens obtained.  
• These measures require some basic knowledge of pharmacology and microbiology, subjects that may be given little priority in some nursing courses |
Table 2.3 Summary of the paper regarding the role of infection control nurses in antimicrobial stewardship (AMS) (n=3)

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<tr>
<th>Author, Publication year, Country, Title</th>
<th>Type of paper</th>
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| 1. Stuart, Orr, Kotsanas, and Gillespie (2015), Australia | Research | • Aims: to assess the role of the infection control clinical nurse consultant (CNC) in the antimicrobial stewardship team in two residential aged care facilities (RACFs).  
• Results: A nurse-led AMS resulted in significant reduction in antibiotic use in a residential aged care facilities |
| 2. The Strategy for the Control of Antimicrobial Resistance in Ireland (SARI) (2009, p. 14), Ireland, “Guidelines for Antimicrobial Stewardship in Hospitals in Ireland” | Guidelines | • Being members of AMS team and directly involving in AMS activities including;  
  o Pre-authorization of restricted antimicrobials  
  o Review of patients on intravenous antimicrobials, for potential switch to oral therapy  
  o Review of patients receiving antimicrobials with duplicate spectra, or other potentially inappropriate drug combinations  
  o Review of patients on selected broad spectrum antimicrobials  
  o Review of patients with documented sterile site infections (e.g. bloodstream infection, meningitis), to ensure appropriate antimicrobial therapy is in place  
  o Review of patients receiving antimicrobials for a duration that exceeds recommendations in the hospital antimicrobial guidelines  
  o Participation in the infection prevention and control program  
  o Provision of education on prudent antimicrobial use to consultant, non-consultant and nurse prescribers |
| 3. Cheng et al. (2009), China | Research | • Aims: To explore a sustainable and cost-effective of AMS initiatives; two-stage immediate concurrent feedback (ICF) model, in which the antimicrobial prescription is audited by two part-time infection control nurses in the first stage, followed by “physician ICF” in the second stage.  
• Results: The overall compliance rate to antibiotic prescription guidelines was 79.4%, while the compliance with ICF was 83.8%. Antibiotics consumption reduced from 73.06 (baseline, year 2004) to 64.01 (year 2007) per 1,000 patient bed-day-occupancy. |
2.2.1 Narrative summary of nurses’ role in antimicrobial stewardship

The earliest paper retrieved that addressed the role of nurses in AMS was published in 1994. The earliest research paper located was published in 2005 and interestingly was a Thai paper and the only publication emerging from Thailand (Pagaiya & Garner, 2005). The study was a randomised controlled trial of adherence to guidelines in nurse-led primary health care centres in Thailand and the conclusions were that there was over-prescribing of antibiotics.

Nurses are recognised as important stakeholders in AMS programs (Gillespie et al., 2013b; Ladenheim et al., 2013b). There is consensus in the literature that nurses have a professional responsibility as members of a multidisciplinary team and as patient advocates to promote safe and effective antimicrobial therapy, provide patient education and raise public awareness about appropriate antibiotic usage.

Nurses are considered to play a vital role in ensuring optimal antibiotic therapy (Ladenheim et al., 2013a) through adjustment of timing and preparation of medications (Wentzel et al., 2014) and monitoring for side effects or adverse effects of antimicrobials (Ladenheim et al., 2013b; Turkoski, 2005). Renaudin, Beaudouin, Ponvert, Demoly, and Moneret-Vautrin (2013) found that more than half of the side effects associated with antibiotic therapy occur while patients are in hospital. Further nurses have a role in initiating reviews of treatment (Aziz, 2013; Curry et al., 2014; Ladenheim et al., 2013a; Lim, 2010) and obtaining cultures and sensitivities before beginning antimicrobial therapy to ensure that isolates are sensitive to antimicrobial treatment and that treatments are in line with recommended guidelines (Aziz, 2013; Edwards et al., 2011c; Glover, 2000a; Ladenheim et al., 2013a; Turkoski, 2005). In a study of the outcomes of AMS rounding in a general hospital in Ireland, nurses were seen as important members of the multidisciplinary AMS team. The AMS teams conducted clinical reviews regarding the appropriateness of antibiotic treatment in terms of dose, choice, route, duration and clinical progress (Galvin & Fennell, 2012) as well as providing ongoing monitoring for treatment safety and effectiveness (Curry et al., 2014).
Patient advocacy in relation to antimicrobial therapy is recognised as a fundamental role of nurses in AMS (Aziz, 2013; Edwards et al., 2011c; Ladenheim et al., 2013a). Patient advocacy involves ensuring that antimicrobial therapies are appropriate and safe (Edwards et al., 2011d). Although nurses may not always have the authority to prescribe antibiotics they can influence what is prescribed (Castledine, 2006; Jutel & Menkes, 2010a). An example of nurses’ roles in the ongoing management of antimicrobial therapy is in decision making related to the transition from intravenous to oral antimicrobial therapy (Curry et al., 2014; Edwards et al., 2011c; Ladenheim et al., 2013a). A study by Gillespie et al. (2013a) showed that after an intervention to promote nurses’ involvement in decisions to change the route of antibiotic treatment, the number of blood stream infections decreased.

Surgical prophylaxis is another area of AMS where nurses can play a fundamental role. The timing of administration and the duration of surgical prophylaxis is related to AMR (Harbarth, Samore, Lichtenberg, & Carmeli, 2000). Nurses can monitor the duration of surgical prophylaxis in consultation with doctors and pharmacists (Edwards et al., 2011c).

One of the most important elements of the WHO strategy to fight antibiotic resistance is to actively educate patients about appropriate antimicrobial use (WHO 2014). This public health role involves education and raising awareness about optimal antibiotic use in the home setting (Amalia, 2014; Clark, 2000; Crombie, 2012a; Storr & Gallagher, 2012), reinforcing messages that antibiotics are not indicated for routine viral infections, promoting symptom management for common colds to reduce antibiotic resistance (Clark, 2000), and informing patients about recognising and reporting adverse effects and complications of antibiotics (Curry et al., 2014; Glover, 2000a). As well as ensuring safe and effective antimicrobial therapy through education, nurses can play a vital role in infection prevention and control practices (Ness, Price, Currie, & Reilly, 2014) by acting as role models for good hygiene to minimise the spread of antibiotic resistant pathogens through hand hygiene, standard precaution practices, and environmental cleanliness (Clark, 2000; Gallagher & Storr, 2012a; Turkoski, 2005).
Infection control nurses (ICNs) have a particular role in AMS however there has been little attention to this role in the current literature. The two research papers from Australia and China reported the positive outcomes regarding antibiotic use when ICNs engaged in AMS programs. The Irish guidelines for infection control nurses in AMS provide a useful framework for exploring this specialist role. According to the guidelines, infection control nurses are recognised members of the AMS team directly involved in stewardship for the appropriate use of antibiotics in particular as outlined in Table 2.2 (SARI, 2009, p. 14). Nurses can play a significant role in AMS however, the role is complex, and nurses may not recognise AMS as an integral part of their role or may perceive that they do not have the knowledge, skills or authority to fulfil the role. This notion is explored further in the section to follow.

2.3 Clinicians’ attitudes and perceptions towards antimicrobial stewardship

In this section, a search and narrative summary of the literature related to clinicians’ attitudes and perceptions towards AMR, antimicrobial use and AMS is presented from a worldwide perspective. This review informs our understanding of what is known about the attitudes and perceptions of different AMS team members as well as identifying the measurement instruments that have been developed to measure perceptions and attitudes.

The CINAHL and MEDLINE electronic databases were searched from January 2000 to November 2017. The databases were searched using the following terms: “attitude* and perception*” and “antimicrobial resistance” or “antimicrobial use” or “antimicrobial stewardship” or “antibiotic stewardship” not “nursing home”. Additionally, Google (Scholar) databases were also searched using the term “clinicians’ attitude and perceptions in antimicrobial stewardship”. Qualitative and quantitative research published in English were included. The review process revealed 32 relevant research papers. The papers were categorised according to the different disciplines of clinicians and included seven papers of a multidisciplinary nature, 20 papers focused on physicians and five papers focused on pharmacists, nurses and nurse practitioners. The summaries of reviewed papers are presented in Tables 2.4, 2.5 and 2.6 followed by a narrative discussion of the key findings.
Table 2.4 Summary of published papers of attitudes and perceptions towards antimicrobial resistance, antimicrobial use and antimicrobial stewardship: **multidisciplinary clinicians** (n=7).

<table>
<thead>
<tr>
<th>Author, Publication year, Country, Title</th>
<th>Design of study</th>
<th>Participants</th>
<th>Perceptions and attitudes towards AMS</th>
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</thead>
</table>
| 1. Fathi et al. (2017), Egypt Knowledge, attitudes, and beliefs regarding antimicrobial therapy and resistance among physicians in Alexandria university teaching hospitals and the associated prescription habits | Survey          | Physicians, Pharmacists | • Majority of respondents perceived that AMR is a problem at global (95%), national (97%), and local levels (85%)  
• Decisions regarding antibiotic prescribing are mainly based on patient indicators (78.5%) and socioeconomic status (76.3%)  
• Lack of engagement in educational activities, low awareness of local drug resistance patterns and insufficient patient education particularly side effects of drugs. |
| 2. Lim et al. (2014a), Australia Antimicrobial stewardship in residential aged care facilities: need and readiness assessment | Semi-structured interviews and focus groups | Nurses, general practitioners, pharmacists | • Five main perceptions studied were: 1) antibiotic prescribing behavior, 2) AMR, 3) attitude towards and understanding of AMS, 4) perceived barriers/facilitators of AMS implementation, and 5) feasibility of AMS interventions  
• Lower perceived over-prescribing of antibiotics in aged care facilities were found in nurses compared to GPs and pharmacists  
• AMS implementation in RACFs was perceived important  
• Perceived barriers to AMS implementation were workload and logistics  
• Nursing-based education and aged-care specific antibiotic guidelines to address scope of AMS practice and interventions  
• The perceived most useful and feasible intervention was regular antibiotic surveillance |
| 3. Cotta et al. (2014), Australia Attitudes towards antimicrobial stewardship: results from a large private hospital in Australia | Survey          | Specialists, nurses, pharmacists | • AMR was perceived by participants as a serious problem (62% in Australian hospital and 45% in surveyed hospitals)  
• Half of participants were willing to participate in AMS interventions.  
• 58% of participants agreed that improving antibiotic prescribing would reduce AMR.  
• 29% of participants have worked in facilities that had AMS in place.  
• AMS was more familiar to pharmacists than other health professions |
<p>| 4. Sanchez, Roberts, Albert, Johnson, and Hicks (2014), USA Effects of knowledge, attitudes, and practices of primary care providers on antibiotic selection, United States | In-depth interviews | Physicians, nurse practitioners, physician assistants | • Participants were concerned about AMR but did not consider resistance when choosing antimicrobial medications for treatment because they were more concerned about patient and parent satisfaction, and complications of infection. |</p>
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<tr>
<th>Author, Publication year, Country, Title</th>
<th>Design of study</th>
<th>Participants</th>
<th>Perceptions and attitudes towards AMS</th>
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</table>
| 5. Adera, Kibret, and Mulu (2014a), Ethiopia | Survey | Physicians, nurses | • 98% of nurses and 65% of physicians reported that they need AMS training  
• 72.2% of respondents had knowledge about antimicrobial resistance (AMR).  
• Most respondents agreed that AMR is a national and global problem but only few respondents thought that AMR was a problem in their own hospitals.  
• Two main factors causing AMR were poor adherence and anti-microbial overuse  
• Most common causes of AMR were: self-prescribing, lack of access to local antibiogram data, and poor awareness among antibiotics prescribers  
• Patient driven and treatment failure were identified as most common causes of unnecessary antibiotic prescriptions |
| 6. Evans, Rogers, Weaver, and Burns (2011b), USA | Survey | Physicians, physician assistants, nurse practitioner | • Most of respondents agreed with statements regarding the social impact of antibiotic resistance  
• 61% of respondents agreed that patient demand was a major reason for unnecessary antibiotic prescription  
• 17.8% of respondents reported that they overprescribed antibiotics. |
| 7. Giblin et al. (2004a), USA | Survey and focus groups | Nurse, physician, microbiologist, pharmacist | • Most of participants perceived that AMR was a national problem rather than in their own institution/practice. This perception was in line with results from focus groups  
• Barriers were lack of knowledge and nursing shortages which could be resolved by facilitating education, improving information technology and consultation  
• Computer programs, posters, and local data could be resources to influence clinicians about AMR |
Table 2.5 Summary of published papers of attitudes and perceptions towards antimicrobial resistance, antimicrobial use and antimicrobial stewardship: Physicians (n=20)

<table>
<thead>
<tr>
<th>Author, Publication year, Country, Title</th>
<th>Design of study</th>
<th>Participants</th>
<th>Perceptions and attitudes towards AMS</th>
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</table>
| 1. Wilcock, Wisner, and Powell (2016), UK GPs' perceptions of AMR and antimicrobial stewardship | Survey          | General practitioners | • All participants accepted that AMR is a real threat to their patients  
• About half of respondents perceived that evidence of AMR was increasing over the past three years  
• 65% of respondents reported that their patients were demanding antibiotic prescriptions  
• 25% of respondents suggested that campaign to raise patient’s awareness/education/information could help improving antibiotic prescribing practice |
| 2. Steinberg et al. (2016), Canada National Survey of Critical Care Physicians' Knowledge, Attitudes, and Perceptions of Antimicrobial Stewardship Programs | Survey          | Physicians     | • 74% of respondents reported at least 1 component of AMS at their institution.  
• 86% of respondents agreed or strongly agreed that the patients in their ICU benefit from AMS and 81% reported that AMS increased their knowledge and appropriate antimicrobial use  
• AMS was supported and believed to add value to care |
| 3. Paño-Pardo et al. (2016), Spain Opportunities to improve antimicrobial use in paediatric intensive care units: a nationwide survey in Spain | Survey          | Physicians     | • 86% of respondents considered that AMR was a significant problem and 90% thought that improving antimicrobial use in their Paediatric ICU (PICU) should be a priority  
• The excessive use of antimicrobials in patients with non-confirmed infections and excessive use of broad-spectrum antimicrobials were perceived problems among respondents.  
• Antimicrobial therapy guidelines was the most valuable AMS intervention  
• Spanish PICU doctors were aware of the relevance of the problem of AMR and the need to improve antimicrobial use |
| 4. Chuenchohm, Thamlikitkul, Chaiwarith, Deoisares, and Rattanaumpawan (2016a), Thailand Perceptions, attitudes, and knowledge regarding antimicrobial resistance, appropriate antimicrobial use, and infection control among future medical practitioners: A multicenter study | Survey          | Final-year medical students. | • AMR was well recognised  
• Limited perceptions, knowledge and appropriate antimicrobial use were found  
• Half of respondents recognized infection control strategies and existence of an AMS programs in their hospitals. |
| 5. Sharma, Jain, and Sharma (2015), India Knowledge, attitude and perception of medical and dental undergraduates about antimicrobial stewardship | Survey          | Second year medical and dental undergraduate course student | • Knowledge, attitude and perception among future medical and dental prescribers showed statistically significant differences  
• While the attitudes among undergraduate students were good, knowledge and perceptions need to be improved |
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<tr>
<th>Author, Publication year, Country, Title</th>
<th>Design of study</th>
<th>Participants</th>
<th>Perceptions and attitudes towards AMS</th>
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| 6. Baadani, Baig, Alfaahad, Aldalbahi, and Omrani (2015), Saudi Arabia Physicians’ knowledge, perceptions, and attitudes toward antimicrobial prescribing in Riyadh, Saudi Arabia | Survey | Physicians | • 56% of respondents perceived AMR was a significant problem in their daily practice and 70% thought that AMR was a national level problem  
• Two main contributors of an increase in AMR were inappropriate empirical therapy (and excessive use of antimicrobials in healthcare settings  
• Physician education was the most effective intervention to reduce AMR.  
• 45% of respondents did not feel confident in their knowledge of antimicrobial prescribing  
• Two-thirds of the respondents knew of the existence of local antimicrobial guidelines and 67% found them useful |
| 7. Al-Harthi et al. (2015), Saudi Arabia Perceptions and knowledge regarding antimicrobial stewardship among clinicians in Jeddah, Saudi Arabia | Survey | Physicians | • Patient/parent’s demand for antimicrobials was reported by 33% of the general physicians compared to 13.2% of the residents, and 4.3% of the specialists  
• Expensive antimicrobials are more often prescribed by 70% of general physician (70.4%), 26% of residents and 30% of specialists  
• Knowledge and perceptions regarding the current scope of antimicrobial agents and use and misuse of antimicrobial agents were indifferent among different types of clinicians |
| 8. Szymczak, Feemster, Zaoutis, and Gerber (2014), USA Pediatrician Perceptions of an Outpatient Antimicrobial Stewardship Intervention | Semi-structure interview | Pediatricians | • Respondents recognized that antibiotic overuse is a significant problem, but they believed that this problem resulted from the behavior of nonpediatric physicians.  
• Major barrier of antibiotic prescriptions was parent pressure |
| 9. Dallas, van Driel, van de Mortel, and Magin (2014), USA Antibiotic prescribing for the future: exploring the attitudes of trainees in general practice | Semi-structure interview and focus group | Trainees in general practice | • Participants were aware of the importance of evidence-base antimicrobial prescribing and the impact of their decisions on AMR  
• Prescribing decisions can be affected by: patient and system factors, diagnosis uncertainty, multiple clinician input, and the habits of and relationship of trainees’ supervisors |
| 10. Steinberg et al. (2014), Canada Vancomycin-resistant enterococci (VRE) and the role of the healthcare worker | Survey | Physicians | • Most respondents agreed that patients in ICU benefit from an AMS program  
• 83% of respondents reported that their knowledge of appropriate antimicrobial use increased because of AMS programs implemented in ICU setting |
| 11. Chaves et al. (2014), Australia Analysis of knowledge and attitude surveys to identify barriers and enablers of appropriate antimicrobial prescribing in three Australian tertiary hospitals | Survey | Residents, interns, and consultant hospital doctors | • Barriers included knowledge gaps in antimicrobial prescribing, lack of awareness about restricted antimicrobials and reliance on senior colleagues to prescribe antimicrobial agents  
• Enablers included: an acknowledgement of the need for assistance in prescribing and access to national prescribing guidelines. |
| 12. Wood et al. (2013), European countries Primary care clinicians’ perceptions of antibiotic resistance: a multi-country qualitative interview study | Qualitative interview study | Primary care clinicians | • Most clinicians believed that AMR was not a problem in their practice.  
• Clinicians agreed that resistance will become more serious without improved AMR or new drug discovery |
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<tr>
<th>Author, Publication year, Country, Title</th>
<th>Design of study</th>
<th>Participants</th>
<th>Perceptions and attitudes towards AMS</th>
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| 13. Thriemer et al. (2013b), Congo | Survey | Doctors and Students | • Knowledge about antibiotic (AB) was low.  
• AMR was recognised more as a worldwide problem than nationally and in their own practice  
• Confidence in AB prescribing was high  
• Local AB guidelines and courses relating to AB prescribing were needed. |
| Antibiotic Prescribing in DR Congo: A Knowledge, Attitude and Practice Survey among Medical Doctors and Students | | | |
| 14. Hardy-Holbrook et al. (2013), Australia | Survey | General practitioners (GPs) | • 40% of respondents admitted that they prescribed antibiotics to meet parent’s expectation  
• Antibiotic resistance was generally not discussed with patients |
| Antibiotic resistance and prescribing in Australia: current attitudes and practice of GPs | | | |
| 15. Abbo et al. (2013c), USA | Survey | Fourth-year medical students | • 92% of respondents agreed that strong knowledge of antimicrobials is important  
• 90% of respondents said that they would like to have more education on appropriate use of antimicrobials  
• Two-thirds of respondents perceived their preparedness was inadequate in some fundamental principles of antimicrobial use |
| Medical students’ perceptions and knowledge about antimicrobial stewardship: how are we educating our future prescribers? | | | |
| 16. Navarro-San Francisco et al. (2013), Spain | Survey | Resident doctors | • Over 83% of residents of all hospitals, specialties and seniority considered that AMR was an important problem at a national level, at their institution, and in their daily practice  
• Residents reported having insufficient antibiotics training although 87% prescribed antibiotics in the last month  
• To improve antibiotic prescribing some activities were suggested including availability of local antibiotic guidelines and advice/specialist, specific teaching sessions, having an antimicrobial management team |
| Knowledge and perceptions of junior and senior Spanish resident doctors about antibiotic use and resistance: results of a multicenter survey | | | |
| 17. Garcia et al. (2011a), Peru | Survey | Physicians | • Theoretical knowledge was good, but awareness of local antimicrobial rate was poor  
• Most participants strongly agreed that AMR is a problem worldwide and in Peru, but it is not a problem in their own practice.  
• Antimicrobial overuse was perceived in the community and the hospital settings.  
• Antimicrobials overuse in the community was contributed to by patient pressure  
• Pocket-based AM prescribing guidelines and the internet were considered to be useful sources of information  
• More AM prescribing educational programs were requested. |
| Knowledge, attitudes and practice survey about antimicrobial resistance and prescribing among physicians in a hospital setting in Lima, Peru | | | |
| 18. Bannan, Buono, McLaws, and Gottlieb (2009), Australia | Survey | Junior and specialist medical staff | • Most participants stated that the AMS program is important  
• Most staff believed that seeking approval made teams think carefully about antibiotic choice and the approval system provided was a useful educational material  
• The AMS program was perceived as a time consuming and distracting activity |
<p>| A survey of medical staff attitudes to an antibiotic approval and stewardship program | | | |</p>
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<tr>
<th>Author, Publication year, Country, Title</th>
<th>Design of study</th>
<th>Participants</th>
<th>Perceptions and attitudes towards AMS</th>
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</table>
| 18. Bannan et al. (2009), Australia (cont) |                |              | • Advice through the AMS program improved patient outcomes  
• The AMS program was well supported by all staff and helped maintain AMs program policy |
Assessing motivation for physicians to prevent antimicrobial resistance in hospitalized children using the Health Belief Model as a framework | Focus groups | Physicians | • Physicians perceived that AMR was a problem at a national level rather than in their institution |
| 20. Walker, Grimshaw, and Armstrong (2001), UK  
Salient beliefs and intentions to prescribe antibiotics for patients with a sore throat | Survey | General practitioners (GPs) | • The majority of participants tended to prescribe antibiotics to less than half of their patients with sore throats  
Intervention targeting salient beliefs associated with motivation to antimicrobial prescribing was suggested |
Table 2.6 Summary of published papers of attitudes and perceptions towards antimicrobial resistance, antimicrobial use and antimicrobial stewardship: Pharmacists, Nurses and Nurse Practitioners (n=5)

<table>
<thead>
<tr>
<th>Author, Publication year, Country, Title</th>
<th>Design of study</th>
<th>Participants</th>
<th>Perceptions and attitudes towards AMS</th>
</tr>
</thead>
</table>
| 1. Toska and Geitona (2015), Greece       | Survey          | Nurses       | • 87% of participants reported irrational prescribing was an important cause of AMR  
| Antibiotic resistance and irrational prescribing in paediatric clinics in Greece |                 |              | • Uncertainty of diagnostic was a main cause of irrational antibiotic prescribing  
|                                           |                 |              | • 94% of participants suggested the use of protocols and guidelines to control overprescribing.  
|                                           |                 |              | • Parent’s demand for antibiotics in hospitals increased  
|                                           |                 |              | • Nurse involvement in AMS could educate patients and parents on antibiotic overprescribing and AMR. |
| 2. Broom, Broom, Kirby, Plage, and Adams (2015), Australia | Semi-structured interviews | Pharmacists | • Mixed attitudes towards the significance of AMR was found and optimal use of antibiotics was perceived as a low priority  
| What role do pharmacists play in mediating antibiotic use in hospitals? A qualitative study |                 |              | • Pharmacists had limited influence on antibiotic decision-making of physicians  
|                                           |                 |              | • Identified existing barriers included medical hierarchy, limited contact with senior doctors, insufficient pharmacy workforce to foster collaborative relationship and facilitate the uptake of doctors’ advice |
| 3. Pawluk, Black, and El-Awaisi (2014), Qatar | Survey          | Pharmacists  | • The most common barrier to implementing AMS programs were lack of infectious disease specialists and training for healthcare providers. |
| Strategies for improving antibiotic use in Qatar: a survey of pharmacists’ perceptions and experiences |                 |              |                                           |
| 4. Abbo, Smith, Pereyra, Wyckoff, and Hooton (2012), USA | Survey          | Nurse Practitioners | • Most participants agreed that AMR was a local and national problem.  
| Nurse Practitioners’ attitudes, perceptions, and knowledge about antimicrobial stewardship |                 |              | • All of participants agreed that appropriate antibiotic use would decrease AMR and over 90% of participants needed more antibiotic education.  
|                                           |                 |              |                                           |
| 5. Itokazu et al. (2006b), USA            | Survey          | Pharmacists  | • 73% of pharmacists perceived that their AMS program effectively addressed AMR, improved patient outcomes.  
| Pharmacists’ perceptions of the effectiveness of antimicrobial control programs |                 |              | • Many pharmacists indicated the effectiveness of their AMS was uncertain mainly due to inadequate support for the AMS. |
2.3.1 Narrative summary of clinicians’ attitudes and perceptions towards antimicrobial stewardship

In order for AMS programs to be effective, clinical stakeholders need to be aware of the problems of AMR and appropriate antimicrobial use (Abera, Kibret, & Mulu, 2014b; Cotta et al., 2014; Evans et al., 2011b; Szymczak et al., 2014). Although this review of clinicians’ perceptions and attitudes towards AMR, antimicrobial use and AMS interventions identified literature related to several groups of healthcare professionals such as doctors, nurse practitioners and nurses, pharmacists, general practitioners, medical students, and microbiologists, most studies were focused on doctors’ perceptions and attitudes. Investigation of the attitudes and perceptions of healthcare professionals about AMR and antibiotic use is important for successful AMS and to develop interventions to minimise AMR.

Many of the surveys of clinicians’ attitudes, beliefs and perception identified that clinicians in general recognised that AMR is a problem internationally and a public health problem (Abbo et al., 2012; Abbo et al., 2013b; Abera et al., 2014b; Cotta et al., 2014; García et al., 2011a; Giblin et al., 2004c; Navarro-San Francisco et al., 2013; Szymczak et al., 2014). Perceptions of the extent of AMR were studied in developing and first world countries and findings were largely consistent. For example, in surveys of physicians and nurses in Ethiopia, medical doctors and students in the Congo, and physicians in Peru, most participants perceived that AMR is a worldwide problem (Abera et al., 2014b; García et al., 2011a; Thriemer et al., 2013b). However, clinicians in first world countries agreed that AMR was a major problem but perceived that AMR was more serious problem nationally or internationally, than within their institutions (Abbo et al., 2012; Abera et al., 2014a) or their personal practice (Brinsley, Sinkowitz-Cochran, & Cardo, 2005b; Cotta et al., 2014; García et al., 2011a; Giblin et al., 2004c; Thriemer et al., 2013b).

Another area of worldwide consensus is the recognition that overuse of antimicrobial medicines in hospitals and communities contributes to AMR (Abbo et al., 2012; Abbo et al., 2013c; Abera et al., 2014a; Cotta et al., 2014; García et al., 2011a). For example in a study of general practice trainees’ attitudes towards
antibiotic prescribing, respondents believed that their decisions in antimicrobial prescribing would impact on AMR (Dallas et al., 2014). Further, 100% of pharmacists in a large private hospital in Australia (Cotta et al., 2014) and 96% of nurse practitioners and medical students in the United States (US) believed that improving antimicrobial prescribing would help reduce AMR (Abbo et al., 2012; Abbo et al., 2013c).

There is evidence from a variety of disciplines that prescribers recognised that they had insufficient knowledge and training about optimal antimicrobial usage. Again, this was the case in studies conducted in both first and third world countries (Abbo et al., 2012; Abbo et al., 2013b; Abera et al., 2014b; García et al., 2011a; Giblin et al., 2004c; Pawluk et al., 2014; Steinberg et al., 2014). In a US study, 91.2% of nurse practitioners surveyed reported that they required more education about antimicrobial prescribing (Abbo et al., 2012; Giblin et al., 2004c). A study of knowledge of antibiotic prescribing of medical doctors and students in the Congo showed that 39% of participants perceived that their antibiotic knowledge was low although they felt highly confident about their antibiotic prescribing (Thriemer et al., 2013b). Surveys of antimicrobial prescribing knowledge, especially among interns, have identified knowledge as a problem in three Australian tertiary hospitals (Chaves et al., 2014) and in Peru (García et al., 2011a). There is recognition by clinicians that more education and training is needed to improve antimicrobial usage (Abbo et al., 2013c; Abera et al., 2014b; Chaves et al., 2014; García et al., 2011a) as well as more resources to assist antimicrobial decision-making such as antimicrobial guidelines (García et al., 2011a; Thriemer et al., 2013a) and internet-based programs (García et al., 2011a).

Another barrier to optimal antimicrobial use is pressure from patients’ expectations (Abera et al., 2014b; Evans et al., 2011b; García et al., 2011a; Hardy-Holbrook et al., 2013; Sanchez et al., 2014; Szymczak et al., 2014). Responding to patient requests for antimicrobials has been identified in many countries including Ethiopia (Abera et al., 2014b) and the US, where as many as 61% of prescribers perceived that a major cause of unnecessary antibiotic prescribing was patient
demand (Evans, Rogers, Burns, Lopansri, & Weaver, 2011a; Szymczak et al., 2014). The problem of patient expectations is augmented in countries where antibiotics can be purchased without a prescription (Abera et al., 2014b).

In order for AMS to be effective it needs engagement of multidisciplinary clinicians. Support for the potential benefits of AMS programs was identified in surveys conducted in Europe (Wood et al., 2013), Australia (Bannan et al., 2009), Canada (Steinberg et al. 2014) and the USA (Bannan et al., 2009; Itokazu et al., 2006b; Steinberg et al., 2014). However, there are barriers to effective AMS including lack of specialised personnel, training and education (Pawluk et al., 2014) as well as low levels of experience in AMS programs because of the slow implementation of AMS programs within healthcare. For example, only 7% of nurses in an Australian survey had experience of working in healthcare facilities with AMS programs (Cotta et al., 2014). Willingness of clinicians to participate in AMS may be variable as AMS can be time consuming, may interfere with clinical responsibilities (Bannan et al., 2009) and may be perceived by physicians to impact on their prescribing autonomy.

Understanding clinicians’ perceptions and attitudes toward AMS is important in determining the difference and similarities between professions and the barriers and facilitators to effective AMS. Perceptions and attitudes towards AMS held by multidisciplinary clinicians are, in general positive, however, there are potential barriers to effective AMS that are related to the need for education, training and resources, willingness of clinicians to participate and external pressure from patients that impact on prescribing. Patients play an important role in the use of antibiotics and are key stakeholders. In the section to follow the literature related patient participation in AMS is reviewed with the intent of determining how patients’ roles can be augmented and supported.

### 2.4 Patient participation in antimicrobial stewardship

In this section, a search and narrative review of the literature related to patient participation or engagement in antimicrobial use and AMS is presented in
order to understand current and potential patient participation in AMS from the perspectives of different cultures and contexts worldwide.

The CINAHL and MEDLINE electronic databases were searched from January 2000 to September 2017. The databases were searched using the following terms: "patient participation" or "patient engagement" or "patient involvement" or "patient decision" and “antibiotic* or antimicrobial”. Additionally, Google (Scholar) databases were also searched using the term “patient participation in antimicrobial stewardship” in this literature review. Qualitative and quantitative research and clinical reviews that were published in English were included. The review process revealed 12 papers that met the search criteria including 11 research papers and one review paper. An additional Thai language paper was found however this was excluded (Porisutiwutiporn & Hemchayat, 2014b). A summary of the findings is presented in Table 2.7 followed by a narrative summary of the major themes related to patient participation in AMS.
Table 2.7 Summary of published papers of patient participation or engagement in antimicrobial use and stewardship (n=12)

<table>
<thead>
<tr>
<th>Author, Publication year, Country, Title</th>
<th>Participants</th>
<th>Intervention</th>
<th>Type of research</th>
<th>Significant outcomes of patient participation/engagement</th>
</tr>
</thead>
</table>
| 1. Heid, Knobloch, Schulz, and Safdar (2016), USA | Patients | None | Qualitative Semi-structured interviews | • Participants perceived AMS as a serious public health problem but recognised low perceived susceptibility to being personally affected by AMR.  
• Participants had a high degree of trust in physicians and misperceptions regarding the mechanisms underlying resistance.  
• Participants perceived high self-efficacy and a desire to participate in their treatment.  
• Patients perceived their roles in appropriate use of antibiotics were asking questions and speaking up regarding concerns to active sharing in decision-making regarding antibiotic treatments.  
• Few participants expressed being offered the chance to share in decision making during a hospital admission.  
• Patient participation has not been recognised as a significant component of AMS programs. |
| 2. Rosati et al. (2014), Italy | Doctors | Informed parents of medical shared-decision making in choosing injected or oral therapy | Comparison group Survey | • Parents were more satisfied with information received.  
• Children were more likely to be prescribed an oral therapy if parents participated in shared decision-making. |
| 3. Légaré et al. (2013), Canada | Physicians and patients | Implementing DECISION + 2, a training program for physicians and evaluated the impact | Parallel randomized clustered trial | • Antibiotics were used less in the shared decision making group (27.2%) compared with the control group (52.2%).  
• Patients in the intervention group perceived playing more proactive role in shared decision making of antibiotic use (67.1%) than in the control group (49.2%) (p = 0.04) for acute respiratory tract infections. |
<table>
<thead>
<tr>
<th>Author, Publication year, Country, Title</th>
<th>Participants</th>
<th>Intervention</th>
<th>Type of research</th>
<th>Significant outcomes of patient participation/engagement</th>
</tr>
</thead>
</table>
| 4. Gudnadottir et al. (2013), USA        | Patients     | None         | Interviewer-administered questionnaire | • 98% of participants perceived that their participation in multidrug resistant organisms (MDROs) was important.  
• Majority of participants expressed that being informed regarding MDROs would help them in decision-making about choices and that would improve their health care.  
• Preferences of patients must be involved in education to increase participation for prevention of MDROs and HAIs. |
|                                          |              |              |                  |                                                        |
| 5. Coenen et al. (2013), 13 European countries | Patients Clinicians | None | Prospective observational study | • Participants’ beliefs about antibiotic effectiveness were not useful for identifying those who will benefit from antibiotics.  
• Clinician perceptions did not match with patient perspectives, but influenced antibiotic prescribing.  
• In general participants were satisfied with care. Those patients not prescribed antibiotics were less satisfied.  
• Clinicians should be more active to support patient participation in antibiotic use. |
<p>| | | | | |
|                                          |              |              |                  |                                                        |
| 6. Legare et al. (2012), Canada          | Family physician | Trained Physicians in shared decision making about the use of antibiotics for acute respiratory infection | Cluster randomized trial | • The percentage of patients who decided to use antibiotics after consultation was 52.2% in the control group versus 27.2% in the shared decision-making group. |
|                                          |              |              |                  |                                                        |
| 7. Legare et al. (2011a), Canada         | Family physician | Implemented a shared decision-making program about antibiotic use for acute respiratory infection | Two arm parallel clustered pilot randomized controlled trial | • The percentage of patients who decided to use antibiotics after consultation was 49% in the control group versus 33% in the shared decision-making group. |</p>
<table>
<thead>
<tr>
<th>Author, Publication year, Country, Title</th>
<th>Participants</th>
<th>Intervention</th>
<th>Type of research</th>
<th>Significant outcomes of patient participation/ engagement</th>
</tr>
</thead>
</table>
| 8. Alden, Tice, and Berthiaume (2006), USA | Doctors | None | Survey | - Filipino patients had lower levels of antibiotic knowledge and higher perceived need and reported more frequent use when compared to caucasian and Asian American and Hawaiian Pacific islander patients.  
- There were ethnic differences in attitudes towards shared decision making. |
| 9. Merenstein, Diener-West, Krist, Pinneger, and Cooper (2005), USA | Parents | Evaluated outcomes after implementing intervention of a shared-decision model (SDM) and paternalistic model | A cross-sectional survey | - Participants in the shared decision-making model had less antibiotic usage and greater levels of parental satisfaction with treatment of acute otitis media than participants in the paternalistic model. |
| 10. Davey, Pagliari, and Hayes (2002), UK | Doctors | Exploration of the theory and process of patient centred care in the treatment of community acquired RTIs | Review article | - Empowering patients to share decision-making in conjunction with education, can change attitudes and behaviors and improve access to and completion of appropriate antimicrobial therapy, and reduce the development of antimicrobial resistance. |
| 11. Macfarlane et al. (2002), England | Patients | Providing an information leaflet about the natural course of lower respiratory tract symptoms and the advantages and disadvantages of antibiotic use to intervention group | Nested, single blind, randomised controlled trial | - The use of the patient information leaflet and verbal advice reduced the use of antibiotics in patients.  
- Sharing with the patient the uncertainty about the decision to prescribe was more likely to be safe and effective. |
| 12. Scott et al. (2001), USA | Physician-patient communicatio n | Physician-patient interactions were categorized into 6 influence categories and antibiotic prescribing compared across categories | A multi method comparative case study | - Patients strongly influence the antibiotic prescribing of physicians.  
- Providing education about appropriate antibiotic use would decrease antibiotic use for acute respiratory infections |
2.4.1 Narrative summary of patient participation in antimicrobial stewardship

Patient participation is commonly recognised as a key component high quality care (WHO, 2013). Patient participation can be defined as ‘...the involvement of patients in the decision-making process regarding health issues’ (Longtin et al., 2010, p. 54). The terms “patient participation” “patient involvement” “patient engagement” and “patient empowerment” are often used interchangeably (Longtin et al., 2010). The potential benefits of active patient participation in healthcare are increased acceptability and effectiveness of treatments (Davey et al., 2002) and improved patient safety (Pittet & Donaldson, 2005). Patients can participate in their own safety by monitoring and reporting of adverse events; checking that they are given correct and timely medications; observing and asking staff about hand washing practices; and ensuring they have been appropriately identified prior to treatment (Rathert, Huddleston, & Pak, 2011).

Unnecessary use of antibiotics, particularly in primary care, can be linked to patients’ attitudes and perceptions about antimicrobial therapy (Coenen, Michiels, Renard, Denekens, & Van Royen, 2006; Edgar, 2012; Moro, Marchi, Gagliotti, Di Mario, & Resi, 2009). Patients often have misconceptions about the benefits of antibiotic treatment for viral illness (Edgar, Boyd, & Palamé, 2009a; Saengcharoen, Lerkiatbundit, & Kaewmang, 2012) and inappropriate behaviors related to antimicrobial use such as skipping doses and sharing antimicrobial medicines (Edgar, Boyd, & Palamé, 2009b; Saengcharoen et al., 2012; Shehadeh et al., 2012). As discussed earlier, patient expectations relating to antibiotic treatment puts pressure on clinicians to prescribe antibiotics when they are not necessary, for example, in the presence of a respiratory tract infection (McNulty, Boyle, Nichols, Clappison, & Davey, 2007; Saengcharoen et al., 2012). There is also a widely held view among patients that antibiotics can kill viruses and a reason to take antibiotics is “to get better faster” (Edgar et al., 2009b).

In Thailand, inappropriate antibiotic use is a major problem. Saengcharoen et al. (2012) conducted a survey of Thai high school and high vocational students about their knowledge, attitudes, and behaviors regarding antibiotic use for upper
respiratory tract infections. More than 75% of students had misconceptions about antibiotic use; 45% had taken an incomplete course of antibiotics, and half of the students surveyed had taken antibiotics for less than five days (Saengcharoen et al., 2012). In a study of Thai clients in a community hospital, the only factor influencing appropriate antibiotic use was their level of knowledge of appropriate use of antibiotics. Other factors such as age, level of education and how often they had received an explanation about antibiotic use from health care professionals were not significant influences on antibiotic use (Porisutiwutiporn & Hemchayat, 2014a).

Responding to the problem of AMR and overuse of antimicrobial medicines requires that both patients and clinicians make appropriate decisions about antimicrobial treatments. Patient engagement and participation can impact positively on quality of care and has been shown to enhance outcomes related to pain control (Manias & Williams, 2007; Manias & Williams, 2008; McTier, Botti, & Duke, 2014; Street et al., 2014), medication errors (Longtin et al., 2010; Pittet & Donaldson, 2005) achievement of treatment outcomes (Dillon, 2012; Heggland, Mikkelsen, & Hausken, 2013; Heggland, Mikkelsen, Øgaard, & Hausken, 2014; Shepherd, Tattersall, & Butow, 2008) and patient satisfaction (Moral et al. (2011).

There is emerging although limited evidence that patient participation through shared decision making may impact significantly on the optimal use of antimicrobial medicines (Légaré et al., 2013; Legare et al., 2012; Legare et al., 2011a). Empowering patients to share decision-making regarding antibiotic use in respiratory infections reduced the development of AMR (Davey et al., 2002). However, there are important differences between ethnic groups not only in their antibiotic knowledge, perceived need and frequency of use, but also in their preferences for interaction/decision making style between patients and their doctors (Alden et al., 2006).

While there has been very limited research into patient participation in AMS, there is little doubt that patients do influence antibiotic prescribing and therefore impact on AMR. There is also the suggestion that ethnicity may be a factor in
antibiotic use and behaviors and may also influence preferred patient participation roles.

2.5 Chapter summary

Antimicrobial stewardship programs have emerged in response to the problem of AMR and the inappropriate use of antibiotics. A key component of AMS is multidisciplinary involvement. There is consensus in the literature that nurses have a professional responsibility as members of a multidisciplinary team and as patient advocates to promote safe and effective antimicrobial therapy, provide patient education and raise public awareness about appropriate antibiotic usage.

As AMS programs continue to develop, whether nurses claim their place as key stakeholders in organisational AMS systems will be influenced by whether nurses feel that they have the knowledge and skills to actively participate in AMS. The particular skills that nurses need to be effective partners in AMS are effective communication with other members of the AMS team, challenging multidisciplinary clinicians about evidence-based antimicrobial therapy, understanding infection surveillance data, and educating patients about their role in AMS and AMR. Little is known about current roles that nurses assume in AMS programs worldwide, particularly in Thailand.

Patient participation is recognised as a key component of high quality care. There has been very limited research into patient participation in AMS, particularly in Thailand, where antibiotics are sold without prescription and professional involvement. Nurses, as the only hospital clinicians with a 24 hour per day direct patient care role are important stakeholders in AMS programs and are in a key position to collaborate with AMS teams and patients.

The chapter to follow provides a description of the methods used to address the aims of this program of research including research design, conceptual framework, research setting, research participants, and data collection, analysis and ethical considerations.
Chapter 3

Methods

The purpose of this chapter is to present the design and methods used to address the aims of the research. The chapter has eight sections. The research purpose and aims are outlined in the first section. In the second section, the overall design of the research program is outlined and includes a description of the site, setting and contextual background of the healthcare system in Thailand. The subsequent five sections provide a detailed description of the methods used in the four phases of the research program. The ethical considerations of this research are addressed in the final section of this chapter.

3.1 Research aims

The purpose of this research was to explore the current and potential roles of nursing in antimicrobial stewardship (AMS) in acute healthcare in Thailand within the broader context of clinical governance and attitudes and perceptions of antimicrobial resistance and stewardship using a single organisational case study with the intent of informing nursing education and professional development in relation to AMS, health service AMS governance, and strategies to engage patients both within the hospital and the community through education and health promotion.

The specific aims were to:

I. Explore the perceptions and attitudes toward AMS among clinicians in acute healthcare in Thailand;

II. Identify strengths and weaknesses of AMS clinical governance structures and activities as perceived by organisational leaders (executives and clinical leaders) and nurses working in acute healthcare in Thailand, using the CDC recommendations as a framework for the analysis;

III. Explore current and potential for patient participation in AMS in Thailand; and
IV. Explore how organisational leaders and nurses perceive potential future roles for nurses in AMS in Thailand within the current governance, educational and practice context.

The four aims addressed factors pertinent to understanding the status of AMS within a Thai healthcare organisation. Detailed analysis of health service clinical governance for AMS is important to identify alignment with international best practice, gaps in best practice, and where nurses could best contribute to AMS clinical governance. Understanding clinicians’ perceptions and attitudes toward AMS is important in determining the differences and similarities between professions and the barriers and facilitators to effective AMS in order to inform feasible and clinically useful AMS policy. Patient involvement in AMS is a major international strategy to decrease AMR (WHO, 2014b) and an area in which nurses can play a major role. Exploration of how leaders and nurses perceive potential future roles for nurses in AMS within the current governance, educational and practice context is fundamental to informing future patient engagement and education strategies. Understanding current and potential for patient participation in AMS provides the framework for patient and family education, the development of information materials and contributes to the AMS practices of doctors, nurses and pharmacists.

3.2 Research design

A multiple methods, exploratory and descriptive design was employed within a single organisational case study in Thailand. The program was conducted in four phases in order to provide a comprehensive, multi-lens exploration of the current and potential roles of nurses in AMS in acute healthcare in Thailand by investigating key stakeholders’ perceptions and attitudes toward AMS, the strengths and weaknesses of existing AMS clinical governance structures and activities and potential future roles for nurses in AMS. Patient participation in AMS was explored from the perspectives of nurses and patients. The multi-lens framework is illustrated in Figure 3.1. The multiple methods involved survey, in-depth interview and focus groups. Methodological triangulation was used to fully address the aims of the research.
An exploratory descriptive research design was considered appropriate to address the significant gaps in our understanding of nurses’ contribution to AMS in Thailand within the broader context of clinical governance and attitudes and perceptions of antimicrobial resistance and stewardship. Exploratory research adds further depth to descriptive approaches as it enables the full nature of phenomena and related factors to be examined (Loiselle, 2007). This in-depth understanding is necessary to inform future policy, change in nursing education and professional practice, health service AMS governance, and strategies to engage patients both within acute care services and the community.

![Diagram](image)

**Figure 3.1** A multi-lens framework for exploring the current and potential roles of nursing in AMS

### 3.2.1 Setting

The research was conducted in a 1,000-bed university public hospital located in Bangkok, the capital city of Thailand. The study hospital provides advanced medical services with approximately 5,000 outpatient visits per day and over 45,000 in-patient separations per year. The hospital provides the following specialty
services: pediatrics; ophthalmology; psychiatry; pathology; diagnostic and therapeutic radiology; anesthesiology; family medicine; rehabilitation medicine; surgery; obstetrics and gynecology; otolaryngology; orthopedics; medicine; emergency medicine and community medicine. A full description of the organisational, governance and reporting structures is provided in Chapter 5 (p 133) and outlined in Figure 5.1 (p 138). The case study hospital employs 1,450 nurses, 10 Infection Control Nurses (ICNs), 95 pharmacists and 7 Infectious diseases physicians. Nurse/patient ratios in the wards are 1:5 and 1:1 in critical care units. The proportion of nurses who are female in Thailand is greater than 90%.

Thailand, officially called the Kingdom of Thailand, is located at the heart of the Indochina peninsula of South-East Asia (Figure 3.2). The country is classified as an upper middle-income nations by the World Bank with a per capita income of USD 5,640 (The World Bank, 2017b). In 2016, Thailand’s gross domestic product (GDP) was calculated to be USD 406.84 billion of total GDP (The World Bank, 2017b). There are five main regions in Thailand: Northern, Eastern, Northeastern, Central, and Southern divided into 77 provincial administrations, and an estimated population of 68.8 million in 2016 (The World Bank, 2017a). Approximately 93.6% of Thais are Buddhists. The official language of Thailand is Thai (National Statistical Office, 2011).

Figure 3.2 Research setting; Bangkok, Thailand

3.2.2 Healthcare services in Thailand

The Ministry of Public Health (MOPH), established in 1942, is the main national health agency playing an important role in health program development and improvement of the health status of Thai people (MOPH 2000). Both private and public institutions provide healthcare services in Thailand. Most hospitals in Thailand are operated by MOPH while the Medical Registration Division of the MOPH regulates private hospitals (Lefemine, 2012).

Other government divisions also operate public hospitals, including the military, local governments, the Red Cross, the Bangkok Metropolitan Administration and the Ministry of Education. In 2013, there were 1,286 public hospitals and 326 registered private hospitals in Thailand (MOPH, 2013).

Health services in Thailand are classified into five levels as follows:

1. **Self Care Level.** In this level, self-care capacity is enhanced and people are encouraged to make decisions about their own health.

2. **Primary Health Care Level.** Each community organises services related to health promotion and prevention, and curative and rehabilitative care. Village health volunteers are service providers at this level of care.

3. **Primary Care Level.** Medical and health personnel provide healthcare services for people in different health units as follows:
   
   I. **Community health services.** This health unit provides health services at village level in remote areas covering a population of 500-1,000. Community health workers provide health promotion and prevention, and primary medical care to people in this level.

   II. **Health centers.** This health service level provides health services such as health promotion and prevention, and primary health services at sub district or village level covering a population of 1,000-5,000. Health service staff including public health administrators, public health officers, and community public health staff that work at this level are under supervision and support from community hospitals.
III. Health centers of municipalities, outpatient departments of public and private hospitals, and private clinics. At these services, outpatient treatment is provided by doctors and health professionals.

4. Secondary Care Level. Health care at this level is provided by different healthcare professional specialists. The general and specialised facilities are as follows:

I. Community hospitals. These facility health services are located in a district, covering a population of 10,000 or more with 10-150 inpatient beds.

II. General hospitals or regional hospitals and other large public hospitals. These hospitals are located in provinces or large district areas with 200-500 inpatient beds.

III. Private hospitals. There hospitals are run as commercial entities. People have to pay for their healthcare treatments and services.

5. Tertiary Care Level. The facilities at this level provide advanced healthcare services and specialized health professionals. This level includes General Hospitals, Regional hospitals, University Hospitals, and large private hospitals.

   University Hospitals provide all services with the highest quality of healthcare facilities and healthcare professionals. University Hospitals are supervised by the Ministry of Education in order to provide medical education and health research and innovation. The Ministry of Public Health controls the quality standards all of hospitals in Thailand. There are eight public University Hospitals in Thailand, three are located in Bangkok, and one in each of the five main regions of Thailand. Most University Hospitals have at least 500 inpatient beds. Several studies have shown that the incidence of inappropriate antibiotic use in University Hospitals in Thailand from 1990 to 2006 was between 24.8% and 91% (Apisarnthanarak, Danchaivijitr, Bailey, & Fraser, 2006; Aswapokee, Vaithayapichet, & Heller, 1990; Ayuthya, Matangkasombut, Sirinavin, Malathum, & Sathapatayavongs, 2003; Thamlikitkul, Danchaivijitr, Kongpattanakul, & Ckokoikaew, 1998; Udomthavorn suk et al., 1990).

   A fifth level tertiary care hospital was selected as the case study organisation for this study because of its specialised and educational functions. It was expected
that the large university teaching hospital where the research was conducted would be representative of fifth level healthcare and would provide an understanding of the highest level of AMS governance and activities currently practiced in Thailand.

The design, methods and analysis frameworks for each of the four phases of this program of research are outlined separately in the sections to follow.

3.3 Phase 1: Clinicians’ perceptions and attitudes towards antimicrobial stewardship

Phase 1 addressed aspects of the first aim of this research to explore the perceptions and attitudes towards AMS among clinicians in acute healthcare in Thailand using survey methods.

The specific objectives were to:

I. Describe the perceptions and attitudes of doctors, nurses and pharmacists towards AMS in acute healthcare in Thailand;

II. Explore differences in the perceptions and attitudes of clinicians of different disciplines towards AMS

3.3.1 Design

The design of this first phase was a prospective hospital-wide, self-administered survey employing closed-ended questions completed by doctors, nurses and pharmacists. Effective hospital-wide antimicrobial stewardship programs need engagement with multidisciplinary professionals who are involved in antimicrobial use (Cotta et al., 2014). Surveys are common approaches for collecting data to describe, compare, or explain knowledge, attitudes and behavior (Fain, 2009, p. 127). Saks and Allsop (2012) state that survey methods are essential in examining comparisons and variation between groups, especially in large populations.

3.3.2 Sample

Doctors, nurses, and pharmacists play important roles in AMS implementation in acute care settings. In Thailand, to study medicine, pharmacy and
nursing, students need to complete 12 years of basic education and meet the admission requirement of each institution.

The Medical Council of Thailand is responsible for verifying all medical education curricula in Thailand. The duration of study for this program is six years. Students who successfully complete the program receive a M.D. degree (Doctor of Medicine). The pharmacy curriculum is five years in duration. Students who complete this program obtain a Bachelor of Pharmacy (B. Pharm). The curriculum for the Bachelor of Nursing in Thailand is four years in duration. Graduates receive the Bachelor of Nursing Science (B.N.S). In addition, there are some universities that provide a 2-year program for technical nursing. This program provides an award of Certificate in Nursing Science (Technical Level). Nurses who complete this program can continue their education to Bachelor degree level. The category of technical nurse was not employed in the study hospital.

3.3.3 Survey tool

The survey tool used in this study was based on a survey used in an Australian study (Cotta et al., 2014). There were 26 items in the Australian survey of which 24 were retained: the two items deleted were related to Australian guidelines so not relevant to the Thai context. As antibiotics can be purchased without prescription in Thailand and therefore are widely used, four additional questions related to patient influences on antibiotic prescribing decisions, patients’ ability to buy over-the-counter antibiotics and antibiotic use in the study hospital were added, as these are important contextual issues for Thai healthcare. The full clinician survey is available in Appendix C.

Validity and reliability of the survey was established before collecting the data to ensure that results were consistent and accurate (Creswell, Fetters, & Ivankova, 2004; Houser, 2012). The survey was examined for content and face validity. Content validity is ‘the extent to which an instrument or test measures an intended content area’ (Fain, 2009, p. 117) while face validity is ‘how a measure appears on the surface and whether all the required questions are framed in the
appropriate language’ (Saks & Allsop, 2012, p. 196). In this survey, the original English version was developed based on a literature review (Cotta et al., 2014) and the additional questions were based on the Thai contextual setting. The survey was reviewed by the principal (MB) and associate supervisors (JC and AH) to determine the survey items were clear, that the content of the survey was comprehensive and culturally appropriate. The English version was translated into Thai by the researcher (NS). A nursing educator from a Thai University who holds a PhD in Nursing (written in English) performed a back translation from Thai to English. The consistency of meaning between versions of the Thai and the back-translation English was compared by the researcher (NS). Inconsistencies in the Thai survey were revised if they were identified. The content validity relevant to the Thai context and face validity of the final Thai language version of the survey was established by a Thai panel review consisting of specialists in infection and prevention control. These specialists were infectious disease physicians, an AMS specialist pharmacist and a prevention and control specialist nurse who evaluated the items for relevance and accuracy.

To ensure the survey had adequate content coverage, the judgment of experts needs to be employed (Loiselle 2007). In this study, a content validity index (CVI) was used to indicate the extent of expert agreement of the final Thai language version of the survey (Loiselle, 2007, p. 322). Experts were asked to independently rate the relevance of each item to the objectives, using a 4-point rating scale as: (1 point) not relevant, (2 point) somewhat relevant, (3 point) quite relevant, and (4 point) very relevant (Waltz, Strickland, & Lenz, 2010). The CVI of this survey was 0.90 while a CVI score of 0.80 was minimally acceptable (Loiselle, 2007).

Reliability is defined as ‘the extent to which research instruments and concepts are stable and able to yield an unvarying measurement’ (Saks & Allsop, 2012, p. 476). Internal reliability is stability within an instrument (Houser, 2012, p. 211). To ensure this survey had internal consistency, a pilot test was conducted to enable tests of internal consistency. Fain (2009) recommended 10 subjects, as the minimum number of pilot participants required to uncover questions and/or
instrument that might be unclear. The final developed version of the survey in this study was tested with 10 healthcare professionals at the study hospital before the survey was implemented. Coefficient alpha was used to test internal consistency. A higher coefficient alpha represents higher internal consistency reliability (Waltz, Strickland & Lenz 2010). A value of 0.7 or greater of the coefficient alpha was considered acceptable as a minimum (Houser, 2012). The coefficient alpha of this survey was 0.89.

**3.3.4 Data collection procedures**

In Phase 1, a paper-based survey was distributed to 1,753 doctors, nurses and pharmacists in the following departments: surgery; pediatrics; medicine; operating room; pharmacy; obstetrics and gynecology; orthopedics; ophthalmology; emergency medicine; community health nurses; family medicine and anesthesiology. The minimum acceptable response rate was set at 30% for each of the clinician discipline groups sampled (Dillman, 1978; Fain, 2009).

Clinical nurse supervisors, head nurses, senior doctors and senior pharmacists of each department and ward were asked to distribute the survey to participants and reminded them to complete the survey within the timeframe. Potential participants were given four weeks to complete the survey. Department clerks were asked to gather the completed surveys in a box provided to them. The survey included a covering letter explaining how to complete the survey, while maintaining anonymity. A comprehensive participant Information sheet was given to the participants explaining the intent of the survey and the voluntary nature of completion in line with the ethical considerations of the research. Consent was implied by return of the surveys. Participants were asked to complete the questionnaires themselves. The expected time to complete the survey was approximately 10 minutes. Head nurses, senior doctors and senior pharmacists of each ward and department were asked to remind participants to complete the survey every two weeks. Surveys were collected every 2 weeks to monitor the response rate and ensure that reminders or replacement surveys were sent to maximise the response rate.
3.3.5 Data analysis

All entered data were cleaned and checked for errors prior to starting data analysis. The completed questionnaires were analysed using the Statistical Package for Social Science (SPSS) version 22.0 for Windows® (IBM Inc., Chicago, IL, USA). The response rate for each clinician group was calculated. Descriptive statistics (frequencies, percentages, means and standard deviation) were used to summarise the study data. As the data did not conform to the normal distribution, medians and quartiles one and three (Q1-Q3) were presented. For survey items that were categorical in nature, clinicians’ responses were described as frequencies and comparisons were made using the Chi-Square test. For continuous data, Kruskal Wallis test was used to compare the responses of different professional groups (doctors, nurses and pharmacists).

3.4 Phase 2: Clinical governance for antimicrobial stewardship

Phase 2 addressed the second aim of this research, which was to identify the strengths and weaknesses of AMS clinical governance structures and activities as perceived by organisational leaders (executives and clinical leaders), and nurses in acute care in Thailand using the Core Elements of Hospital AMS Programs, Centers for Disease Control and Prevention (CDC) recommendations (referred to as the CDC recommendations) as a framework for the analysis.

The specific objectives of this phase were to:

I. Describe the current clinical governance structure and AMS activities in the case hospital based on organisational leaders as key informants

II. Explore perceptions of the strengths and weaknesses of the current clinical governance structures and activities related to AMS

3.4.1 Design

The design of this second phase was qualitative using in-depth, individual semi-structured key informant interviews. In order to explore the current clinical governance structure and AMS activities and the perceptions of the strengths and weaknesses, it was considered important to examine a range of views from
organizational leaders and acute care nurses so data from Phase 4 (to be described) were analysed to address Aim 2. In Phase 2, analyses of the outcomes of semi-structured interviews were used to identify alignment of current AMS governance with international best practice, gaps in best practice, and where nurses could best contribute to AMS clinical governance. Details of participants, sampling approach, data collection, and data analysis are presented in the sections to follow.

### 3.4.2 Sample

In order to examine the current status of AMS clinical governance, organisational leaders at the study hospital; who were involved in AMS programs were invited to participate as key informants. Participants in this phase were selected purposively as follows: the medical director; the nursing director; infection control and prevention committee members including an ID physician (Committee Chair), nurse manager of the infection control department (Committee Secretary), the pharmacy director, head of the epidemiology department, head of anesthesiology department, head of surgical department, head of medical department, nurse manager of operating department, nurse manager of medical department, nurse manager of surgical department and nurse manager of pediatric department; antibiotic committee members including an ID physician from the medical department, an ID physician from the pediatric department, a family medicine physician, surgeons and a pharmacist.

### 3.4.3 Semi-structured interview

A semi-structured interview was used to collect Phase 2 data. Interviewees were respected and encouraged to express their own opinions. In the semi-structured interview, flexibility was valued and impromptu questions were responsive to the answers. The Core Elements of Hospital AMS Programs, Centers for Disease Control and Prevention (CDC) recommendations were adapted to identify alignment of clinical governance for AMS in the study hospital with international best practice, therefore enabling gaps in best practice to be identified. The CDC recommendations were used to frame the topic guide and to analyse the
Data. Data from organisational leaders provided insight into the strengths and weaknesses of the current clinical governance structures and activities related to AMS. In addition, topics regarding the current and potential role of nurses in AMS in Thailand were included to explore perceptions about nurses’ involvement in AMS. The full interview guide is available in Appendix A.

3.4.4 Data collection procedures

All identified organisational leaders were invited to participate in this study through a face-to-face invitation by the researcher. After receiving agreement to participate, administrative assistants of each participant were contacted to identify suitable times to meet and interview times and place were then scheduled. The participants were asked to complete a written consent form before starting the interview. As the participants in this study and the student researcher speak Thai as their first language, the interviews were conducted in Thai. Each interview was audiotaped and took approximately 20-30 minutes using the interview guide.

3.4.5 Data analysis

The qualitative data were analysed using a combination of general inductive method and thematic analysis. Audio-recordings and field notes from the interviews were transcribed in Thai by the researcher (NS) who conducted the interviews. The accuracy of the Thai transcripts was checked against the recordings. Next, a professional translator translated the Thai transcripts into English. The researcher (NS) then reviewed the accuracy and consistency of the English and Thai transcripts, especially the clinical terms. Then, a Thai nursing educator who holds a PhD in Nursing (written in English) verified the consistency of the English and Thai transcripts. The data analysis to follow was conducted using the English transcripts. To ensure the rigour of data analysis in a qualitative study, peer debriefing with supervisors occurred throughout all stages of the data analysis including the generation of the coding frame and identification of major sub themes. Representative quotations from the transcribed text used in relation to major
themes and subthemes were also confirmed. The analytical process is auditable in the raw data and coding documents.

For the first objective of describing the current clinical governance structure and activities in the case hospital and their relationship with the CDC guidelines, data were analysed using general inductive method (Thomas, 2006). The steps taken involved close reading of the text of each transcript (familiarisation) and listening to the audio recording. The next step involved coding the transcript data into the CDC categories. The CDC guidelines provided clear categories for recommended AMS governance and enabled the analysis of gaps in governance. Category creation was inductive and progressive. Refining the category system continued as analysis progressed.

For the second objective of exploring the perceived strengths and weaknesses of the current clinical governance structures and activities and nurses’ roles in AMS, thematic analysis was used. Braun and Clarke (2006, p. 79) defined thematic analysis as ‘a method for identifying, analysing and reporting patterns (themes) within data’. While Saks and Allsop (2012) describe that ‘a thematic analysis involves identifying recurring themes within the data; exploring typologies of these themes; and looking at variations and relationships between, and within, themes’. Thematic analysis is a useful and flexible method for qualitative data analysis (Braun & Clarke, 2006).

In this phase, steps for data analysis involved the processes of thematic analysis described by Saks and Allsop (2012, p. 139) and Spencer et al. (Ritchie, Lewis, Nicholls, & Ormston, 2014). The first step was to become thoroughly familiar with the interview data in order to identify issues of recurrent interest across the data. This process allowed the identification of the initial themes that would be used to sort the data and was the beginning of the process of abstraction. Each transcript was reviewed individually and data were highlighted manually into topic themes of strengths, limitations and nurses’ roles. During this stage, data of interest were identified, and coded, using a simple coding list developed from the topic headings of the interview guide.
The next step was to develop the coding frame, a list of concepts and their labels (‘codes’), in order to organise the data. This process involved using the a priori issues introduced by the interview topic guide and emergent issues raised by respondents and this was a deductive and inductive process. Coding labels evolved as coding progressed.

The third step involved sorting and coding the data and was the process of systematically applying the coding frame to the data (Ritchie et al., 2014). Care was taken to ensure data were interpreted accurately. The data extracts were then reviewed for coherence between the data extracted and to begin the process of refining the thematic framework (Ritchie et al., 2014). The framework was refined over time and in response to peer debriefing.

The formal interpretation process commenced once the coding of all transcripts was complete. Major and sub themes were identified that explained the meaning of the data. This process involved identifying the connections between the subthemes and interpreting the unifying features of the data within the subthemes.

3.5 Phase 3: Patient participation in antimicrobial stewardship

Phase 3 addressed aspects of the third aim of this research to explore current and potential patient participation in AMS in Thailand using survey methods.

The specific objectives were to:

I. Explore patients’ perceived behaviours, attitudes and knowledge relating to antibiotic use in the community;

II. Determine how patients participate in AMS in the community and during hospital admission from patients’ perspectives

3.5.1 Design

The design of this third phase was a prospective, self-administered survey employing closed-ended questions administered to patients during an acute care admission episode. Inappropriate antibiotic use in hospitals leads to AMR and increased risk of worse clinical outcomes and death (WHO, 2014b). In Thailand, the
causes of AMR are not only from inappropriate use of antibiotics in the hospitals (Apisarnthanarak et al., 2006) but also because antibiotics can be purchased over the counter without a prescription (Moongtui et al., 2011; Thamlikitkul, 1988). Therefore, understanding patients’ attitudes and behaviors regarding AMS and use of antimicrobial medicines underpins strategies for patient and family participation in AMS. Further, understanding patient participation in AMS also informs AMS practices of clinicians.

3.5.2 Sample

The sample for Phase 3 was derived from patients who were admitted to six medical and surgical wards at the study hospital January to March 2016. The six wards were female medical, male medical, combined female and male medical, female surgical, male surgical ward, and combined female and male surgical wards.

Most antimicrobial medicines are prescribed in medical wards and surgical wards (Lesprit, Landelle, & Brun-Buisson, 2013). Patients who are admitted to medical and surgical wards are therefore more likely to be taking antimicrobial medicines. Patients were recruited into the study if they had been prescribed antibiotics and had been admitted in hospital for two days or longer and were able to communicate verbally in Thai. These criteria were to ensure that patients had adequate time to become familiar with the hospital and clinicians.

Consecutive sampling was used to recruit patients to the study. Consecutive sampling is “a nonprobability sampling approach involving all people from the accessible population over the specific time interval” Polit and Beck (2014, p. 179). Consecutive sampling is preferable to convenience sampling in terms of sampling representation because it decreases the risk of selection bias if the sampling period is long enough (Polit & Beck, 2012). In this study, 205 inpatients completed the survey.

3.5.3 Survey tool

In Phase 3, a survey was used to collect data related to patients’ attitudes and behaviors in antibiotic use, and patients’ perceptions of participation in AMS.
The questionnaire was a modified version of tools developed and used by Porisutiwutiporn and Hemchayat (2014b) and Saengcharoen et al. (2012), and additional items were based on the literature review. The full version of the patient survey is available in Appendix D.

Validity and reliability of the survey was established before collecting the data to ensure that results were consistent and accurate (Creswell et al., 2004; Houser, 2012). An English version of the survey was developed by the researcher (NS) based on a literature review and tools used in previous studies. In order to ensure content and face validity, the survey was reviewed by the principal (MB) and associate supervisors (JC and AH) to determine that survey items were clear and that the content of the survey covered the concepts required (Houser, 2012).

The processes for the development of the patient survey was similar to those used in the clinician survey. The English version was translated into Thai by the researcher (NS). A nursing educator from a Thai University who holds a PhD in Nursing (written in English) performed a back translation from Thai to English. The consistency of meaning between versions of the Thai and the back-translated English version was compared by the researcher (NS). Inconsistencies in the Thai survey were revised if they were identified. The content validity relevant to the Thai context and face validity of the final Thai language version of the survey was established by a Thai panel review consisting of specialists in infection and prevention control. These specialists were infectious disease physicians, an AMS specialist pharmacist and a prevention and control specialist nurse who evaluated the items for relevance and accuracy.

An expert panel reviewed the survey to ensure adequate content coverage (Loiselle 2007). Content validity index (CVI) was used to indicate the extent of expert agreement of the final Thai language version of the survey (Loiselle, 2007, p. 322). The CVI was 0.87 in this survey while a CVI score of 0.80 was minimally acceptable (Loiselle, 2007).
To ensure this survey had internal consistency, a pilot test was conducted with 10 patients who were admitted to female and male surgical wards at the survey hospital before the actual study was implemented. The coefficient alpha was used to test internal consistency. A higher coefficient alpha represents higher internal consistency reliability (Waltz, Strickland & Lenz 2010). A value of 0.7 or greater of the coefficient alpha is acceptable as a minimum (Houser, 2012). The coefficient alpha of this survey was 0.91.

3.5.4 Data collection procedure

The paper-based copy of the survey was distributed to patients who met the study inclusion criteria. Patients were approached to participate by the researcher (NS) who introduced herself and the purpose of the study. The survey included a covering letter explaining how to complete the survey while maintaining anonymity. The comprehensive Participant Information Form was given to participants to keep and they were informed that consent would be implied by completing the survey. Patients were asked to complete the questionnaires themselves. When collecting the completed surveys from patients, the researcher reviewed patients’ responses and clarified any missing responses to questions to minimise missing data. The time taken for patients to complete the survey was approximately 15 minutes. The researcher was available for patients to address any difficulties or questions arising from the survey tool or process.

3.5.5 Data analysis

All entered data were cleaned and checked for errors prior to starting data analysis. The completed questionnaires were analysed using the Statistical Package for Social Science (SPSS) version 22.0 for Windows® (IBM Inc., Chicago, IL, USA). Descriptive statistics (frequencies, percentages, means and standard deviation) were used to summarise participants’ demographic characteristics such as education, gender, age, antimicrobial use behaviors, attitudes and beliefs in antimicrobial use of patients.
3.6 Phase 4: Nurses' role in AMS

Phase 4 addressed the fourth aim of this research, to explore how key organisational leaders and senior clinicians, and nurses perceive potential future roles for nurses in AMS in Thailand within the current governance, educational and practice context.

The specific objectives of this phase were to:

i. Describe the current roles of nurses in AMS?
ii. Identify perceived barriers and facilitators to nurses taking a broader role in AMS?
iii. Describe the potential future roles of nurses in AMS?

3.6.1 Design

The design of this fourth phase was qualitative using focus group interviews with two groups of nurses: infection control nurses and clinical ward nurses. Nurses are the largest group of healthcare professionals and are the only healthcare professionals with patients 24 hours a day in acute care environments (Mensik, 2014). They are in a unique position to educate patients and family regarding use of antimicrobial medicines, ensure safe administration of antimicrobial medicines, monitor the effectiveness of antimicrobial medicines, identify unnecessary antimicrobial medicines and contribute to multidisciplinary plans of care (Edwards et al., 2011c; Galvin & Fennell, 2012; Gillespie et al., 2013b; Ladenheim et al., 2013b; Lim, 2010; Storr, 2012). A multidisciplinary approach is considered best practice in AMS (Lin et al., 2013b), however not all AMS programs include nurses (Edwards et al., 2011c). Despite the important role that nurses play in AMS, little is known about nurses’ contribution to AMS (Edwards et al., 2011d) in particular the current and potential role of nurses in AMS in Thailand.

3.6.2 Sample

Two groups of nurses were invited to participate in Phase 4 of the study: clinical nurses working in medical and surgical wards and infection control nurses (ICNs). The reason medical and surgical ward nurses were selected was because
most antimicrobial medicines are prescribed in medical and surgical wards (Lesprit et al., 2013; Vessal, Namazi, Davarpanah, & Foroughinia, 2011). Nurses who work in medical and surgical wards are more likely to be familiar with administration of antimicrobial medicines and engaging patients in AMS. Clinical ward nurses were separated into junior and senior nurse focus groups as a deliberate strategy because senior and junior nurses have different working experience and communication skills (Gerrish, Ashworth, Lacey, & Bailey, 2008). Further, avoiding different hierarchical levels within a group enabled participants to express their own view in a non-threatening environment (Fain, 2009; Watson, 2008). A senior nurse was defined as a nurse undertaking advanced clinical practice in a senior management position within a ward (for example head nurses, the nurse in charge of nurses or shift managers). A junior nurse was defined as a registered nurse undertaking clinical practice under the supervision of a senior nurse (Kingston, Evans, Berry, & Smith, 2004). The focus groups with ICNs were also conducted separately to explore the perceptions and involvement of nurses who have a specialist role in infection prevention and control. In some countries such as Ireland, ICNs have been recognised to be important members of the AMS team and are involved directly in AMS activities (SARI, 2009).

3.6.3 Focus groups

Focus groups are a method of interview designed for small groups, that allow the collection of qualitative data in a particular topic of interest (Andrew & Halcomb, 2009). As described by Shaha, Wenzel, and Hill (2011), this method can provide deeper information than survey or individual interview by encouraging interactive exploration of issues and group resolution of key issues. The focus group discussions were used in this phase to explore the current and potential roles of nurses in AMS and how nurses interact with patients in relation to AMS throughout the care trajectory from admission, during hospitalisation and in preparation for discharge. In addition, this approach was used to investigate perceived barriers to nurses’ engagement in AMS in order to inform future involvement and the potential to enhance patient engagement and education strategies.
It is recommended that focus groups have at least six to eight attendees (Shaha et al. (2011). In this study, three focus groups were conducted with nurses: seven nurses participated in the ICN group, five nurses participated in the senior nurse group and six nurses participated in the junior nurse group.

The focus group discussions were guided by open-ended questions and prompts to encourage group discussion. The full version of interview guide is available in Appendix B.

3.6.4 Data collection procedure

Nurses who were working in medical or surgical wards in the case hospital were invited to participate in focus groups though a face-to-face invitation. ICNs were invited to participate in the study though a face-to-face meeting in the infection prevention and control department. The researcher invited nurses to participate. The three focus groups were conducted separately; senior ward nurses, junior ward nurses, and ICNs. The participants were asked to complete written consent forms before starting the focus group. All focus groups were conducted by the researcher (NS) within the hospital at a time that was convenient for nurses and by agreement from the hospital executive. All participants were provided with an opportunity to debrief and feedback. The focus groups were conducted in approximately 60 minutes using a topic guide. Two types of recording methods were used: written notes were taken and the groups were audio-recorded.

3.6.5 Data analysis

The qualitative data were analysed using thematic analysis. The procedure for the management of data was the same as that of Phase 2. Audio-recordings and field notes from focus group interviews were transcribed in Thai by the researcher (NS) who conducted the focus groups. The accuracy of the Thai transcripts was checked against the recordings by the researcher (NS). Next, a professional translator translated the Thai transcripts into English. After that, the researcher (NS) reviewed the accuracy and consistency of the English and Thai transcripts, especially the clinical terms. Then, a Thai nursing educator who holds a PhD in Nursing (written
in English) verified the consistency of the English and Thai transcripts. The data analysis was conducted using the English transcripts.

Again as in Phase 2, to ensure the rigour of data analysis peer debriefing with supervisors occurred throughout all stages of the data analysis including the generation of the coding frame and identification of major themes and subthemes. Representative quotations from the transcribed text used in relation to major themes and subthemes were also confirmed. The analytical process is auditable in the raw data and coding documents. Data analysis was conducted using the steps outlined in Section 3.4.5.

3.7 Methodological triangulation

The four phases of research were conducted as described in Sections 3.3, 3.4, 3.5 and 3.6. However, for the purpose of addressing the full aims and objectives of the research, the data derived from the clinician and patient surveys were triangulated with data derived from interviews and focus groups in the final analyses. The process was a sequential analysis where the qualitative and quantitative data were analysed separately and then, to address the aims of the research, both the qualitative and quantitative analysis findings were combined to better understand the data and provide a context for responses to the clinician and patient surveys.

3.8 Ethical considerations

The full protocol for the four phases of the research was submitted for approval to the Human Research Ethics Committee at Deakin University (HREC) and the Institutional Review Board (IRB) of the study hospital. Data collection did not commence until ethical approval was obtained. The ethical issues of relevance to this research are discussed below.

3.8.1 Informed consent

Participation in this study was voluntary. In Phase 2 and Phase 4, potential participants received a face-to-face invitation to participate where they could ask questions and clarify expectations. The focus group and organisational leaders were
informed in writing of the purpose of the study, the possible risks and benefits of participation and how the research data were to be maintained, used and disseminated. Potential participants, who did not wish to take part of the study or changed their mind after signing consent, were free to withdraw from the study without effect on their relationship with colleagues, the researcher or the institutions involved. Those who agreed to participate in these phases were invited to complete written consent forms before commencing the interview or focus groups. Potential participants were informed that if they changed their mind about participation they could withdraw their data until the time when the data were analysed, after which it would not be possible to withdraw data.

In Phases 1 and 3, all eligible patients and clinicians were provided with a copy of the approved Patient Information Form. In the information forms, potential participants were informed about the nature, scope and consequences of the study. Consent to participate was implied by completing the survey instruments. All participants were given a copy of the Patient Information Form to keep so that they could refer back to the details of their participation. Completion of the surveys was anonymous, participants were not be able to withdraw data once the surveys were submitted.

3.8.2 Anonymity, Privacy and Confidentiality

All participants at each phase of the research were assured that any information provided by them would not be reported publically in a way that could identify them. However, given the nature of the case study research, full anonymity could not be assured for participants in the organisational leaders in Phase 2 and this was disclosed at the outset. Data from the survey questionnaires were not identifiable. Data from focus groups and interviews were transcribed verbatim, identifiers permanently removed and a study identification code allocated to each participant’s data. The information obtained in connection with the research project was kept confidential and were only used for the purpose of the research project.
In Phase 4, focus group participants were informed that in focus groups data collection is not anonymous by the nature of a group interview, nor can confidentiality of the discussion be assured. At the beginning of each focus group, participants were reminded to respect the confidentiality of the discussion and not to discuss the group discussion outside of the group. Participants in focus groups could not be identified by stored or reported characteristics or findings.

3.8.3 Data management and storage

All of the participant data were maintained confidentially throughout the study. Paper-based questionnaire data were entered into the statistics software then stored in a locked cabinet in a locked research office during data collection and then archived within the School of Nursing and Midwifery, Deakin University, Australia. The audiotapes of individual interviews and focus groups were transcribed in full. Digital interview data were kept on a password-protected computer. Only the researcher and principal supervisors could assess the records. The original surveys and audiotapes were to be retained in a secure location at Deakin University for a minimum of seven years from the date of publication of findings. After that time, all electronic data will be deleted. These include audiotape recordings, transcripts, SPSS data files, other descriptive data, graphs, and spread sheets. Hard copy paper data will be shredded using a secure disposal service.

The research findings are presented in the next four chapters in alignment with the four aims of the research.
Chapter 4
Perceptions and Attitudes Towards Antimicrobial Stewardship Among Clinicians

In this chapter, the analyses of the clinician survey, interview and focus group data related to perceptions and attitudes towards AMS are presented in two major sections. In the first section, the results of the clinician survey are presented. In the second section, the results of the organisational leader interviews and nurse focus groups are described. This is followed by a discussion of the findings.

Aim and objectives

The first specific aim of this research program was to explore the perceptions and attitudes toward AMS among clinicians in acute healthcare in Thailand. The specific objectives were to:

1. Describe perceptions and attitudes of doctors, nurses and pharmacists towards AMS using a clinician survey.
2. Explore perceptions and attitudes of organisational leaders, infection control nurses and clinical nurses regarding antimicrobial resistance using semi-structured interviews and focus groups.
3. Explore differences in the perceptions and attitudes of clinicians from different disciplines towards AMS.
4.1 Clinician survey results

In this section, the results of the clinician survey regarding perceptions and attitudes towards AMS of doctors, nurses and pharmacists are presented. The aim of the clinician survey was to describe the attitudes and perceptions of doctors, nurses and pharmacists towards AMS and explore differences among clinicians in acute health care in Thailand. The results are presented in two sections: the description of participant characteristics; and the survey findings.

4.1.1 Participant characteristics

There were a total of 1,087 participants: 392 (36.1%) were doctors, 613 (56.4%) were nurses and 82 (7.5%) were pharmacists (Table 4.1). A total of 1,753 surveys were distributed and the overall response rate was 62% (1,087/1,753). The specific response rates per group were 41.4% (392/948) among doctors and 86.3% among nurses (613/710) and pharmacists (82/95).

Table 4.1 Response rate of participants according to discipline (n=1,087)

<table>
<thead>
<tr>
<th>Professions</th>
<th>n</th>
<th>N (Total)</th>
<th>% (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resident</td>
<td>192</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fellow</td>
<td>64</td>
<td></td>
<td>392</td>
</tr>
<tr>
<td>Staff</td>
<td>136</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ward nurse</td>
<td>602</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced Practice Nurse</td>
<td>11</td>
<td>613</td>
<td>56.4</td>
</tr>
<tr>
<td>Pharmacist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmacist</td>
<td>78</td>
<td></td>
<td>82</td>
</tr>
<tr>
<td>Advanced Practice Pharmacist</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1,087</td>
<td>100</td>
</tr>
</tbody>
</table>

Overall, 80.9% (n=879) of participants were female. Females comprised 52.6% (n= 206) of doctors 97.7% (n=599) of nurses and 90.2% (n=74) of pharmacists. Table 4.2 shows that participants were most commonly working in the areas of surgery (20.8%), pediatrics (18%) and medicine (17.6%). Almost half the participants (42.3%) had 1-5 years of clinical experience (n=460).
Table 4.2 Participant’s employment characteristics

<table>
<thead>
<tr>
<th>Demographic data</th>
<th>All participants (N=1087)</th>
<th>Doctors (N=392)</th>
<th>Nurses (N=613)</th>
<th>Pharmacists (N=82)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td><strong>Hospital departments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery</td>
<td>226 (20.8%)</td>
<td>76 (19.4%)</td>
<td>150 (24.5%)</td>
<td>-</td>
</tr>
<tr>
<td>Paediatrics</td>
<td>196 (18.0%)</td>
<td>51 (13.0%)</td>
<td>145 (23.7%)</td>
<td>-</td>
</tr>
<tr>
<td>Medicine</td>
<td>191 (17.6%)</td>
<td>115 (29.3%)</td>
<td>76 (12.4%)</td>
<td>-</td>
</tr>
<tr>
<td>Operating room nurses</td>
<td>86 (7.9%)</td>
<td>-</td>
<td>86 (14.0%)</td>
<td>-</td>
</tr>
<tr>
<td>Pharmacy department</td>
<td>82 (7.5%)</td>
<td>-</td>
<td>-</td>
<td>82 (100)</td>
</tr>
<tr>
<td>Obstetrics and gynaecology</td>
<td>61 (5.6%)</td>
<td>28 (7.1%)</td>
<td>33 (5.4%)</td>
<td>-</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>60 (5.5%)</td>
<td>24 (6.1%)</td>
<td>36 (5.9%)</td>
<td>-</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>51 (4.7%)</td>
<td>24 (6.1%)</td>
<td>27 (4.4%)</td>
<td>-</td>
</tr>
<tr>
<td>Emergency medicine</td>
<td>49 (4.5%)</td>
<td>22 (5.6%)</td>
<td>27 (4.4%)</td>
<td>-</td>
</tr>
<tr>
<td>Community health nurses</td>
<td>33 (3.0%)</td>
<td>-</td>
<td>33 (5.4%)</td>
<td>-</td>
</tr>
<tr>
<td>Family medicine</td>
<td>28 (2.6%)</td>
<td>28 (7.1%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Anaesthesiology</td>
<td>24 (2.2%)</td>
<td>24 (6.1%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Years of experience since qualification</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 year</td>
<td>94 (8.6%)</td>
<td>2 (0.5%)</td>
<td>76 (12.4%)</td>
<td>16 (19.5%)</td>
</tr>
<tr>
<td>1 to 5 years</td>
<td>460 (42.3%)</td>
<td>171 (43.6%)</td>
<td>252 (41.1%)</td>
<td>37 (45.1%)</td>
</tr>
<tr>
<td>6 to 10 years</td>
<td>247 (22.7%)</td>
<td>122 (31.1%)</td>
<td>107 (17.5%)</td>
<td>18 (22)</td>
</tr>
<tr>
<td>11 to 20 years</td>
<td>204 (18.8%)</td>
<td>61 (15.6%)</td>
<td>135 (22)</td>
<td>8 (9.8)</td>
</tr>
<tr>
<td>&gt; 20 years</td>
<td>82 (7.5%)</td>
<td>36 (9.2%)</td>
<td>43 (7)</td>
<td>3 (3.7)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>29</td>
<td>31</td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td>IQR</td>
<td>26-35</td>
<td>28-37</td>
<td>24-35</td>
<td>26-34</td>
</tr>
</tbody>
</table>

The median age was 29 years (IQR= 26-35 years). The youngest participant was 22 years of age and the oldest was 70 years of age. As shown in Figure 4.1 most participants were aged between 22 and 35 years (76.4%, n = 830).
The study findings will be presented as per the following sections of the survey: i) perceptions about AMR; ii) participants’ perceptions of AMS programs; iii) previous involvement and experience with AMR and AMS; iv) estimation of inappropriate antibiotic orders and surgical prophylaxis; v) frequent problems associated with surgical prophylaxis; vi) clinicians’ knowledge about appropriate antibiotic prescribing and vii) patient groups at greatest and lowest risk of inappropriate antibiotic prescriptions.

Participants’ rated their responses on a Likert Scale (1 = not a problem and 7 = very serious problem or 1= does not contribute and 7= Strongly contributes). As the survey data were not normally distributed, the median score and quartiles 1 and 3 (Q1-Q3) are presented as indicators of interquartile range for each survey item. Comparisons between professional groups (doctors, nurses and pharmacists) were made using Kruskal Wallis test. The proportion of responses that were rated as 6 or 7 (agreed) versus 1 to 5 (disagreed or neutral) were also calculated for each survey item and the professional groups were compared using ANOVA and post hoc tests. Likert scale data is ordinal therefore non-parametric tests (median, Q1, Q3, and Kruskal Wallis test) were used in the first instance. The decision to use ANOVA and post hoc tests for further analysis was based on the premise by Norman (2010) who asserted that ANOVA is highly robust to issues such as skewness and non-normality (Norman, 2010). For survey
items that were categorical in nature, the participants’ responses are presented as frequencies and comparisons were made using Chi Square test.

4.1.2 Perceptions about antimicrobial resistance

Participants’ perceptions in relation to antimicrobial resistance (AMR) are presented in Table 4.3. Overall, participants considered that AMR was a serious problem worldwide, in Thai Hospitals and at the study hospital as indicated by the median rank of 7.0. AMR in the Thai community was considered less important as indicated by median rank of 6.0. Doctors (median = 7.0) were more likely than nurses and pharmacists to agree that AMR was a serious problem worldwide, in Thai hospitals, and at the study hospital (median = 6.0) ($p<0.001$). Nurses however were less likely to agree (median = 5.0) than doctors and pharmacists (median = 6.0) that AMR was a serious problem in the Thai community. Most respondents believed that antimicrobial use in Thai Hospitals contributed to AMR (median=6.0). One contributing factor was that patients were able to buy antibiotics over the counter. This was indicated by median rank of 6.0 for all professions. Antimicrobial use in Thai animal or agriculture sectors, the Thai community and patient pressure to receive antibiotics as part of their treatment were viewed less likely contribute to AMR as indicated by median rank of 5.0 (Table 4.3). Nurses were less likely to agree than doctors and pharmacists that antimicrobial use in Thai animal or agriculture sectors (median 5.0 versus 6.0, $p<0.001$) and in the Thai community (median 4.0 versus 5.0, $p<0.001$) contributed to AMR at the study hospital. Doctors were more likely to agree (median = 6.0) than nurses and pharmacists (median = 5.0) that antimicrobial use at the study hospital contributed to its own AMR. Nurses were less likely to agree (median = 5.0) than doctors and pharmacists (median = 6.0) that patient pressure for antibiotics as part of treatment contributed to AMR at the study hospital ($p<0.001$).
Table 4.3 Responses by profession to survey items related to antimicrobial resistance

<table>
<thead>
<tr>
<th>Questions</th>
<th>All participants (N=1087)</th>
<th>Doctors (N=392)</th>
<th>Nurses (N=613)</th>
<th>Pharmacists (N=82)</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1: World-wide</td>
<td>Median</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicate how serious a problem you believe</td>
<td>7.0</td>
<td>7.0</td>
<td>6.0</td>
<td>6.0</td>
<td>61.53</td>
<td>2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>antimicrobial resistance is in the following places:</td>
<td>5.0-7.0</td>
<td>6.0-7.0</td>
<td>5.0-7.0</td>
<td>6.0-7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2: Thai Community</td>
<td>6.0</td>
<td>6.0</td>
<td>5.0</td>
<td>6.0</td>
<td>62.74</td>
<td>2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>4.0-7.0</td>
<td>5.0-7.0</td>
<td>4.0-6.0</td>
<td>5.0-7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3: Thai Hospitals</td>
<td>7.0</td>
<td>7.0</td>
<td>6.0</td>
<td>6.0</td>
<td>18.96</td>
<td>2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>6.0-7.0</td>
<td>6.0-7.0</td>
<td>5.0-7.0</td>
<td>6.0-7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4: The study hospital</td>
<td>7.0</td>
<td>7.0</td>
<td>6.0</td>
<td>6.0</td>
<td>38.34</td>
<td>2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>6.0-7.0</td>
<td>6.0-7.0</td>
<td>6.0-7.0</td>
<td>5.0-7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Likert scale: 1 = Not a problem and 7 = Very serious

Indicate how strongly you believe the following contribute to antimicrobial resistance at the study hospital:

<table>
<thead>
<tr>
<th>Questions</th>
<th>All participants (N=1087)</th>
<th>Doctors (N=392)</th>
<th>Nurses (N=613)</th>
<th>Pharmacists (N=82)</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q5: Antimicrobial use in</td>
<td>Median</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thai animal / agricultural sectors</td>
<td>5.0</td>
<td>5.0</td>
<td>4.0</td>
<td>5.0</td>
<td>51.37</td>
<td>2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>4.0-5.0</td>
<td>4.0-6.0</td>
<td>3.0-5.0</td>
<td>4.0-6.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q6: Antimicrobial use in Thai community</td>
<td>5.0</td>
<td>6.0</td>
<td>5.0</td>
<td>6.0</td>
<td>123.18</td>
<td>2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>4.0-6.0</td>
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<td>4.0-6.0</td>
<td>5.0-6.0</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Q7: Antimicrobial use in Thai Hospitals</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
<td>85.01</td>
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<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>5.0-7.0</td>
<td>6.0-7.0</td>
<td>5.0-7.0</td>
<td>5.0-6.0</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Q8: Antimicrobial use at the study hospital</td>
<td>6.0</td>
<td>6.0</td>
<td>5.0</td>
<td>5.0</td>
<td>52.48</td>
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<td>&lt; 0.001</td>
</tr>
<tr>
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<td>5.0-7.0</td>
<td>4.0-6.0</td>
<td>5.0-6.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q9: Patient pressure for antibiotics as part of</td>
<td>5.0</td>
<td>6.0</td>
<td>5.0</td>
<td>6.0</td>
<td>80.77</td>
<td>2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>treatment</td>
<td>4.0-6.0</td>
<td>5.0-7.0</td>
<td>3.0-6.0</td>
<td>5.0-6.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q10: Patients are able to</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
<td>25.72</td>
<td>2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>buy antibiotics over the counter</td>
<td>5.0-7.0</td>
<td>5.0-7.0</td>
<td>5.0-7.0</td>
<td>5.0-6.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Likert scale: 1 = Does not contribute and 7 = Strongly contributes

* Kruskal-Wallis Test
To enable further analysis of differences between professions, the proportion of responses related to the seriousness of AMR that were rated as 6 or 7 (agreed) were compared with responses rated as 1 to 5 (disagreed or neutral) by profession. Participants’ responses, by profession, to statements about the seriousness of AMR along with the results of ANOVA and post hoc tests are shown in Figures 4.2-4.5.

There were significant between group differences in perceptions of the seriousness of AMR. Nurses were significantly less likely than doctors to agree that AMR is a worldwide problem (64.4% vs. 85.2%, *p*<0.001) (Figure 4.2) or that AMR is a problem in Thai hospitals (74.2% vs. 85.5%, *p*<0.001) (Figure 4.4) but there were no differences between nurses and pharmacists for either of these survey items. Nurses were also less likely than both doctors (41.6% vs. 60.5%, *p*<0.001) and pharmacists (41.6% vs. 69.5%, *p*<0.001) to perceive AMR as a problem in the Thai community (Figure 4.3). Doctors were more likely than nurses (86.7% vs. 75.2%, *p*<0.001) and pharmacists (86.7% vs. 72.0, *p*=0.001) to agree that AMR was a problem at the study hospital (Figure 4.4).

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>68.210</td>
<td>2</td>
<td>34.105</td>
<td>28.916</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Within groups</td>
<td>1278.501</td>
<td>1084</td>
<td>1.179</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1346.710</td>
<td>1086</td>
<td>1.179</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Hoc Tests</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Doctor vs. Nurse</td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>- Doctor vs. Pharmacist</td>
<td></td>
<td></td>
<td></td>
<td>0.052</td>
<td></td>
</tr>
<tr>
<td>- Nurse vs. Pharmacist</td>
<td></td>
<td></td>
<td></td>
<td>0.180</td>
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</tr>
</tbody>
</table>

Figure 4.2 Q1: AMR as worldwide problem
### ANOVA

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>166.262</td>
<td>2</td>
<td>83.131</td>
<td>37.046</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Within groups</td>
<td>2432.452</td>
<td>1084</td>
<td>2.244</td>
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</tr>
<tr>
<td>Total</td>
<td>2598.714</td>
<td>1086</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post Hoc Tests

- Doctor vs. Nurse: < 0.001
- Doctor vs. Pharmacist: 0.296
- Nurse vs. Pharmacist: < 0.001

Figure 4.3 Q2: AMR as problem in Thai community

### ANOVA

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>20.080</td>
<td>2</td>
<td>10.040</td>
<td>10.134</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Within groups</td>
<td>1073.882</td>
<td>1084</td>
<td>.991</td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
<td>1093.961</td>
<td>1086</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post Hoc Tests

- Doctor vs. Nurse: < 0.001
- Doctor vs. Pharmacist: 0.321
- Nurse vs. Pharmacist: 0.583

Figure 4.4 Q3: AMR as problem in Thai Hospitals

### ANOVA

<table>
<thead>
<tr>
<th>Source</th>
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<th>df</th>
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<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>31.798</td>
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<td>15.899</td>
<td>15.949</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Within groups</td>
<td>1080.598</td>
<td>1084</td>
<td>.997</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1112.396</td>
<td>1086</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post Hoc Tests

- Doctor vs. Nurse: < 0.001
- Doctor vs. Pharmacist: 0.001
- Nurse vs. Pharmacist: 0.720

Figure 4.5 Q4: AMR as problem at the study hospital
The proportion of responses rated as 6 or 7 (agreed) to statements about the factors that may contribute to AMR at the study hospital were compared to those rated 1 to 5 (disagreed or neutral) by profession. Participants’ responses, by profession, to statements about contributing factors to AMR along with the results of ANOVA analyses and post hoc tests are shown in Figures 4.6 - 4.11. Nurses were significantly less likely than doctors or pharmacists to agree that AMR at the study hospital was influenced by Thai animal or agricultural sectors (17.5% vs. 33.9% \( p<0.001 \) and 17.5% vs. 30.5%, \( p<0.001 \)) (Figure 4.6), the Thai community (29.7% vs. 60.5% \( p<0.001 \) and 29.7% vs. 59.8%, \( p<0.001 \)) (Figure 4.7), other Thai hospitals (52.4% vs. 78.1% \( p<0.001 \) and 52.4% vs. 74.4%, \( p=0.003 \)) (Figure 4.8) and patient pressure to receive antibiotics as part of their treatment (29.5% vs. 53.3% \( p<0.001 \) and 29.5% vs. 53.7%, \( p<0.001 \)) (Figure 4.10). There were no significant differences between doctors and pharmacists for these survey items. Doctors were more likely than nurses (67.9% vs. 46.5%, \( p<0.001 \)) and pharmacists (67.9% vs. 46.3%, \( p=0.002 \)) to agree that the study hospital contributes to its own AMR problems (74.0% vs. 58.1%, \( p<0.001 \)) (Figure 4.9) or that AMR at the study hospital was influenced by patients being able to buy antibiotics over the counter and without prescription (74.0% vs. 62.2% \( p=0.030 \)) (Figure 4.11). There were no significant differences between nurses and pharmacists in their perceptions that the study hospital contributes to its own AMR problems or that patients purchasing antibiotics over the counter and without prescription influences AMR at the study hospital.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>( F )</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>119.423</td>
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<td>59.711</td>
<td>26.180</td>
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<tr>
<td>Within groups</td>
<td>2472.423</td>
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<td>2.281</td>
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<tr>
<td>Total</td>
<td>2591.845</td>
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<tr>
<td>Post Hoc Tests</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctor vs. Nurse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Doctor vs. Pharmacist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.557</td>
</tr>
<tr>
<td>Nurse vs. Pharmacist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Figure 4.6 Q5: Thai animal/agricultural sectors contribute to AMR at the study hospital
ANOVA  

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
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<th>Sig.</th>
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</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>264.795</td>
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<td>132.397</td>
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<tr>
<td>Within groups</td>
<td>2164.075</td>
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<td>1.996</td>
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</tr>
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<td>Total</td>
<td>2428.870</td>
<td>1086</td>
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</tbody>
</table>

Post Hoc Tests  
- Doctor vs. Nurse < 0.001  
- Doctor vs. Pharmacist 0.865  
- Nurse vs. Pharmacist < 0.001  

Figure 4.7 Q6: Thai community contribute to AMR at the study hospital  

ANOVA  

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
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<td>Between groups</td>
<td>127.993</td>
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<td>27.665</td>
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</tr>
<tr>
<td>Within groups</td>
<td>1486.857</td>
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<td>1.372</td>
<td></td>
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</tr>
<tr>
<td>Total</td>
<td>1614.850</td>
<td>1086</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post Hoc Tests  
- Doctor vs. Nurse < 0.001  
- Doctor vs. Pharmacist 0.002  
- Nurse vs. Pharmacist 0.852  

Figure 4.8 Q7: Other Thai Hospitals contribute to AMR at the study hospital  

ANOVA  

<table>
<thead>
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<th></th>
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<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
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<td>45.449</td>
<td>27.665</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Within groups</td>
<td>1780.850</td>
<td>1084</td>
<td>1.643</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>1871.748</td>
<td>1086</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Post Hoc Tests  
- Doctor vs. Nurse < 0.001  
- Doctor vs. Pharmacist 0.002  
- Nurse vs. Pharmacist 0.852  

Figure 4.9 Q8: the study hospital contributes to own AMR problems
### ANOVA

<table>
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<tr>
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<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Within groups</td>
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<td>1084</td>
<td>2.383</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2787.196</td>
<td>1086</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post Hoc Tests
- Doctor vs. Nurse < 0.001
- Doctor vs. Pharmacist 0.997
- Nurse vs. Pharmacist < 0.001

**Figure 4.10 Q9:** Patient pressure contributes to AMR at the study hospital

### ANOVA

<table>
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<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>13.992</td>
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<td>Within groups</td>
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<td>1.787</td>
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<tr>
<td>Total</td>
<td>1986.754</td>
<td>1086</td>
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<td></td>
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</tbody>
</table>

Post Hoc Tests
- Doctor vs. Nurse < 0.001
- Doctor vs. Pharmacist 0.030
- Nurse vs. Pharmacist 0.968

**Figure 4.11 Q10:** Patients are able to buy over the counter antibiotics contribute to AMR at the study hospital

#### 4.1.3 Participants’ responses to antimicrobial stewardship programs

Participants’ attitudes towards antimicrobial stewardship (AMS) programs are presented in Table 4.4. Participants’ rated their responses on a Likert Scale (1 = strongly disagree and 7 = strongly disagree). The majority of participants from all professions agreed AMR would be reduced by improving antimicrobial prescribing and that improved antimicrobial prescribing should be a hospital priority supported by a formal policy: each of these three survey items had a median rank of 6.0 for all professions. All participants perceived that local antimicrobial guidelines and protocols, and a computer application to guide selection and duration of
antimicrobial therapy would be clinically useful as indicated by median rank of 6.0 for all professional groups. However, doctors (median = 5.0) were less likely than nurses and pharmacists (median score = 6.0) to agree with a policy that limits the antimicrobial prescribing \((p < 0.001)\). Doctors also were less likely to be interested in participating in AMS education and training (median=5.0) than nurses and pharmacists (median score = 6.0) \((p < 0.001)\). Pharmacists were more likely to agree (median = 7.0) that a team consisting of an ID specialist physician and pharmacist to individualised antimicrobial prescribing advice and feedback would assist with antimicrobial selection than doctors and nurses (median = 6.0) \((p <0.001)\).
<table>
<thead>
<tr>
<th>Questions</th>
<th>All participants (N=1087)</th>
<th>Doctors (N=392)</th>
<th>Nurses (N=613)</th>
<th>Pharmacists (N=82)</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q17: Improving antimicrobial prescribing at the study hospital will help decrease AMR.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-6.25)</td>
<td>9.79</td>
<td>2</td>
<td>0.008</td>
</tr>
<tr>
<td>Q18: Improving antimicrobial prescribing should be an organisational priority.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-6.0)</td>
<td>1.17</td>
<td>2</td>
<td>0.558</td>
</tr>
<tr>
<td>Q19: A formal policy for the use of antimicrobials should be introduced at the study hospital.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>1.38</td>
<td>2</td>
<td>0.501</td>
</tr>
<tr>
<td>Q20: A policy that limits the prescribing of selected antimicrobials to certain clinical indications via an approval process should be introduced at the study hospital.</td>
<td>6.0 (5.0-7.0)</td>
<td>5.0 (4.0-6.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>33.73</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Q21: Local antimicrobial guidelines and protocols should be introduced at the study hospital.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>3.10</td>
<td>2</td>
<td>0.212</td>
</tr>
<tr>
<td>Q22: A computer application which gives advice on selection and duration of antimicrobial therapy for specific clinical conditions would be clinically useful.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (6.0-7.0)</td>
<td>13.38</td>
<td>2</td>
<td>0.001</td>
</tr>
<tr>
<td>Q23: A team consisting of an ID specialist physician and Pharmacist providing individualized antimicrobial prescribing advice and feedback would assist with antimicrobial selection.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>7.0 (6.0-7.0)</td>
<td>18.05</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Q27: I would be interested in participating in education session about AMS.</td>
<td>6.0 (5.0-7.0)</td>
<td>5.0 (4.0-6.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>22.45</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Q28: I would be willing to participate in any activities to improve the quality of antimicrobial use at the study hospital.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>16.08</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*p Kruskal-Wallis Test
Participants’ responses, by profession, to statements about attitudes towards antimicrobial stewardship programs along with the results of ANOVA and post hoc tests are shown in Figures 4.12 - 4.18.

There were no significant between group differences in statements that improving antimicrobial prescribing should be an organisational priority ($p=0.376$), a formal policy for the use of antimicrobials should be introduced at the study hospital ($p=0.395$), local antimicrobial guidelines and protocols should be introduced at the study hospital ($p=0.358$) (Figures 4.13, 4.14 and 4.16). For each of these three survey items, the proportion of responses rated as 6 or 7 (agreed) ranged from 55.0% to 73.0%. Nurses were significantly less likely than doctors (54.8% vs. 64.8%, $p=0.004$) to agree that improving antimicrobial prescribing at the study hospital will help decrease AMR (Figure 4.12). Doctors were less likely than nurses or pharmacists to agree that a policy that limits the prescribing of selected antimicrobials to certain clinical indications via an approval process should be introduced at the study hospital (48.0% vs. 60.0%, $p<0.001$ and 48.0% vs. 69.5%, $p<0.001$) (Figure 4.15). Doctors were also less likely than nurses or pharmacists to agree that a computer application to guide selection and duration of antimicrobial therapy would be clinically useful (60.7% vs. 64.8%, $p<0.001$ and 60.7% vs. 82.9%, $p<0.001$) (Figure 4.17). There were no significant differences between nurses and pharmacists for these two survey items. Pharmacists were significant more likely than doctors (89.0% vs. 71.9%, $p<0.001$) and nurses (89.0% vs. 74.9%, $p=0.048$) to agree that a team consisting of an ID specialist physician and pharmacist providing individualised antimicrobial prescribing advice and feedback would assist with antimicrobial selection (Figure 4.18). Nurses were also more likely than doctors to agree with this statement (74.9% vs. 71.9%, $p=0.005$).
**ANOVA**

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>20.448</td>
<td>2</td>
<td>10.224</td>
<td>6.067</td>
</tr>
<tr>
<td>Within groups</td>
<td>1826.710</td>
<td>1084</td>
<td>1.685</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1847.157</td>
<td>1086</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Post Hoc Tests**
- Doctor vs. Nurse: 0.004
- Doctor vs. Pharmacist: 0.960
- Nurse vs. Pharmacist: 0.103

**Figure 4.12 Q17:** Improving antimicrobial prescribing at the study hospital will help decrease AMR.

**ANOVA**

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>3.010</td>
<td>2</td>
<td>1.505</td>
<td>.978</td>
</tr>
<tr>
<td>Within groups</td>
<td>1667.237</td>
<td>1084</td>
<td>1.657</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1670.247</td>
<td>1086</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Post Hoc Tests**
- Doctor vs. Nurse: 0.477
- Doctor vs. Pharmacist: 0.376
- Nurse vs. Pharmacist: 0.569

**Figure 4.13 Q18:** Improving antimicrobial prescribing should be an organizational priority

**ANOVA**

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>3.076</td>
<td>2</td>
<td>1.538</td>
<td>.928</td>
</tr>
<tr>
<td>Within groups</td>
<td>1795.930</td>
<td>1084</td>
<td>1.657</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1799.006</td>
<td>1086</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Post Hoc Tests**
- Doctor vs. Nurse: 0.982
- Doctor vs. Pharmacist: 0.376
- Nurse vs. Pharmacist: 0.406

**Figure 4.14 Q19:** A formal policy for the use of antimicrobials should be introduced at the study hospital
### Figure 4.15 Q20: A policy that limits the prescribing of selected antimicrobials to certain clinical indications via an approval process should be introduced at the study hospital.

### Figure 4.16 Q21: Local antimicrobial guidelines and protocols should be introduced at the study hospital.
ANOVA

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>39.887</td>
<td>2</td>
<td>19.943</td>
<td>11.871</td>
</tr>
<tr>
<td>Within groups</td>
<td>1821.046</td>
<td>1084</td>
<td>1.680</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1860.933</td>
<td>1086</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post Hoc Tests
- Doctor vs. Nurse < 0.001
- Doctor vs. Pharmacist < 0.001
- Nurse vs. Pharmacist 0.143

Figure 4.17 Q22: A computer application which gives advice on selection and duration of antimicrobial therapy for specific clinical conditions would be clinically useful

ANOVA

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>21.862</td>
<td>2</td>
<td>10.931</td>
<td>9.857</td>
</tr>
<tr>
<td>Within groups</td>
<td>1202.122</td>
<td>1084</td>
<td>1.109</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1223.983</td>
<td>1086</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post Hoc Tests
- Doctor vs. Nurse 0.005
- Doctor vs. Pharmacist < 0.001
- Nurse vs. Pharmacist 0.048

Figure 4.18 Q23: A team consisting of an ID specialist physician and Pharmacist providing individualized antimicrobial prescribing advice and feedback would assist with antimicrobial selection

The proportion of responses rated as 6 or 7 (agreed) versus 1 to 5 (disagreed or neutral) by profession to statements about readiness to participate in AMS along with the results of ANOVA and post hoc tests are presented in Figure 4.19 and 4.20. Pharmacists were significantly more likely than doctors and nurses agree that they would be interested in participating in education session about AMS (72.0% vs. 46.9%, p<0.001 and 72.0% vs. 55.0%, p=0.003) (Figure 4.19). Nurses were also more likely than doctors to agree to this statement (55.0% vs. 46.9%, p=0.008).

Pharmacists were also more willing agree to participate in any activities to improve the quality of antimicrobial use at the study hospital than doctors and nurses (79.3%
vs. 51.3%, \( p<0.001 \) and 79.3% vs. 55.5%, \( p=0.003 \) (Figure 4.20). There were no differences between doctors and nurses for this survey item.

### ANOVA

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>46.723</td>
<td>2</td>
<td>23.362</td>
<td>12.408</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Within groups</td>
<td>2040.960</td>
<td>1084</td>
<td>1.883</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2087.684</td>
<td>1086</td>
<td>1.718</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Post Hoc Tests
- Doctor vs. Nurse: 0.008
- Doctor vs. Pharmacist: <0.001
- Nurse vs. Pharmacist: 0.003

Figure 4.19 Q27: I would be interested in participating in education session about AMS.

### ANOVA

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>28.732</td>
<td>2</td>
<td>14.366</td>
<td>8.361</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Within groups</td>
<td>1862.604</td>
<td>1084</td>
<td>1.718</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1891.336</td>
<td>1086</td>
<td>1.796</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Post Hoc Tests
- Doctor vs. Nurse: 0.225
- Doctor vs. Pharmacist: <0.001
- Nurse vs. Pharmacist: 0.003

Figure 4.20 Q28: I would be willing to participate in any activities to improve the quality of antimicrobial use at the study hospital.

### 4.1.4 Previous involvement and experience with antimicrobial resistance and antimicrobial stewardship

Participants’ responses to questions related to previous involvement and experience with antimicrobial resistance (AMR) and antimicrobial stewardship (AMS) are presented in Table 4.5. The majority of participants had previously been involved in the care of patients with an antibiotic resistant infection (88.1%), however less pharmacists reported being involved in the care of patients with an antibiotic
resistant infection than doctors or nurses (59.8% vs. 93.1% vs. 88.7%, \(p<0.001\)). The majority of participants also reported that they had noticed increasing number of antimicrobial resistance infections over the past five years (82.3%). Again fewer pharmacists reported this change over time than doctors or nurses (68.3% vs 85.5% vs 82.2%, \(p=0.001\)). Overall, less than one in five participants (17.2%) had heard of AMS terminology in English. A significantly higher percentage of pharmacists had heard of the term AMS than doctors or nurses and nurses reported the lowest level of awareness of the term AMS (48.8% vs. 20.4% vs. 10.2%, \(p<0.001\)). Less than half the participants (37.6%) worked in healthcare facilities with AMS programs. More pharmacists reported working in healthcare facilities with AMS programs than doctors or nurses (46.3% vs. 39.3% vs. 35.4%, \(p<0.001\)).

Table 4.5 Previous involvement and experience with AMR and AMS by profession

<table>
<thead>
<tr>
<th>Questions</th>
<th>All participants (N=1087)</th>
<th>Doctors (N=392)</th>
<th>Nurses (N=613)</th>
<th>Pharmacists (N=82)</th>
<th>(\chi^2) *</th>
<th>df</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q11: Previously involved in care of patients with an antibiotic resistant infection</td>
<td>958 (88.1)</td>
<td>365 (93.1)</td>
<td>554 (88.7)</td>
<td>49 (59.8)</td>
<td>79.52</td>
<td>4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Q12: Have noticed increasing number of antimicrobial resistance infections over past 5 years</td>
<td>895 (82.3)</td>
<td>335 (85.5)</td>
<td>504 (82.2)</td>
<td>56 (68.3)</td>
<td>18.58</td>
<td>4</td>
<td>0.001</td>
</tr>
<tr>
<td>Q24: Have heard of term AMS (English term)</td>
<td>187 (17.2)</td>
<td>80 (20.4)</td>
<td>67 (10.9)</td>
<td>40 (48.8)</td>
<td>99.49</td>
<td>4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Q25: Worked in healthcare facilities with AMS programs</td>
<td>409 (37.6)</td>
<td>154 (39.3)</td>
<td>217 (35.4)</td>
<td>38 (46.3)</td>
<td>42.16</td>
<td>4</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

* Chi Square

4.1.5 Estimation of inappropriate antibiotic orders in inpatient and surgical prophylaxis in the study hospital

Participants’ responses related to estimation of inappropriate orders in inpatient antimicrobial agents and surgical prophylaxis are presented in Table 4.6 and Table 4.7. Overall, 77.5% of participants estimated that 10 to 50% of inpatient antibiotic orders at the study hospital were inappropriate (n=843, \(p<0.001\)) (Table 4.6). Only 8.6% of participants estimated that inappropriate antibiotic orders in
inpatient and surgical prophylaxis in the study hospital were less than 10%. However 13.8% of participants indicated that more than 50% of inappropriate antibiotic inpatient orders. Nearly 60% (59.8%) of pharmacists indicated that 26-50% of inpatient antibiotic orders were inappropriate.

Table 4.6 Participants’ estimation of the percentage of inpatient antibiotic orders that are inappropriate at the study hospital by profession

<table>
<thead>
<tr>
<th>Items</th>
<th>All participants (N=1087)</th>
<th>Doctors (N=392)</th>
<th>Nurses (N=613)</th>
<th>Pharmacists (N=82)</th>
<th>(\chi^2)</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10%</td>
<td>94 (8.6)</td>
<td>13 (3.3)</td>
<td>80 (13.1)</td>
<td>1 (1.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 to 25%</td>
<td>398 (36.6)</td>
<td>171 (43.6)</td>
<td>209 (34.1)</td>
<td>18 (22.0)</td>
<td>15.53</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>26 to 50%</td>
<td>445 (40.9)</td>
<td>164 (41.8)</td>
<td>232 (37.8)</td>
<td>49 (59.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50% or greater</td>
<td>150 (13.8)</td>
<td>44 (11.2)</td>
<td>92 (15.0)</td>
<td>14 (17.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Chi Square

Overall, 72.1% (n = 783) of participants estimated that inappropriate surgical prophylaxis orders occurred in 10% to 50% of patients (Table 4.7). There were similar percentages of doctors (42.9%) nurses (41.4%) and pharmacists (40.2%) that viewed an inappropriate order in surgical prophylaxis to be 10%-25%. Only 9.5% of participants estimated that more than 50% of surgical prophylaxis orders were inappropriate.

Table 4.7 Participants’ estimation of the percentage of surgical prophylaxis orders that are inappropriate at the study hospital by profession

<table>
<thead>
<tr>
<th>Items</th>
<th>All participants (N=1087)</th>
<th>Doctors (N=392)</th>
<th>Nurses (N=613)</th>
<th>Pharmacists (N=82)</th>
<th>(\chi^2)</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10%</td>
<td>201 (18.5)</td>
<td>67 (17.1)</td>
<td>124 (20.2)</td>
<td>10 (12.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 to 25%</td>
<td>455 (41.9)</td>
<td>168 (42.9)</td>
<td>254 (41.4)</td>
<td>33 (40.2)</td>
<td>5.89</td>
<td>2</td>
<td>0.053</td>
</tr>
<tr>
<td>26 to 50%</td>
<td>328 (30.2)</td>
<td>114 (29.1)</td>
<td>188 (30.7)</td>
<td>26 (31.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50% or greater</td>
<td>103 (9.5)</td>
<td>43 (11.0)</td>
<td>47 (7.7)</td>
<td>13 (15.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Chi Square
4.1.6 Frequent problems associated with surgical prophylaxis at the study hospital

Participants were asked to rate the most frequent problems associated with surgical prophylaxis at the study hospital (Figure 4.21). Inappropriate antimicrobial choice was considered by 53% of all participants as the most frequent issue (n=576) followed by inappropriately stopping time (30.0%, n=326) and timing of first dose (15.5%, n=169) (Table 4.8). Inappropriate stopping time includes stopping antimicrobials too early but also more commonly stopping antimicrobials too late. Problems with the time of first dose can include the first dose being too early (e.g. on ward before operation time) or less commonly too late.

Figure 4.21 Most frequent problems associated with surgical prophylaxis at the study hospital by profession
Table 4.8 Responses by profession to survey item related to most frequent problems associated with surgical prophylaxis at the study hospital

<table>
<thead>
<tr>
<th>Items</th>
<th>All participants (N=1087)</th>
<th>Doctors (N=392)</th>
<th>Nurses (N=613)</th>
<th>Pharmacists (N=82)</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing of first dose</td>
<td>169 (15.5)</td>
<td>48 (12.2)</td>
<td>103 (16.8)</td>
<td>18 (22.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inappropriate antimicrobial chosen</td>
<td>576 (53.0)</td>
<td>225 (57.4)</td>
<td>308 (50.2)</td>
<td>43 (52.4)</td>
<td>9.94</td>
<td>6</td>
<td>0.127</td>
</tr>
<tr>
<td>Inappropriate stopping time</td>
<td>326 (30.0)</td>
<td>112 (28.6)</td>
<td>194 (31.6)</td>
<td>20 (24.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>16 (1.5)</td>
<td>7 (1.8)</td>
<td>8 (1.3)</td>
<td>1 (1.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Chi Square

4.1.7 Participants’ rating of their knowledge about appropriate antibiotic prescribing

The participants’ ratings of their knowledge about antibiotic prescribing are shown in Figure 4.22. More than half of participants perceived that they had an average knowledge about appropriate antibiotic prescribing (63.9%, n=695). Only 10.7% (n=116) of participants reported they had good or very good knowledge about this topic. Only 4.8% (n=29) of nurses perceived that they had a knowledge about antibiotics prescribing (Table 4.9).

Figure 4.22 Clinicians’ rating of their knowledge related to antibiotic prescribing
Table 4.9 Participants’ perceptions related to their knowledge about antibiotic prescribing

<table>
<thead>
<tr>
<th>Items</th>
<th>All participants (N=1087)</th>
<th>Doctors (N=392)</th>
<th>Nurses (N=613)</th>
<th>Pharmacists (N=82)</th>
<th>X²*</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimal</td>
<td>32 (2.9)</td>
<td>5 (1.3)</td>
<td>25 (4.1)</td>
<td>2 (2.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited</td>
<td>244 (22.4)</td>
<td>39 (9.9)</td>
<td>191 (31.2)</td>
<td>14 (17.1)</td>
<td>104.314</td>
<td>2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Average</td>
<td>695 (63.9)</td>
<td>274 (69.9)</td>
<td>368 (60.0)</td>
<td>53 (64.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>110 (10.1)</td>
<td>69 (17.6)</td>
<td>28 (4.6)</td>
<td>13 (15.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very good</td>
<td>6 (0.6)</td>
<td>5 (1.3)</td>
<td>1 (0.2)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Chi Square

4.1.8 Participant’s perceptions of risk of inappropriate antibiotic prescriptions

Participants were asked to rank, in order, which patient groups they thought were most at risk of inappropriate prescriptions at the study hospital (Figure 4.23). The rankings ranged from 1 (most at risk) and 6 (least at risk). Patients with community-acquired infection were ranked as the group with the highest risk of inappropriate antimicrobial orders while patients with immune suppressive condition were ranked as lowest risk for inappropriate antimicrobial orders by all participants (Figure 4.23). The Table 4.10 shows that pharmacists were more likely to report that inappropriate antimicrobial orders were more common in surgical patients (exclude surgical prophylaxis) when compared with doctors and nurses (ranking order 2nd vs. ranking order 4th vs. ranking order 4th, p=0.001). Doctors were more likely to report that patients being treated in the ward assigned to very important persons (VIP) were prescribed inappropriate antimicrobials when compared with nurses (ranking order 2nd vs. ranking order 5th, p < 0.001).
Note: 1 = Most at risk of inappropriate prescriptions in the hospital
6 = Least at risk of inappropriate prescriptions in the hospital

Figure 4.23 Patient groups considered at greatest and lowest risk of inappropriate antibiotic prescriptions by profession

Table 4.10 Participants’ raking patient groups at greatest and lowest risk of inappropriate antibiotic prescriptions

<table>
<thead>
<tr>
<th>Items</th>
<th>All participants (N=1087)</th>
<th>Doctors (N=392)</th>
<th>Nurses (N=613)</th>
<th>Pharmacists (N=82)</th>
<th>χ²*</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with community acquired infection</td>
<td>1st 394 (36.2)</td>
<td>1st 133 (33.9)</td>
<td>1st 204 (33.3)</td>
<td>1st 57 (69.5)</td>
<td>40.435</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Patients with immune suppressive condition</td>
<td>6th 282 (25.9)</td>
<td>6th 125 (31.9)</td>
<td>6th 130 (21.2)</td>
<td>6th 26 (31.7)</td>
<td>30.928</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Surgical patients (exclude surgical prophylaxis)</td>
<td>4th 251 (23.1)</td>
<td>4th 85 (21.7)</td>
<td>4th 153 (25.0)</td>
<td>2nd 27 (32.9)</td>
<td>14.911</td>
<td>2</td>
<td>0.001</td>
</tr>
<tr>
<td>Patients being treatment in critical care</td>
<td>6th 248 (22.8)</td>
<td>5th 90 (23)</td>
<td>6th 135 (22.0)</td>
<td>6th 30 (36.6)</td>
<td>30.692</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Patients being treatment in general ward</td>
<td>3rd 288 (26.5)</td>
<td>4th 118 (30.1)</td>
<td>3rd 159 (25.9)</td>
<td>3rd 26 (31.7)</td>
<td>1.732</td>
<td>2</td>
<td>0.421</td>
</tr>
<tr>
<td>Patients being treatment in VIP ward</td>
<td>2nd 227 (20.9)</td>
<td>2nd 100 (25.5)</td>
<td>5th 118 (19.2)</td>
<td>3rd 34 (41.5)</td>
<td>18.948</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

* Kruskal-Wallis Test
4.2 Findings from the interviews and focus groups

In this section, the key themes emerging from the organisational leader (executives and clinical leaders) interviews and focus groups with clinical and infection control nurses (ICNs) relating to their perceptions and attitudes toward AMR are presented. The aim of the interviews with key informants and focus groups with nurses was to explore perceptions and attitudes of organisational leaders and nurses towards AMR. The findings are presented in two sections: the description of participant characteristics; and the description of key themes.

4.2.1 Participant characteristics

There were 33 participants in the interviews and focus groups (Table 4.11) of which, 15 were organisational leaders who were interviewed individually. Purposeful sampling was used to enroll participants. The organisational leaders interviewed were the Director of the hospital, Director of Nursing, Director of Pharmacy, Chair of infection prevention and control (IPC) committee, nurse manager of IPC department, infection control specialists (2), surgeons (2), ID specialists (1), nurse manager in operating room (1), nurse manager in ICU (1), AMS and clinical pharmacists (2) and Head of Virology Department (1).

There were two groups of nurses who participated in the focus groups: seven infection control nurses, and 11 clinical ward nurses (senior nurses (n=5) and junior nurses (n=6)). Clinical nurses were working in either the medical or surgical wards of the study hospital. The years of nursing experience for participants in the senior nurse group was greater than ten years and in the junior nurse group was less than three years.

Table 4.11 Individual interviews and focus group: participant categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of interviews</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual interviews</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Focus group interviews</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Total interviews</td>
<td>18</td>
<td>33</td>
</tr>
</tbody>
</table>
4.2.2 Underlying causes of antimicrobial resistance in Thailand

Attitudes and perceptions of organisational leaders and nurses regarding the main issues that contribute to antimicrobial resistance (AMR) in Thailand emerged as four themes. These were: 1) lack of regulatory control, 2) poor consumer knowledge of antibiotic use, 3) inappropriate use in clinical practice and 4) poor implementation of infection prevention and control (IPC) policies in Thailand (Table 4.12)

Table 4.12 Underlying causes of antimicrobial resistance in Thailand

<table>
<thead>
<tr>
<th>Theme</th>
<th>Subthemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Lack of regulatory control</td>
<td>1.1 Widespread use in agriculture, and health</td>
</tr>
<tr>
<td></td>
<td>1.2 Over the counter availability for consumers</td>
</tr>
<tr>
<td>2) Poor consumer knowledge of antibiotic use</td>
<td>2.1 Inappropriate use of antibiotic for viral infections</td>
</tr>
<tr>
<td></td>
<td>2.2 Antibiotic not used therapeutically</td>
</tr>
<tr>
<td></td>
<td>2.3 Patient expectations</td>
</tr>
<tr>
<td>3) Inappropriate use in clinical practice</td>
<td>3.1 Lack of prescriber awareness</td>
</tr>
<tr>
<td></td>
<td>3.2 Lack of prescriber knowledge</td>
</tr>
<tr>
<td></td>
<td>3.3 Influence of the pharmaceutical industry</td>
</tr>
<tr>
<td>4) Poor implementation of IPC policies in Thailand</td>
<td>4.1 Spread of resistant organisms within healthcare</td>
</tr>
<tr>
<td></td>
<td>4.2 Environmental impact of antibiotic disposal</td>
</tr>
</tbody>
</table>

1) Lack of regulatory control

The participants perceived that AMR in Thailand is caused by the lack of regulatory control. Widespread use of antibiotics in agriculture and health, and over the counter availability of antibiotics for consumers were identified as subthemes, exacerbated by lack of government policy and regulation of antibiotic distribution in Thailand. The widespread use of antibiotics in agriculture and health is problematic as there is no system of monitoring where antibiotics are being used and individuals or groups are unaware that they have secondary exposure to antibiotics. In contrast, over the counter availability of antibiotics to the layperson is related to individual behavior. The lack of regulation means that the individual can decide to purchase
antibiotics without any consultation with a healthcare professional about their need for antibiotics.

1.1 Widespread use in agriculture and health

The participants believed that the lack of regulatory control from government agencies such as the Thai Ministry of Health, meant there was little information about the volume of consumption of antimicrobials in Thailand. Participants identified that Thailand does not have the systems to monitor antibiotic use and they suggested that a better system to regulate antibiotic use in Thailand was urgently needed.

“The use is high [antibiotic use] but we do not know how high, how much is imported, and how much we use. It [antibiotics] might go into animals or humans.” (D1)

“The AMR problem would not be as bad if we had a formal system to monitor antibiotic use in Thailand.” (N2)

“Because our country does not have laws that strictly control the selling of drugs for humans, plants, and animals, there is a dramatic spread of antimicrobial resistance” (ICN2)

The widespread availability of antibiotics across Thailand was identified as an issue because individuals could be exposed to antibiotics both directly and indirectly. Participants mentioned that Thai people are able to acquire antibiotics easily in both community and healthcare settings. The consequence of this is an increase in antimicrobial resistance across Thai hospitals, as individuals presenting for acute health care are already colonised with microbes that are resistant to widely available antibiotics.
“Because in the community, Thai people have too easy access to antibiotics, they can get antibiotics from the agricultural section of a drug store. When they see a doctor in hospital they already have an antimicrobial resistant infection. This means doctors need to step up antibiotic treatment. Patients come to hospital with antimicrobial resistance.” (P2)

“Previously we used to implement isolation precautions for patients with Extended-Spectrum beta-lactamases (ESBLs) infection as a contact precaution. But now we no longer do that because there are so many patients. We also realise that ESBLs infections are from the community and not from the hospitals.” (N3)

The widespread availability of antibiotics across Thailand results in increased exposure to antibiotics, (and potentially antibiotic resistant organisms) in the food consumed. The use of antibiotics in crop and animal agriculture in Thailand means that antimicrobials are used at all levels in the food chain. Antibiotic use in animals was particularly emphasised as a significant issue contributing to AMR in Thailand. Participants state that there is overuse of antibiotics in animal agriculture, so when people consume meats and vegetables they are exposed to AMR organisms.

“Also…. the use of antibiotics in animals such as in shrimps [and] pigs. So, we will receive these drugs [antibiotics] when we eat them” (N1)

One participant mentioned that antibiotic resistant genes were found in chicken, pork and shrimps.

“ When I joined the infection control conference last time, one of researchers presented that they found the genes of antimicrobial resistance in prawns chicken and pork.” (N3)
1.2 Over the counter availability to the lay person

Antibiotic use is not only widely available but also used inappropriately. From the participants’ perspective in the Thai context, antibiotics are overused by all people in both clinical contexts and by lay people outside the hospital. One of the consumer endpoints for this lack of regulatory control over the import and distribution of antibiotics was identified as the availability of antibiotics over the counter to consumers. In Thailand people can buy antibiotic without prescription. To purchase antibiotics over the counter is easy and convenient.

"We can see that when people feel unwell, they will purchase antibiotics over the counter at a chemist." (L1)

"In our country we can buy drugs at the drugstores. A seller does not give advice. If patients want antibiotics, they (sellers) will sell them without asking about the condition so it results in excessive and unreasonable antibiotic use." (JRN2)

2) Poor consumer knowledge of antibiotic use

Poor consumer knowledge of antibiotic use was identified as another major issue contributing to AMR in Thailand. Participants described inappropriate use of antibiotics for viral infections, failure to use antibiotics therapeutically, and patient expectations of antibiotic use. Participants believed that poor consumer knowledge of antibiotic use includes the belief that an antibiotic can cure the flu and minor infection so people have an expectation to be prescribed antibiotics. Once people take antibiotics, they stop taking them as soon as they feel better so they often do not complete a full course of antibiotics.

2.1 Inappropriate use of antibiotics for viral infections

Lack of consumer knowledge and awareness of the potential problems associated with regular antibiotic use was identified as a significant problem. When
Thai people get the flu they go to a drug store to buy antibiotics with the belief that antibiotics will make them feel better and recover faster.

“*When they have flu, they buy medicines themselves without knowing whether they are infected with a virus or bacteria.*” (ICN4)

2.2 Antibiotics not used therapeutically

Another problem contributing to AMR in Thailand is that people fail to complete a course of antibiotics. After commencing antibiotics they sometimes stop taking them when they feel better. As participants noted,

“*And when they feel better, they instantly stop taking medicines without taking the full course.*” (ICN4)

2.3 Patient expectations

Patients expect to receive antibiotics when they have infections irrespective of whether the infection is viral or bacterial,

“*A friend of mine told me that when she had flu, [she] went to see a doctor at a clinic because she wanted antibiotics. She kept changing doctors when the condition was not getting better. She said each doctor also prescribed different antibiotics for the same condition.*” (ICN5)

3) Inappropriate use in clinical practice

Antimicrobial resistance in Thailand was also related to inappropriate antibiotic use in clinical practice. The categories of lack of prescriber awareness and knowledge along with the influence of the pharmaceutical industry were major perceived components of inappropriate use in clinical practice. Lack of prescriber awareness was defined failing to consider the impact of inappropriate use when deciding to prescribe antibiotics; while lack of prescriber knowledge was defined as prescribers having insufficient knowledge of antibiotic prescribing. The influence of
the pharmaceutical industry on a doctor’s decision-making in relation to antibiotic prescribing was also noted. There was a pervasive sentiment from participants that “regulation of antibiotic use in Thai hospitals is not strict enough.” (D4)

3.1 Lack of prescriber awareness
In clinical practice, inappropriate use of antibiotics occurs because some doctors are not aware of the importance of AMR and not concerned about ensuring that they adhere to best-practice principles when they prescribe antibiotics. One of the participants stated that some doctors always prescribe antibiotics as a routine rather than when they are clinically indicated. They sometimes start antibiotics without obtaining a specimen to investigate whether there is an infective cause or whether the infection is caused by bacteria or viruses. Also when patients are admitted to the hospital to treat infection sometimes doctors start treatment with broad spectrum antibiotic without pre-laboratory tests for antimicrobial sensitivities.

“The main problem is doctors often prescribe antibiotics as a routine when people get a cold”. (N4)

“They [doctors] often treat patients who have the flu with a broad-spectrum antibiotic. This is especially a problem with doctors in some departments.” (N3)

“Moreover, a friend of mine at a community hospital told that when [she] sees patients who have flu come into the hospital, if doctors cannot think of anything, they firstly inject Ceftriaxone without the confirmation of a culture result. And they do not have a laboratory.” (ICN2)

3.2 Lack of prescriber knowledge
Inappropriate use of antibiotics in the clinical setting may also occur as a result of lack of prescriber knowledge and expertise in AMS and inappropriate use of antibiotics. One participant identified that this was a particular problem in surgical
units. The area of infection management has become more complex and doctors’ training does not prepare them to use best practice in antibiotic prescribing,

“*There are not many doctors who have knowledge about appropriate antibiotic prescribing*” (D4)

“*Doctors have poor knowledge about antibiotic prescribing, they often treat patients who have the flu with a broad-spectrum antibiotic. This is especially a problem with doctors in some departments*” (N3)

3.3 Influence of the pharmaceutical industry

Pharmaceutical companies can impact on doctors’ decisions in antibiotic prescribing. It was reported that it was common to see pharmaceutical sales representatives in Thai hospitals, and their main objective was to increase the purchase of medical products including antibiotics rather than providing prescribers with evidence-based, scientific information about their products. Some doctors may be unduly influenced by their sales pitch, which may influence their decision to prescribe a particular antibiotic as empirical treatment in routine clinical practice.

“I sometimes see doctors try new antibiotics when they are offered by pharmaceutical sales representatives.” (N5)

“Once, I heard a medical representative trying to convince a doctor to use broad-spectrum antibiotics. She said this antibiotic could kill [a wide range of organisms], covering both gram positive and negative bacteria and that this product could prevent and cure patients’ infections” (N3)

4) Poor implementation of infection prevention and control in Thailand

Lack of infection prevention and control (IPC) practice was raised as an important issue regarding AMR control. Spread of resistant organisms within healthcare and the environmental impact of antibiotic disposal were categorised by
participants as a potential cause of poorly implemented IPC policies in Thailand. A theme that emerged from the interviews was that IPC policies were not strict enough to prevent the spread of AMR across the organisation. Additionally, participants described that the lack of IPC policy in Thailand was considered to impact the spread of AMR to the environment. Important aspects of IPC policy were identified as: (i) the need for strict IPC policies across all health care providers including the residential aged care sector and (ii) stricter guidelines around the disposal of leftover antibiotics.

4.1 Spread of resistant organisms within healthcare

A number of participants perceived that most of the hospitals in Thailand do not have adequate IPC policies including residential aged care. It was identified that once patients got antibiotic-resistant infections in the hospital, that if the hospital had poor IPC policy and practices, then AMR could be rapidly disseminated across the health service. Participants reported that some hospitals including residential aged care facilities in Thailand do not have an IPC policy.

“We do not have good enough policy to control antimicrobial resistance for elderly people in residential aged care yet.” (D4)

4.2 Environmental impact of antibiotic disposal

Concerns about the environmental impact of antibiotic disposal were also expressed by participants. They believed that incorrect antibiotic disposal was another potential mechanism through which antibiotics entered the environment and increased the incidence of AMR throughout Thailand.

“Another cause is the inappropriate method of drug [antibiotics] disposal which impacts on the environment.” (D2)
4.2.3 Underlying causes of antimicrobial resistance in the study hospital

Attitudes and perceptions of organisational leaders regarding the main issues that contribute to antimicrobial resistance (AMR) in the study hospital emerged as four themes. These were: 1) complex patients with complex infections, 2) spread of infection within the study hospital and infection prevention control practice, 3) the barriers to good AMS, and 4) resources to develop an AMS program (Table 4.13).

Table 4.13 Underlying causes of antimicrobial resistance in the study hospital

<table>
<thead>
<tr>
<th>Themes</th>
<th>Subthemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Complex patients with complex infections</td>
<td>1.1 Complex patient cohort (multiple comorbidities and antimicrobial resistant organisms present on admission) 1.2 Microorganisms mutate and develop resistance during admission</td>
</tr>
<tr>
<td>2) Limitations of infection prevention control practices within the study hospital</td>
<td>2.1 Inadequate IPC 2.2 Poor knowledge of IPC practice at the bedside 2.3 Inadequate hospital infrastructure in particular, overcrowding decreases the effectiveness of IPC</td>
</tr>
<tr>
<td>3) There are barriers to good AMS</td>
<td>3.1 Lack of staff knowledge 3.2 Empirical antibiotic use 3.3 Lack of medical engagement in AMS. 3.4 Misconception around antibiotic use in junior nurses and patients 3.5 Undue influence of the pharmaceutical industry on prescribers</td>
</tr>
<tr>
<td>4) Inadequate resources to develop an AMS program</td>
<td>4.1 Lack of resources to support appropriate prescribing 4.2 Ineffective process to gain expert advice when prescribing antibiotics</td>
</tr>
</tbody>
</table>

1) Complex patients with complex infections

Health services in Thailand are classified into five levels. The study hospital is categorised as the highest-level of tertiary care, as it provides advanced healthcare services. Most patients who are treated in the hospital have complicated illnesses and this affects the volume of antibiotics used. Also a number of patients presenting to the study hospital already have AMR infection before admission, so during their
hospitalisation there is also the potential for microorganisms to mutate and develop resistance to antibiotics. The micro-ecology of the hospital also means that there is potential for horizontal transfer of AMR between different gram-negative microorganisms via sharing of resistance genes between species.

1.1 Complex patient cohorts (multiple comorbidities and antimicrobial resistant organisms present on admission)

Participants perceived that the study hospital provided complex treatments for a complex patient cohort. There were many patients admitted to the study hospital that already had AMR infections prior to admission that increased the organisations’ spending and use of antibiotics. As stated by participants,

“‘I’m not sure how much [monetary] value in total that the hospital uses on antimicrobial prescribing. But the ratio of using [expensive] antibiotics is quite high... the cost associated with carbapenam use in the study hospital is around 60 million baht per year [equivalent is US$1.7 million per annum].’” (D1)

“This is a university teaching hospital we treat patients with a lot of complications. More than 50 % of patients have AMR infection before being admitted to the hospital.” (N6)

1.2 Microorganisms mutate and develop resistance during admission

Study participants perceived the spread of resistance between microorganisms as a factor contributing to the problem of AMR. Once patients get infections, the organisms mutate and increase the risk of AMR. Participants described that although doctors treat an AMR infection with an appropriate antibiotic regimen, the microorganisms can mutate during treatment and develop more complex antimicrobial resistance patterns.
“The problem is due to patients who use antibiotics for a long time and eventually AMR occurs. That means that even though we use appropriate antibiotics the bacteria mutate and develop resistance.” (N3)

2) Limitations of infection prevention control practices within the study hospital

Participants identified inadequate IPC practice, and inadequate hospital infrastructure resulting in AMR transmission within the hospital. Participants explained that inappropriate IPC practice by healthcare providers and lay staff continued to be a problem in the hospital. Additionally, inadequate infrastructure and overcrowding in the hospital was perceived as an additional factor.

2.1 Inadequate infection prevention and control

Inadequate IPC practices such as poor hand hygiene or failure to use personal protective equipment (PPE) were identified as risks,

“...caused by medical personnel due to not washing hands.” (ICN2)

“... staff think that their heavy workloads justify cutting corners not wearing any protective equipment.” (ICN1)

“Since the hospital is a medical school we have rapid staff turnover. This means that new staff may not know about the policies about controlling the spread of infections.” (ICN6)

2.2 Poor knowledge of infection prevention and control practice at the bedside

Knowledge of appropriate infection prevention and control practices of doctors and nurses was perceived to contribute to the ease of AMR transmission in the hospital,
“For example, we teach nurses that caring for patients with antimicrobial resistant infection, they have to wear gloves and they do this. But after they take them off, they don’t wash their hands before putting on new gloves” (N1)

“Doctors are still not on the same page or have misconceptions about wearing protective equipment.” (ICN1)

2.3 Inadequate hospital infrastructure in particular overcrowding decrease the effectiveness of infection prevention and control

Inadequate hospital infrastructure was one of the major perceived problems for the ICN participants. The ICNs perceived that the structure of the hospital buildings were issues along with overcrowding of patients and staff in the clinical wards. These factors contribute to the ineffectiveness of IPC and spread of AMR within the hospital,

“ In medical wards, we have a space problem where patients are too close to each other and this is a risk for the spread of antimicrobial resistance.” (ICN1)

“... too many medical and nursing students in the ward make it difficult to control infection risk.” (ICN1)

“...we do not have enough separate rooms for patients with infections.” (ICN2)

3) There are barriers to good AMS

Barriers to good AMS were perceived to be one of the underlying causes of AMR in the study hospital. Issues related to prescribers such as knowledge of antibiotics, supervision of junior doctors and empirical antibiotic use were identified as obstacles to achieving sound use of antibiotics by prescribers. Misconceptions about antibiotic use were found in clinicians, junior nurses and patient participants in this study. Participants considered the influence of the pharmaceutical industry
and patients’ pressure for antibiotics as additional barriers to the development of good AMS in the study hospital.

3.1 Lack of staff knowledge

Participants explained that the study hospital was a medical school where interns, residents and other less-experienced medical staff were able to gain experience in treating patients with multi-drug resistant organisms. Participants perceived that patients were more likely to be treated with antibiotics inappropriately if there is poor supervision for junior doctors,

“Our hospital is a medical school. There are medical students who come here to study so, sometimes, it feels like this place is an antibiotic experiment. There are a lot of antibiotics used and, eventually, this causes antimicrobial resistance.” (SRN2)

As most of the junior medical staff had little clinical experience, they were less likely to withhold antibiotics until sensitivities and cultures were obtained and they did not always prescribe the most appropriate antibiotics for a given clinical presentation,

“Poor clinical judgment for example, even though the laboratory results show an infection with a gram negative cocci bacteria, they[prescriber] treat with meropenem.” (D2)

Participants also reported that some senior doctors prescribed antibiotics as routine treatment irrespective of whether the patient had an infection(s),

“In a ward, there is a doctor who is a professor and no matter what kind of wounds patients have, the doctor would prescribe Clindamycin and Ceftazidine as a routine. It is like an antibiotic formula which the doctor prescribes for his/her patients almost in every case.” (SRN1)"
3.2 Empirical antibiotic use

Empiric therapy was considered an underlying cause of AMR in the study hospital particularly from the perspectives of clinical nurse participants. Participants considered that starting broad-spectrum antibiotics before the specific bacterium causing an infection is known, was a cause of AMR,

“Doctors are another factor. Initially, they like to use broad-spectrum antibiotics and then when culture results come back, they will change to less strong antibiotics.” (SRN2)

“In some wards, if there are patients with fever after surgery, doctors would start with very strong antibiotics, such as, Ertapenem Carbapenem. Doctors can prescribe these antibiotics for 3 days, so they prefer to use them without waiting for the results of antibiotic sensitivity tests. Sometimes that particular bacteria is sensitive to first generation antibiotics but doctors have already used third generation antibiotics.” (JRN4)

Additionally, many prescribers, who are not ID specialists, treat patients with multi drug resistant infections without consulting with ID specialists,

“ Some surgeons like to treat infection themselves first. If they cannot treat it or a fever is not reducing, they would consult the ID doctors. By the time an ID doctor comes, the bacteria is already CRE (Carbapenem-Resistant Enterobacteriaceae) or VRE (Vancomycin-Resistant Enterococci).” (JRN4)

3.3 Lack of medical engagement in antimicrobial stewardship

Although there was a program to control antibiotic use in the study hospital, not all doctors thought that AMR was a serious problem. Participants described that some doctors prescribed antibiotics without considering whether there was a clinical need or research evidence to support their use. Some doctors believed in their own
prescribing decisions and did not change the prescription even when the pathology results for microscopy, culture and sensitivities were available.

“When their patients have fever they will start antibiotics before waiting for the culture results. Sometimes the culture shows that there is no infection, but they still continue the antibiotics for up to 7-10 days. If we did not mention this, they would continue the antibiotic order. Some doctors have very high self-confidence, they would not stop the antibiotics even we raised the issue with them. They say that they prefer to complete the antibiotic course.” (N2)

The size of the study hospital was a perceived contributing factor in the lack of widespread awareness of the importance of appropriate antibiotic prescribing because the size made it difficult to raise awareness of the issues across the hospital,

“We are in a transitional period for developing antibiotic use awareness. After trying to foster awareness for a while, some staff have started to realise that antibiotic resistance and use are a big problem. However because the hospital is quite big, it takes time to change the perceptions and attitudes of every staff members” (P2)

3.4 Misconceptions about antibiotic use in junior nurses and patients

Nurses who were less experienced in clinical practice mistakenly considered empirical antibiotic use as inappropriate treatment.

“When patients have a fever and doctors do a septic workup, doctors start prophylactic antibiotics straight away without the results [of sensitivity testing]. Once the result come in, doctors have to change antibiotics into stronger antibiotics because the old antibiotic was not sensitive to the bacteria. That means patients are given antibiotics unnecessarily and then becomes resistant to the antibiotic.” (JRN2)
Misconceptions about antibiotic use also occurred in patients where patients perceived that imported antibiotics were superior to cheaper generic brands,

“*I've had an experience with a high-class patient and his/her relatives. The patient asked for strong or imported antibiotics because he/she could afford the medical fee*” (SRN2)

### 4) Inadequate resources to develop antimicrobial stewardship programs

Another major concern raised by participants was the perceived lack of resources to develop and implement an AMS program in the study hospital. Participants identified lack of resources to support appropriate prescribing and ineffective processes to gain expert advice to support prescribing decision-making as critical barriers to decreasing the overuse of antibiotics in the study hospital.

#### 4.1 Lack of resources to support appropriate prescribing

Participants explained that the current AMS program in the study hospital was not able to drive consistent change in prescriber behaviour. For example, the hospital had no antibiotic prescribing guidelines and empiric antibiotic use was not able to be linked with laboratory data of antibiotic sensitivities. The lack of an effective laboratory reporting system and follow-up of pathology reports was also identified as problematic,

“I *am in doubt about the effectiveness of the reporting system in the pathology department.*” (P1)

Participants also raised the issue that there was no multidisciplinary team to monitor antibiotic use in the study hospital. Further, the service currently offered by clinical pharmacists was perceived to be inadequate as there were insufficient staff to monitor every ward and every antibiotic prescription in the hospital. It was suggested that more resources needed to be put into clinical pharmacy services to ensure that effective monitoring systems were in place.
“If we have a better cover of clinical pharmacists on the wards, this would help a lot in monitoring appropriate antibiotic use in the hospital.” (N5)

4.2 Ineffective processes to gain expert advice when prescribing antibiotics

The pharmaceutical department in the study hospital provides clinical pharmacists to monitor appropriate antibiotic use, however participants were questioning the effectiveness of the consultation process,

“We have clinical pharmacists who are specialists in antibiotic prescribing but there is no formal consultation process. I am also not sure if the consultations happen too late.” (P1)

4.3 Discussion

Two major findings emerged from the clinician survey, interviews and focus groups. First, all participants surveyed perceived AMR as a major problem, and that improved prescribing and use of antibiotics was important. Second, there were some differences between professions regarding AMR and AMS. Key themes that emerged from the organisational leader interviews and focus group discussion supported the findings of the staff survey. These findings are discussed in detail in the sections to follow.

4.3.1 Similarities in participants’ perceptions of antimicrobial resistance and antimicrobial stewardship

In this first section, similarities in participants’ perceptions of AMR, and participants’ attitudes and perceptions of AMS and antibiotic use in the study hospital are presented in the following section.

4.3.1.1 Participants’ perceptions of antimicrobial resistance

All participants surveyed perceived AMR as a major problem, particularly in hospitals, as indicated by a median score of 7.0 for survey items related to AMR globally, in Thai hospitals, and at the study hospital. Participants perceived that AMR
was less of a problem in community settings (median score=6). Similarly, the themes emerging from organisational leader interviews and focus groups with nurses supported that AMR was a substantial problem across all sectors of Thailand. Organisational leaders believed that the widespread availability of antimicrobials across all sectors of Thai life was one of the major drivers of AMR in Thailand. In contrast to the organisational leaders, although the nurses who participated in the focus groups recognised AMR as problem in Thailand, it appears that they were less concerned about AMR in Thailand overall and had specific concerns about AMR and IPC issues in the hospital. The perception that AMR was a major problem globally was reported in many other studies (Abbo et al., 2012; Abera et al., 2014a; Brinsley, Sinkowitz-Cochran, & Cardo, 2005c; Cotta et al., 2014; García et al., 2011b; Giblin et al., 2004b; Navarro-San Francisco et al., 2013; Sanchez et al., 2014; Thriemer et al., 2013b; Wood et al., 2013).

In this study, clinician survey participants, organisational leaders and focus group nurse participants all reported that AMR was a major problem for Thai hospitals and for the study hospital. The lack of regulatory control over the distribution of antimicrobials in Thailand and poor implementation of IPC practice were reported to be important drivers of AMR. Only a few studies, including another study from Thailand, have reported that participants perceived AMR as a major problem in their hospital (Chuenchom, Thamlikitkul, Chaiwarith, Deoisares, & Rattanaumpawan, 2016b; Navarro-San Francisco et al., 2013). Focus group participants reported that in their clinical practice they cared for complex patients who required long-term, combination antimicrobial treatment for their condition. If these patients developed antibiotic resistance it was possible that this resistance pattern could spread to other patients in the hospital. The concerns raised by clinicians in this study were in contrast to previous reports that found that although participants believe AMR is a major problem, they do not perceive that AMR is a problem that affects their practice at their hospital (Abera et al., 2014a; Brinsley et al., 2005c; Cotta et al., 2014; García et al., 2011b; Giblin et al., 2004c; Thriemer et al., 2013b; Wood et al., 2013). These findings are concerning as AMR is an increasing and serious quality and safety issue (Ventola, 2015). Further, AMR is one of the
biggest public health threats that requires cooperation across government sectors globally to prevent and control the spread of resistant infections (CDC, 2016; WHO, 2016a). Resolving AMR will be challenging if healthcare providers, often mistakenly, do not perceive that AMR is an issue in their hospital so are not willing to change their practice to address problems related to AMR. The themes emerging from the interviews in this study indicated that there was a greater awareness of the importance of AMR and its impact on clinical care amongst clinicians.

Many health professionals report being concerned about AMR as a major issue in healthcare however, they did not think it was an issue in their hospital. One possible reason for this disparity may be the different regulation of purchasing and use of antibiotics in different countries. Antibiotics are purchased over the counter in many countries across the world including Thailand (Apisarnthanarak, Tumpornchai, Tanawitt, & Mundy, 2008; Kagashe, Minzi, & Matowe, 2011; Morgan, Okeke, Laxminarayan, Perencevich, & Weisenberg, 2011b; Tomson & Sterky, 1986). Similarly, studies from Ethiopia and Peru where people can buy antibiotics without a prescription also showed that the most of participants agreed AMR is serious problem worldwide but less so in their own practice (Abera et al., 2014a; García et al., 2011a). These studies from countries where prescriptions are not required to buy antibiotics may explain participants’ perceptions that AMR is a problem originating from outside their hospital and from the broader community. Likewise, the results from the organisational leader interviews support the finding that it is the widespread availability of antimicrobials in all sectors of Thai life that is driving the emergence of AMR. The lack of antimicrobial regulation was viewed as creating a problem that was beyond the direct control of organisational leaders. The organisational leaders also raised the issue of widespread use of antibiotics in agriculture, which impacts on both the volume of antimicrobials entering the food chain and the dispersion of antimicrobials into the natural environment. Some organisational leaders also highlighted that inappropriate disposal of antimicrobials meant that these products could enter the waterways in Thailand and from there be dispersed throughout the environment.
In Thailand, antibiotics are easily bought over the counter at grocery stores or drug stores. Thai people commonly seek basic advice from the pharmacist at a drug store if they are feeling unwell (Khamsarn et al., 2016). The clinicians surveyed in this study reported that antibiotic use and patients’ buying over the counter antibiotics was a major influence on AMR (median=6). Additionally, interviews with organisational leaders and focus groups with nurses identified that poor consumer knowledge of when antibiotics should be used was also a contributor to AMR. Patient expectations that it is helpful to use antibiotics when they get a cold or other minor infection was also reported to increase antibiotic use in the community context. Also, there was the tendency for patients in the community not to complete a full course of antibiotic treatment further demonstrating that consumers in Thailand lacked the knowledge about how to use antibiotics in a therapeutic manner.

The majority of survey participants (88%) in this Thai study reported that caring for patients with antibiotic resistant infections was common, which may explain the perceptions of participants that AMR was a major issue in the study hospital. A perception that AMR was common is also supported by the themes that emerged from the focus groups with clinical nurses as they reported regularly caring for patients with AMR infections. Clinical nurses perceived that AMR was a major problem at the study site and that overcrowding in the clinical areas and inadequate infrastructure to support IPC best practice was contributing to the spread of AMR within the hospital. However, the perceptions of AMR, as a major problem in hospitals and as an issue when caring for patients with antibiotic resistant infection were not the same in all studies. An Australian study showed that although 84% of the participants reported they cared for patients with antibiotic resistance, only 45% of them reported AMR as a major problem in their hospital (Cotta et al., 2014).

4.3.1.2 Participants’ attitudes and perceptions of antimicrobial stewardship and antibiotic use in the study hospital

Inappropriate antibiotic prescribing was identified as a significant barrier to achieving best practice in AMS. Participants perceived that lack of prescriber
knowledge was a major contributing factor to inappropriate antibiotic use in the study hospital. Participants considered that they needed to improve their supervision of junior doctors’ prescribing of antimicrobials. Organisational leaders mentioned that the pharmaceutical industry had too much influence over junior staff prescribing behaviour and that more resources were needed to raise awareness of AMS and appropriate prescribing practice across the study hospital.

The majority of survey participants in this study agreed that systems for improving antibiotic prescribing were important to reduce the occurrence of AMR and should be a hospital priority (median score=6). All participants surveyed perceived that systems to improve decisions related to antibiotic use would be useful, as indicated by a median score of 6 for survey items related to local antibiotic guidelines. They indicated that a computer application to guide antibiotic prescribing and an AMS team to give antibiotic advice and feedback would be vital. The notion of decision support for antibiotic prescribing as a useful strategy to decrease AMR and improve antibiotic use was also supported in the organisational leader interviews who also highlighted the lack of resources to develop and implement an AMS program.

Many other studies also report that systems to improve antibiotic prescribing would be clinically useful to ensure the optimal prescribing and use of antibiotics (Abbo et al., 2012; Abbo et al., 2013c; Bannan et al., 2009; Cotta et al., 2014; García et al., 2011a; Giblin et al., 2004a; Itokazu et al., 2006a; Navarro-San Francisco et al., 2013; Pawluk et al., 2014; Steinberg et al., 2014; Wood et al., 2013), and that would in turn, support AMS programs to decrease inappropriate antibiotic use, reduce healthcare costs, decrease the occurrence of AMR, and minimise adverse drug events, all of which improve patient care (Buising et al., 2008c; Dellit et al., 2007; Lin et al., 2013b; Raymond et al., 2001). Therefore, the strategies and systems that promote appropriate antibiotic use or AMS programs have been set as a worldwide agenda (WHO, 2016a). In 2011, WHO launched the WHO global strategy on containment of antimicrobial resistance campaign to empower every country in the world to respond to the AMR problem (Leung et al., 2011).
In many countries, systems for improvement antibiotic prescribing have been initiated as a national agenda. For example, in Australia, the AMS strategy in hospitals is one of the compulsory criteria for approval of hospital accreditation (Duguid & Cruickshank, 2011). In USA, the Infectious Disease Society of America (IDSA) published guidelines for improving the use of antimicrobial agents in the hospital as far back as 1988. Recently in 2016, the National Action Plan for Combating Antibiotic Resistant Bacteria has been approved in the National Action Plan in the USA (CDC, 2016). In England, the Department of Health has launched activities to support AMS and the AMS guideline is updated regularly. Antimicrobial Stewardship Toolkit for English Hospitals was the latest AMS guideline to be published by Public Health England (PHE) (PHE, 2015). All of the above strategies demonstrate that many countries across the world have responded to the emergence of AMR as a major issue. An AMS strategy is effective in improving the appropriateness of antimicrobial use.

4.3.2 Differences in participants’ perceptions of antimicrobial resistance and antimicrobial stewardship

Nurses had a different perception of community issues and AMR than doctors and pharmacists. Nurses (median =5) were less likely than doctors and pharmacists to agree that AMR was a serious problem in the Thai community, and antibiotic use in community contributed to AMR at the study hospital (median = 6) \( (p<0.001) \). One possible explanation for this finding was that the nurses surveyed in this study were hospital-based nurses who rarely worked in community settings therefore their knowledge of AMR issues in the community may be poor. Although both nurses and doctors take a health history that includes antibiotic use in the community, doctors have the responsibility for prescribing so are more likely than nurses to have to considered antibiotic use in the community in their decision making. Doctors also consult pharmacists for advice regarding antibiotic prescription so pharmacists may also have a deeper understanding than nurses of the consequences of antibiotic use in the community than nurses. The finding that nurses were less concerned than doctors and pharmacists about AMR in the
community is similar to the results of an Australian study. This study showed that nurses, doctors and pharmacists believed that antibiotic use in the Australian community contributed to AMR at their hospital by 38%, 57% and 70% respectively (Cotta et al., 2014).

In this Thai study, nurses (89%) were more likely than pharmacists (60%) to report being involved in the care of patients with antibiotic resistance. This was confirmed by emerging themes from the focus group discussion that clinical nurses were more concerned about preventing the spread of infection within the study hospital and a lack of consistent IPC practice in the clinical setting. Therefore, this was an important consideration when providing education to nurses about antibiotic use in community and their consequences because nurses have a major role in antibiotic management during patient hospitalisation and patient education about antibiotics before discharge from the hospital (Aziz, 2013; Ladenheim et al., 2013b; Storr, 2012).

Despite doctors agreeing that guidelines and protocols to support antibiotic prescribing would be useful, doctors (median = 5) were significantly less likely than nurses and pharmacists (median = 6) to agree with any interventions that limited prescribing and prescribing decisions ($p<0.001$). These findings were supported by the organisational leader interviews and nurse focus groups, both of which highlighted the lack of medical engagement in AMS. These results showed that although the study hospital had a program to control the use of some antibiotics, not all doctors took the issue seriously. Some prescribers had their own beliefs and lack awareness when prescribing antibiotics even though those antibiotics were not identified as sensitive to the pathology results for microscopy, culture and sensitivities. The finding that doctors do not support interventions that limit prescribing have also been reflected in other studies (Cotta et al., 2014; Wester et al., 2002). Additionally, there may be cultural factors that may have influenced these results. Doctors have a high status in Thailand so are well respected and rarely challenged. The findings from the organisational leader interviews support that in
Thailand doctors have too much power, and that they are unable to accept expert advice as they view this as interfering with their professional autonomy. Therefore, implementing and enforcing programs restricting prescribing behaviour would be challenging in Thailand, particularly if AMS initiatives were not supported by medical staff.

Pharmacists seemed to have a higher focus on system improvements than doctors and nurses. Pharmacists were more likely to agree with policies related to AMS programs than doctors and nurses as indicated by median rank of 6 for the survey items regarding limitation of antibiotic prescribing, computer applications to guide antibiotic selection and an AMS team to provide antibiotic advice and feedback \( P<0.001 \). Almost half of pharmacists reported that they have heard of AMS terminology (49%) and worked in healthcare facilities with AMS programs (46%). However, only 20% of doctors and 11% of nurses knew about AMS as a specific term. Other studies from Australia have also shown that pharmacists are more engaged with AMS systems than doctors and nurses (Cotta et al., 2014). One possible reason for this difference in pharmacists’ perceptions of systems to improve AMS may be because pharmacists have more of an overview of the whole hospital whereas doctors and nurses only know the patients and practices on their wards. In the study hospital, it is general practice for pharmacists to work throughout the whole hospital where nurses typically only work in one ward and doctors may visit two or three wards. It is probable that these working conditions of pharmacists, doctors and nurses are similar in other countries.

4.4 Chapter summary

This is the first results chapter addressing perceptions and attitudes towards AMS among clinicians. The staff survey, which was based on a survey used in an Australian study (Cotta et al., 2014), semi-structured interviews with organisational leaders and focus groups with nurses were used to explore the perceptions and attitudes towards AMS among clinicians in acute healthcare in Thailand. The major findings were that all participants surveyed, interviewed or who participated in focus
groups perceived AMR as a major problem and that improved prescribing and use of antibiotics was important. Further, there were differences between professions regarding AMR and AMS. The study findings also highlighted barriers and facilitators to effective AMS programs in the study hospital.

The findings of the qualitative data analyses of the current clinical governance structure related to AMS in the study site is presented in Chapter 5.
Chapter 5
Clinical Governance and Antimicrobial Stewardship

In this chapter, the analyses of the organisational leaders’ interview and nurse focus group data related to current clinical governance structures and activities for AMS in the case study hospital are presented in three major sections. In the first section is a contextual description of the clinical governance structure and AMS activities in the case study hospital as described by the organisational leaders as key informants. The Core Elements of Hospital AMS Programs, Centers for Disease Control and Prevention (CDC) recommendations provided the framework for the interviews, analysis and interpretation. In the second section, findings of the analyses of the perceived strengths and weaknesses of clinical governance and AMS activities among organisational leaders, clinical nurses and infection control nurses (ICNs) are presented. The significance of the findings is discussed in relation to the CDC guidelines and the international literature in the final section of the chapter.

Aim and objectives

The analyses presented in this Chapter address the second specific aim of this research program, that was to identify strengths and weaknesses of AMS clinical governance structures and activities as perceived by key organisational leaders and nurses working in acute healthcare in Thailand. The specific objectives related to this aim were to:

I. Describe the current clinical governance structure and AMS activities in the case hospital based on hospital documentation and organisational leaders as key informants.

II. Explore perceptions of the strengths and weaknesses of the current clinical governance structures and activities related to AMS among organisational leaders, clinical nurses and infection control nurses.
5.1 Methods

The methodological approach for this research program is described in detail in Chapter 3. Data used in the analyses to address the second aim of the research and the related objectives, were collected in Phases 2 and 4. Semi-structured interviews were used to explore the current clinical governance structure and AMS activities and identify gaps in best practice by analysing activities in relation to the CDC recommendations. These interviews were conducted with organisational leaders. Exploration of the perceived strengths and weakness of AMS governance structures in the case study hospital, involved the analysis of data derived from both organisational leaders and nurse focus groups. The Core Elements of Hospital Antibiotic Stewardship Programs of the CDC were used to frame the semi-structured interview question and prompt guide. Refer to Appendix A for the full interview guide. The topics included: leadership support; accountability and drug expertise; interventions to support optimal antimicrobial use; tracking and reporting antimicrobial prescribing; use and resistance; and education.

Organisational leaders as defined in Chapter 3 were interviewed to explore current clinical governance structures and AMS activities at the case hospital. Content analyses of the interview transcripts allowed extraction of content to complement documentation derived from the hospital website relating to its governance structure and are presented in Section 5.2. In Section 5.3, the findings of the thematic analyses of organisational leaders’ and clinicians’ perceptions of the strengths and weaknesses of the current clinical governance structures are presented.

5.2 The clinical governance structure and AMS activities in the case study Hospital

This analysis of the current clinical governance structure was informed and framed by the Core Elements of Hospital AMS programs based on the CDC recommendations (CDC, 2014). This section is presented as follows i) leadership commitment; ii) accountability and drug expertise; iii) current AMS interventions to
support optimal antibiotic use; iv) tracking and reporting antibiotic use and outcomes and, v) staff education and training regarding AMR and AMS.

5.2.1 Leadership Commitment

Leadership support is a significant element for successful AMS programs. Clear reporting lines and links in accountability between the AMS team, the hospital executives, director of clinical governance, drug and therapeutics committee and IPC committee is a strong recommendation in international AMS practice guidelines (Duguid & Cruickshank, 2011; Nathwani, 2006). The AMS governance structure in the case hospital is presented in Figure 5.1; the key committees that have involvement in AMS are highlighted. Governance related to AMS occurs within the operational area of Healthcare Process. The IPC Committee and the Pharmacy and Therapeutics Committee are the two major committees that operate and support the AMS program. The Pharmacy and Therapeutics Committee is the main hospital committee that monitors overall medication distribution and use across the hospital including antimicrobial prescribing, whereas the IPC committee oversees the policies and activities relating to infection prevention and control and hospital acquired infections.

The Antibiotics and Vaccines Working Group (AVWG), which reports to the Pharmaceutical Oversight Subcommittee, and the Rational Drug Use Subcommittee (RDUSC), are the main two groups that work in the oversight of antibiotic prescribing policies and AMS activities across the hospital. These two groups report to the Pharmacy and Therapeutics Committee. For inpatient departments, the AVWG has a role in making recommendations about which antibiotics should be available as standard antibiotics on hospital ward imprest lists. This working group also develops policies for prescribing and monitoring the use of specific antibiotics such as the carbapenems. Additionally, the AVWG has the role of setting up the criteria for determining which prescribers are authorised to prescribe specific restricted antibiotics. For outpatient departments, the RDUSC operates the Antibiotics Smart Use (ASU) program that follows the recommendations of The National Strategic Plan
on Antimicrobial Resistance (WHO, 2016b). This program promotes appropriate antibiotic use for upper respiratory tract infections (URTI) and diarrhoea.

The Pharmacy and Therapeutics Committee and the IPC committee work cooperatively to support AMS activities and monitor the outcomes of antibiotic use across the hospital. Both these committees report to the Healthcare Service Committee, which is directed by the Faculty Executive Committee. It was noted that the IPC, the AVWG and the RDUSC currently have the same chairperson who is an infectious disease (ID) specialist with an interest in AMS and IPC.

The AMS recommendations of the CDC identify the need for organisations to facilitate a formal or written policy to support improvements in antibiotic use. Also, AMS leadership commitment needs to include dedicating the necessary human, financial and information technology resources to support AMS activities. In the case hospital, the major hospital quality and safety policy known as Patient Safety Goals that includes the surgical safety checklist, medication reconciliation, emergency response (early warning signs) and infection control (hand hygiene), was promoted in 2015. At the time of data collection for this study, the organisational leaders interviewed stated that a formal policy or statement about AMS was not included as a primary strategy to promote patient safety in the hospital.

The CDC guidelines recommend that hospital leaders should include stewardship-related duties in clinicians’ job descriptions and that staff should be given sufficient time within their workload to support AMS activities. Organisational leaders identified the ID specialist who currently chairs the IPC and noted his commitment to controlling AMR in the hospital. All participants acknowledged that he was recognised as the key individual who had initiated AMS programs within the case hospital. This ID specialist was also a clinical champion for AMS. However, the current AMS team did not have multidisciplinary representatives and it was identified by the participants that there was insufficient executive level support in terms of financial and information technology resources.
“There is no additional compensation and staff. They [the hospital executive] do not allocate pharmacists or nurses specifically to be part of the team. It is not an ideal AMS team right now. At the moment, we ask each department for help but they already have their own duties. It’s not a system like other countries that has a full-time job for AMS team members.” (D1)

“I found that only Dr. [name] has been taking action in this program (AMS programs). I have not seen other teams or staff support him properly. Dr. [name] has been trying to encourage the pharmacist team and pediatric ID specialist team to participate in the AMS team.” (P2)
Figure 5.1 The AMS governance structure in the study hospital

*Com is Committee; SC is Subcommittee; WG is working group
5.2.2 Accountability and drug expertise

Multidisciplinary engagement is a significant element of AMS programs (CDC, 2017a; Dellit et al., 2007; Duguid & Cruickshank, 2011; Nathwani, 2006). The AMS guidelines suggest that a single leader who is responsible for AMS outcomes needs to be identified. At the case hospital, an ID physician has been recognised as providing effective leadership for the AMS program and a pharmacy leader was also identified by organisational leaders as a co-lead for the program. Additionally, the CDC recommends that key members of the multidisciplinary team are part of the AMS leadership team. Key disciplines that should be represented include: clinicians and department heads, infection prevention leads and hospital epidemiologists, quality improvement staff, laboratory staff, information technology staff and clinical nurses. According to the CDC guidelines, multidisciplinary team membership enhances the effectiveness of AMS programs and initiatives (CDC, 2014).

The organisational leaders in this study identified the role of the key role of the AVWG and RDUSC in facilitating AMS activities and programs. The AVWG membership was identified as functioning as the main AMS team in the organisation. In terms of membership of the AVWG, the main members included ID specialists, surgeons and a clinical pharmacist. The leader participants identified the ID specialist who chairs the AVWG, the RDUSC and the IPC committee, as the AMS program leader and the clinical pharmacist as having a role in providing drug expertise and as the appointed pharmacy leader in AMS. These two individuals are both members of the AVWG. However other key groups in the hospital, which the CDC recommends are represented on the AMS committee to support the work of stewardship program leaders, are not currently part of the membership of the AVWG.

5.2.3 Current AMS interventions to support optimal antibiotic use

According to the CDC, organisations should initiate policies to support optimal antibiotic use and then undertake activities to implement their AMS policies into clinical practice. AMS strategies are categorised into the three major groups: broad interventions, pharmacy-driven interventions and infection related or syndrome-specific interventions. Additionally, an organisation should choose AMS interventions, based on specific local
hospital requirements and the availability of local resources to support their implementation (CDC, 2014).

Organisational leaders reported that the AVWG and the RDUSC were the two main subcommittees responsible for AMS polices and activities in the case hospital. Current interventions to improve antibiotic use are described under the three major categories below:

5.2.3.1 Broad-based interventions

The AVWG had implemented two broad-based AMS interventions by controlling the prescribing and use of specific antibiotics. The use of broad-spectrum beta-lactam antibiotics such as carbapenems was controlled in the hospital using a computerised software program. This formulary restriction intervention operates by requiring prescribers to obtain pre-authorisation to continue treatment with this class of antibiotics. The computer program allows doctors to prescribe carbapenem for the first three days of treatment; once this time period has elapsed if doctors continue to use carbapenems they are required to obtain additional authority from the hospital ID specialists and confirm that there is an appropriate clinical indication based upon patients’ diagnosis and microbiology results. The pharmacist participants described that this system to control antibiotic prescribing was initiated by the members of the AVWG who considered which antimicrobials were available for prescription within the hospital and any restrictions associated with their use. These restrictions include criteria for which prescribers had the authority to prescribe which agents, and the duration of treatment allowed without further expert review.

Another vital strategy to control antibiotic prescribing was the rationalisation of the antibiotics available for use at hospital. Doctor and nurse participants in the organisational leader group reported this strategy impacted on the available antibiotic lists in the hospital and each specific clinical area. A doctor participant reported removal of a number of outdated or unbeneﬁcial antibiotics from the formulary stocked in the hospital pharmacy department.
5.2.3.2 Pharmacy-driven interventions

Pharmacist participants identified the role of clinical pharmacists in monitoring the occurrence of errors in antibiotic use and providing advice about dose optimisation to prescribers. One of the major roles of clinical pharmacists is the responsibility for Therapeutic Drug Monitoring (TDM), to ensure dose-adjustment and dose-optimisation is instigated for patients who are prescribed specific antibiotics such as Vancomycin.

5.2.3.3 Syndrome-specific measures

More recently a syndrome specific intervention program had been commenced in the outpatient department (OPD) by the RDUSC. This interventional called ‘Antibiotic Smart Use’ (ASU) was implemented for specific indications. The ASU program was designed to encourage greater awareness by doctors of appropriate antibiotic prescribing for patients attending the OPD by providing them with evidence-based treatment guidelines. The first two conditions that the ASU program had focused on were appropriate antibiotic use for Upper Respiratory Tract Infection (URTI) and diarrhoea.

Additional AMS interventions to support optimal antibiotic use in the hospital included the provision of software programs for decision support and access to experts for consultation about complex cases. The hospital provided resources for prescribers to support decision making in antibiotic prescribing. The participants reported that there was a software application (available for smart phone and android devices) that provided detailed local antibiogram information for prescriber decision support. The software application provided data to support prescribers at the hospital to choose antibiotics that were targeted according to the sensitivities of the infecting pathogens. A nurse participant from organisational leader group reported that the application was convenient to use because it could be downloaded into doctors’ smartphone, which encouraged doctors to use the information more often than was previously the case when this data were only available as hard copies.

A system to support prescribers in accessing specialist expertise was reported as a resource for better antibiotic prescribing in the hospital. The consultation system included ID specialists and clinical pharmacists who could provide advice in regards to optimal
antibiotic use for complex clinical cases. The ID specialist system was reported to increase access to expertise by the doctor and ICN participants. A doctor participant noted that this system was useful in providing advice when the antibiotic dose for patients with comorbidities needed to be adjusted.

One nurse leader discussed the strategy of making antibiotics less accessible in the operation rooms. Previously for the convenience of the surgeons, the common antibiotics used for surgical prophylaxis were stocked in the operating room. After the hospital had launched its ASU policy, the nurse manager applied this policy by not stocking routine antibiotics in the operation room, thereby making antibiotics less accessible. The nurse manager hoped that staff would think more carefully about their use and consciously plan for what antibiotics were required for surgical prophylaxis prior to commencement of the procedure. By requiring conscious planning and decision making, the nurse manager hoped to decrease routine antibiotic use.

A small number of participants spoke about best AMS practice in regards to controlling antiviral medication prescribing. Strict governance and clear processes for the implementation of policies around the use of antiviral medications was identified as a key element to achieving this goal. A virologist participant described that in Thailand, the national anti-viral medication guidelines had been made available to clinicians along with strict national policies about their use. Antiviral prescribing (HIV, influenza) is overseen by ID physicians although all doctors are eligible to prescribe them and are encouraged to consult ID physicians in cases of advanced viral infections. The clear processes about how antiviral national guidelines policies should be applied in practice had already seen improvements in the behaviours and caution of prescribers about the use of antiviral medications in the hospital.

5.2.4 Tracking and reporting antibiotic use and outcomes

Monitoring antibiotic prescribing and use, as well as tracking local patterns of antibiotic resistance, combined with providing timely data feedback to staff are suggested as key to improving antibiotic use and decreasing resistance in organisations (CDC, 2014).
The participants identified the systems available in the hospital to track and report antibiotic use and outcomes.

5.2.4.1 Tracking and reporting antibiotic use

The two main AMS committees, RDUSC and AVWG, supported by the IT division were responsible for tracking and reporting antibiotic use across the hospital. For the outpatient department, the RDUSC monitors the volume of antibiotic use in each department. When the overall antibiotics used by a particular department or specialist group is high, the RDUSC investigates and provides feedback to that department or specialist group to improve their antibiotic prescribing choices. For example, this committee might provide feedback to the surgical team about appropriate surgical antibiotic prophylaxis in terms of antibiotic choice, timing and duration of therapy. At the same time, the RDUSC has a role in tracking antibiotic prescribing for gastrointestinal and upper respiratory tract infections in the outpatient department.

The AVWG specifically monitors carbapenem use in all departments and provides feedback to prescribers. The pharmacist participants reported that the data of antibiotic use such as volume and purchasing are available on the hospital intranet system and that department heads and individuals can access the data via this site. The RDUSC and AVWG monitor these reports and report data on antimicrobial prescribing and consumption to the Pharmacy and Therapeutics committee. Although the data about antibiotic use is available on the hospital intranet system, these data are not reported directly to frontline staff such as nurses and doctors working in the clinical areas. Clinical staff do not therefore receive data relating specifically to their department or the hospital volumes as timely or ongoing feedback about their prescribing choices.

5.2.4.2 Tracking and reporting antibiotic resistant infection and treatment outcomes

Infection control nurses based in the IPC Department cooperate with the IT Division and Microbiology Department to monitor the incidence of antibiotic resistant bacteria such as methicillin-resistant Staphylococcus aureus (MRSA), carbapenem-resistant Enterobacteriaceae (CRE), vancomycin-resistant enterococci (VRE), and C. difficile across the hospital. The occurrence of patients with antibiotic resistant infections are reported to the
clinical nurses who work on the ward so that the frontline nursing staff can implement appropriate IPC measures in a timely manner. ICNs who are all members of the IPC committee develop a three monthly report for the committee, for each clinical area summarising the number and type of patients admitted with resistant infections. The IPC committee then reports this data to the Healthcare Service committee and the Faculty Executive Committee (the hospital board).

At the same time, when staff working in the hospital wards are informed by the Microbiology Department about a new patient who has tested positive for high alert multi-drug resistance organisms (for example VRE or CRE), nursing staff will notify the ICNs and ID specialists, who have the role to investigate and develop procedures to minimise the spread of the identified AMR infections. Additionally, these data are reported to the IPC Committee to facilitate communication of this data to the clinical team leaders on the wards and department heads so that strict IPC policies and procedures are implemented across the organisation.

5.2.5 Staff education regarding antimicrobial resistance and antimicrobial stewardship

Organisations have a responsibility to provide clinical updates and education on topics such as antibiotic prescribing, AMR, and infectious disease management to all healthcare professionals (CDC, 2014). According to participants, the case study hospital provides training courses regarding AMR and IPC practice to healthcare staff routinely and when an outbreak occurs.

5.2.5.1 Education for doctors in the case hospital

For doctors, participants identified training courses to treat infectious diseases in both the undergraduate course and in postgraduate training sessions. However, one participant noted, “...doctors are trained in terms of diseases and their treatment but not in terms of stewardship (D1)”. There was a shared perception that doctors tend to focus on the individual patient and their treatment needs rather than looking at optimal antibiotic use across the hospital as a whole.
At the case hospital, the undergraduate medical curriculum includes subjects in microbiology and infectious diseases and the topic of Rational Drug Use (RDU) has been added recently. In relation to on the job training, participants explained that resident medical officers received additional training about the treatment of common infectious diseases seen in the hospital. As stated by a surgeon participant,

“For doctors, the basic science of infectious diseases and the use of antibiotics is already a topic in the curriculum and it is part of the surgical trainees’ specialty education program. Residents must learn and pass an exam [on this topic]. And of course, surgeons must have basic knowledge about antibiotics and what should be used with which infections.” (D2)

The chair of the IPC committee was mentioned as an educator who had conducted sessions about prophylactic antibiotics for surgical residents along with organising additional training when there is an outbreak in the hospital.

5.2.5.2 Education for nurses in the case hospital

Nurse leaders reported that the training courses for nurses are provided regularly by infection control nurses on a twice yearly basis. Topics regarding AMR and IPC practice such as hand hygiene, isolation precautions and personal protective equipment (PPE) are provided for nurses and nurse assistants and particularly target nurses who are working in the intensive care unit (ICU). The IPC department that includes ID specialists and infection control nurses run these training sessions. Additional training sessions occur when the rate of antibiotic resistance is high as an alert to staff of the problem. As stated by one participant, “...Once there is an outbreak, the ID doctor will communicate with the executive nurses to pass the information on to their subordinates. His action is quite timely.” (N2).

In relation to AMS and antibiotic use, participants reported that the hospital had not provided any specific education sessions for ward nurses, however education about AMS and antibiotic use was offered to students undertaking a specialty-training course in infection control. As part of this specialty course, ID specialists are invited to speak about AMR and AMS. Participants discussed that the concept of AMS had been mentioned in the
general hospital training for nurses when a speaker introduced a topic providing background information about the occurrence of AMR, its prevention and patient outcomes.

“According to the concept of AMS, students who undertake a 4-months specialty-training course in infection control are provided the concept of AMS when a speaker (an ID specialist) talks about the problem of AMR.” (N3)

5.2.5.3 Education for pharmacists in the case hospital

According to pharmacist leaders, training sessions are regularly provided for pharmacists but are not focused on best practice in antibiotic use. The need for pharmacists to have current knowledge of the vast range of medicines prescribed across the hospital, emphasis on antibiotic use and the problem of AMR to the exclusion of other clinically important topics was not considered feasible. As one participant stated, “...The training for pharmacists [about AMS] is not a priority.” (D1). One or two hospital pharmacists a year however, are able to participate in continuing education opportunities. For example, a program named ‘The Communities of Practice’, organised by the Association of Hospital Pharmacy (Thailand) and the Infectious Diseases Association of Thailand that focuses on antibiotic use, antimicrobial resistance and pharmacology is available.

5.2.6 Section summary

Current AMS activities at the study hospital are reported to the executive leadership group through the clinical governance structure that has been established to oversee medication use overall at the study hospital. Based on the findings from the organisational leaders, development of a clinical governance structure, and organisational policies specific to AMS were not yet developed at the study hospital. This is discussed in more detail in the following section.

A wide range of AMS related activities were being run at the study hospital, these included: broad-based restrictive interventions such as the carbapenem control program, syndrome-specific interventions such as the ASU campaign, and projects to facilitate prescriber decision making by providing access to infectious diseases specialist consultations and decision-support applications being made available on mobile phones. The organisational leaders reported that antibiotic use, and the incidence of AMR infections
were tracked and there were processes in place to report this information to the hospital executive committee and to individual prescribers. In addition, AMS and AMR training were reported as being provided for healthcare staff.

The organisational leaders identified that there are specific AMS initiatives that address each of the core elements of AMS recommended by the CDC. These findings demonstrate that there is organisational support for the development of a hospital-wide AMS program at the study hospital. Despite these positive reports, the organisational leaders and clinical nurses interviewed in the focus groups reported that there were limitations around the extent to which these initiatives had become fully operational and had been embedded into clinical practice at the bedside.

In the next section, an exploration of strengths and weaknesses in the current AMS clinical governance structure and activities as identified by organisational leader interviews and the clinical ward nurse and ICN focus groups are described.

5.3 Perceived strengths and weakness of current clinical governance in the case hospital

Organisational leaders and nurses were asked to consider the strengths and weaknesses of current clinical governance related to AMS within the case hospital. The interviews and focus groups revealed four themes related to the level of leadership commitment to AMS: (1) executive seen to endorse but not support AMS activities; (2) lack of AMS policy and resources to optimise antibiotic prescribing, tracking and reporting; (3) lack of multidisciplinary engagement in the AMS team; and (4) that knowledge was acquired through experience not education [Table 5.1].

1) Executive seen to endorse but not support AMS activities

One of the barriers identified by the organisational leaders to developing and implementing a sustainable AMS program was the hospital executive group were seen to endorse having an AMS program at the study hospital, but did not provide additional support for program development. Sub-themes related to this major theme were that (i) authority was delegated to clinical leaders but the hospital executive were not actively engaged in promoting AMS across the organisation, (ii) the AMS clinical champion acts as
lobbyist to obtain executive support and (iii) in contrast, IPC activities are seen as core hospital business.

1.1 Authority delegated to clinical leaders but executive not actively engaged

There were mixed perceptions about executive support for AMS projects. In general, all of the key organisational leaders, clinical nurses and ICNs groups perceived that hospital administrators had endorsed the introduction of the AMS program at the case hospital. As participants in the organisational leader interviews and clinical nurse group identified, a number of useful AMS activities had been established and endorsed by the hospital executive such as the Antibiotic Smart Use (ASU) project and the program to control carbapenem prescribing [Table 5.1, Q1, Q2]. One doctor noted that senior executives were concerned about antibiotic prescribing within the hospital, and they had given the authority to the ID doctors to resolve this problem [Table 5.1, Q3]. Despite this, there was a perception that the senior executives at the study hospital were not fully supportive of the AMS program and did not provide additional financial resources to support the development of the program. One doctor participant described that senior executives did not consider all the details of AMS activities [Table 5.1, Q4] and another identified that there was no additional compensation for staff to be involved in the AMS team or activities. The organisational leaders reported that executive level support for AMS activities appeared to be intermittent, and that this was challenging when intending to embed a sustainable program of AMS activities into clinical care [Table 5.1, Q5, Q6].

1.2 Central clinical champion acts as a lobbyist

One of the perceived strengths of the AMS program was that there was a highly visible clinical champion who was the chair of the AVWG, the RDUSC and the IPC committees. This provided strong clinical leadership and continuity to AMS activities across the study hospital. The organisational leaders and nurse participants in the ICN focus group identified how the proactive actions taken by this clinical leader had raised the profile of AMS at an executive level. For example, he had convinced the hospital executive committee that AMR and AMS are major problems in the hospital and that steps should be taken to address these issues [Table 5.1, Q7, Q8]. Similarly, a doctor participant in the key
organisational leader group agreed that the IPC chairman performed effectively by both promoting and championing the implementation of an AMS program. Despite this it was acknowledged that the level of support from the hospital executive committee was intermittent [Table 5.1, Q6].

1.3 IPC activities are part of core business

In contrast to the intermittent support provide for the AMS programs the organisational leaders recognised that there was strong executive level support for IPC activities and that these activities were seen to be part of core hospital business [Table 5.1, Q9]. The doctor and nurse participants perceived that the hospital executive committee provided high level support for projects to improve IPC practice such as providing support to the hand hygiene project, which cost a lot of money to maintain [Table 5.1, Q9- Q10]. Furthermore, when there were outbreaks of the multidrug resistant organism in the hospital, a nurse leader reported, that the senior executives of the hospital completely supported any IPC initiatives or actions taken by ICN team (Table 5.1, Q11). It appears that this finding may reflect the fact that AMS is a relatively new concept in contrast to IPC which is recognised standard for high quality care.

2) Lack of AMS policies and resources to optimise, track, and enforce good antimicrobial prescribing practice.

The second major theme identified that there was a lack of formal AMS policies and resources to optimise, track and enforce good antimicrobial prescribing practice. Sub-themes relating to this major theme were that on the one hand prescribers reported that there were (2.1) no local antibiotic prescribing guidelines and (2.2) the currently IT infrastructure at the study hospital was inadequate so they had limited access to resources to support good prescribing practice. On the other hand as there were gaps in the current tracking and reporting of antimicrobial prescribing across the hospital, prescribers were not accountable for their decisions.

2.1 No formal AMS policy and antibiotic guidelines

Organisational leaders and clinical nurses perceived that an important barrier to effective implementation of AMS programs was the lack of formal AMS policies and
antibiotic guidelines. Although most of the study participants recognised that the IPC chairperson was a strong champion of AMS as this was the only individual promoting this issue, it was thought that AMS initiatives had not penetrated into all aspects of clinical care provision. A pharmacist participant explained that the lack of a formal policy was a barrier to continuing and embedding AMS activities into clinical care across the organisation [Table 5.1, Q12]. Similarly, a junior nurse participant who worked in a clinical role reported that although the hospital leadership team was trying to raise awareness of appropriate antibiotic use, the practicality of how to implement AMS in practice, was unclear to frontline staff [Table 5.1, Q14].

Additionally, the lack of antibiotic guidelines developed specifically for the Thai context was considered to be an important deficit in the resources available to support the successful implementation of AMS policy. Doctor participants in the organisational leader group reported that at the moment there were no national or local antibiotic guidelines, this meant that they had to rely on international guidelines that did not take into consideration the local epidemiology of infections and patterns of antibiotic sensitivities. [Table 5.1, Q15]. In contrast, the virologist participant identified that the availability of antiviral prescribing guidelines was one of the key elements that supported the success of the programs controlling use of anti-viral medications in the hospital and in Thailand as a whole. Participants thought that the lack of local Thai antibiotic prescribing guidelines could decrease clinician’s confidence that the guidelines they were using were relevant and appropriate for the clinical context in which they were working [Table 5.1, Q16].

2.2 Inadequate IT infrastructure to support optimal antibiotic prescribing

The organisational leaders and clinical nurses discussed the problem of limited IT infrastructure at the study hospital to support AMS activities. The pharmacist participant identified that the current IT system was inadequate and did not have the capacity to provide the bedside clinician with decision support and was not designed to link pathology reports (which provide information about the organisms cultured and their antibiotic sensitivities) to patient therapy and prescriptions [Table 5.1, Q17]. Similarly, the clinical nurses also mentioned that the lack of effective IT systems could limit their role in monitoring the appropriateness of antibiotic prescribing [Table 5.1, Q18]. A doctor
participant suggested that the hospital executive committee was supposed to support the development of an IT system that would support the introduction of decision support software for prescribers [Table 5.1, Q19], however this had not yet been made available.

2.3 Gaps in the current tracking and reporting of antimicrobial use

Both the organisational leaders and the clinical nurses interviewed identified gaps in the current tracking and reporting of AMS activities and practices. Although the antibiotic tracking and reporting system was available in the hospital, a lack of a systematical process for reporting of antimicrobial use was identified as a barrier to expanding the program and fully embedding AMS principles into practice. A doctor participant discussed that although the hospital had a system to control some specific antibiotics, an improvement in antibiotic prescribing would only progress slowly if the hospital has no system to monitor compliance [Table 5.1, Q20]. Also, nurse and doctor participants in the organisational leader group reported that the reporting system at the study hospital for antibiotic use was not systematic and did not provide timely feedback to the frontline staff [Table 5.1, Q21-Q23]. Clinical nurses reported that although the occurrence of AMR was tracked and reported to frontline staff, the lack of systems to support monitoring and tracking of antibiotic prescribing was hampering efforts to implement a sustainable AMS program [Table 5.1, Q24, Q25]. Additionally, a doctor participant suggested that a prospective audit and feedback system should be set up in the hospital in order to improve the behaviour of prescribers. [Table 5.1, Q26]. These findings indicate that although antibiotic use is reported through the RDUSC to the hospital executive committee, the is limited feedback provided to individual clinical units and prescribers, therefore individual prescribers were not being made accountable for their own practice.

3) Lack of multidisciplinary engagement in AMS team

The third major theme to emerge from the organisational leader interviews and focus group discussions was the lack of multidisciplinary engagement in the AMS team and associated activities. The identified sub-themes were that (3.1) there was not an ideal AMS team, (3.2) the lack of doctor engagement in AMS, (3.3) and divergent opinions about nurses’ involvement in AMS governance and on the AMS team.
3.1 Not an ideal AMS team

The lack of multidisciplinary engagement in AMS was identified as a gap in the current leadership commitment by all of the organisational leaders, clinical nurses and ICNs groups. It was identified that the current, membership of AVWG and RDUSC in the hospital was not ideal and did not include all members of the multidisciplinary team. A doctor participant explained that currently, the hospital had no formal AMS policy that encouraged healthcare staff working in the clinical area to work as an effective multidisciplinary AMS team. Also, there was no extra benefits or recognition of staff who participated in the AMS team. This was perceived by participants as an obstacle to the effective promotion of the AMS program across the organisation [Table 5.1, Q27]. Another pharmacist in the organisational leader group reported that having only one person running the AMS program is problematic and the lack of support from executive staff limited the programs capacity to introduce and mandate change. [Table 5.1, Q28]. Additionally, to support multidisciplinary teamwork for AMS, it was suggested that training of the of all clinicians and craft groups across the organisation was needed. [Table 5.1, Q29]

3.2 Lack of doctor engagement in AMS

Organisational leaders and clinical nurses identified a lack of doctor engagement was one of the barriers to multidisciplinary involvement in AMS. At the time of the study, the study hospital did not have a comprehensive AMS policy that covered the use of all antimicrobials, therefore the AMS team leaders had limited authority over doctor’s prescribing choices. Participants from the organisational leader group explained that as the hospital has no robust system to monitor or limit antibiotic prescribing overall, individual prescribers may not believe that they are accountable for their antibiotic use. A nurse leader identified that some doctors might not consider the impact of their individual prescribing decisions and that others appeared to believe that they were too senior to be made accountable to the hospital executive. [Table 5.1, Q30]. Similarly, another nurse leader identified that the hospital executive had limited authority over some senior members of the medical team to alter their current practice [Table 5.1, Q31]. Additionally, the doctor and junior nurse participants raised concerns about the impact of the hierarchy amongst healthcare professionals on developing a multidisciplinary team approach. There
was the perception that doctors had more power than other healthcare professions and had the sole authority to prescribe medications and treatment. There was the perception that doctors’ clinical decision-making could not be challenged by other members of the team and this was raised as a barrier to full doctor engagement in AMS program. As other members of the multidisciplinary team were not empowered to question their treatment decisions doctors were not required to make the reasons behind for their treatment choices transparent and were not being made accountable for their prescribing practice [Table 5.1, Q32, Q33].

3.3 Divergent opinions about nurses’ involvement in AMS

There were differences of opinions amongst those interviewed about whether nurses should be involved in AMS governance and whether they should be members of the AVWG committee. Doctors from the organisational leadership group identified that the membership of the AVWG was not the ideal group to support AMS activities across the organisation or to form the basis of a multidisciplinary AMS team. A number of participants explained the reason why nurses have not had a formal role in AMS and were not members of this committee such as the responsibilities of the AVWG were not directly relevant to nursing, that there were important contributions that nurses could make to this committee’s decision making [Table 5.1, Q34]. One doctor participant explained that the main role of nurses is to implement and support effective IPC practice, therefore, it was better for nurses to lead IPC activities and that prevented the spread of AMR infections across the hospital rather than being members of the AVWG committee [Table 5.1, Q35].

As nurses were responsible for antibiotic administration, patient safety and educational activities, some study participants thought that nurses should be the members of the AVWG committee and have the opportunity to participate in the leadership team for AMS activities at the study hospital. A pharmacist participant explained that because the AVWG was linked to AMS activities such as Antibiotic Smart Use program, which related to nursing care, that nurses should be included on the committee overseeing this program [Table 5.1, Q36]. A doctor participant also expressed the view that nurses should be involved on the committee as this group was making decisions that affected the provision of nursing care. Nurses could receive antibiotic use policies and promote implementation of
these recommendations into nursing practice in activities such as medication administration. [Table 5.1, Q37]. Furthermore, nurse participants from the organisational leader group and clinical nurses agreed that nurses should be included in the AVWG team in order to support multidisciplinary work and monitoring of patient safety in antibiotic use. [Table 5.1, Q38, Q39]. Nurse leaders and nurses from the ICN focus group suggested that nurses who get involved in the AVWG should have experience in IPC practice or sufficient relevant clinical practice to make an active contribution to the committee’s decision-making processes [Table 5.1, Q40- Q41]. However, one clinical nurse participant suggested that nurses who are involved on the AVWG committee should work in a clinical ward because they understand the real problems faced by clinicians providing care at the frontline [Table 5.1, Q42].

4) Lack of clinician expertise and education about AMS is a major hurdle

The fourth major theme that emerged was that the majority of clinicians (from across a range of disciplines) lacked expertise in AMS and that this was a major hurdle that needed to be overcome before the principles of AMS activities could be consistently embedded into routine clinical care. The associated sub-themes were that clinicians’ AMS knowledge was acquired through clinical experience rather than formal education programs and that an organisation-wide structured approach to AMS education was needed to address this knowledge deficit.

4.1 Knowledge acquired through experience not education

Knowledge gaps relating to appropriate antibiotic use were identified across all members of the multidisciplinary team. All of the participants interviewed reported that in general, healthcare staff at the study hospital did not have adequate knowledge about AMS, and how AMS principles should be applied in practice. Only relatively small numbers of professionals who had experience in treating patients with antibiotic resistant organisms were recognised as having expertise in antibiotic prescribing choices and treatment regimens. Participants from the organisational leadership group and the ICNs perceived that doctors’ knowledge of antibiotic prescribing depended on their sub-specialty area of practice. ID specialists and paediatricians were recognised as having a high-level knowledge
in antibiotic prescribing. [Table 5.1, Q43, Q44] and one doctor participant indicated that because he was not ID specialist, he did not consider himself an expert in AMS [Table 5.1, Q45]. Participants reported that variations in prescribers’ knowledge and clinical experience resulted in variability in clinical prescribing practice at the study hospital. The availability of expert prescribers overnight and on weekends was identified as a barrier to consistent implementation of AMS principles. One nurse leader reported that they had noticed that inappropriate antibiotics were more likely to be prescribed on the weekend when junior staff had less access to expert advice [Table 5.1, Q46].

Both nurse leaders and clinical nurses reported that nurses were more likely than other professionals groups to have a sound knowledge of IPC, but that they did not enough knowledge to evaluate whether antibiotic prescribing choices were appropriate [Table 5.1, Q47]. Similar to other professions, nurses’ level of knowledge about antibiotic use depended on their sub specialty of practice and experience caring for patients with antibiotic resistant infections. Nurse participants from organisational leader group and clinical nurses agreed that ICNs and ICU nurses had a higher level of knowledge about appropriate antibiotic use than general ward nurses [Table 5.1, Q48]. The nurse participants expressed the view that nurses typically acquired this knowledge by direct clinical experience rather than through a formal educational program [Table 5.1, Q49]. Likewise the pharmacists interviewed perceived that the clinical pharmacists (particularly those on the AMS team did have expert knowledge in antibiotic prescribing and use. [Table 5.1, Q50], however not all pharmacists were experts in this area [Table 5.1, Q51].

4.2 Need for organisation-wide, multi-disciplinary antimicrobial stewardship education

All the study participants identified that knowledge about antibiotic use and AMS is based on clinical experience rather than on formal education provided by the study hospital. A pharmacist participant commented that the current AMS training were not multidisciplinary but organised separately by each professional group [Table 5.1, Q52]. The doctor and pharmacist participants suggested that the hospital should provide a program of multidisciplinary AMS training [Table 5.1, Q52-Q53]. Similarly, an ICN participant stated the
hospital should organise a campaign about antibiotic use and resistance to raise awareness amongst healthcare staff across the organisation [Table 5.1, Q54].

5.3.1 Section summary

In the second section of this chapter, the data from organisational leaders, clinical nurses and infection control nurses were analysed using thematic analysis. The results show that there were both perceptions of strengths and weaknesses of the current clinical governance structures in the study hospital. The study participants perceived that strong executive level support IPC activities and having a central champion for AMS activities were advantages of the current clinical governance structure at the study hospital. A number of important barriers to the implementation of a sustainable, organisation-wide AMS program were identified by participants. Participants perceived that the health service executive acknowledged the importance of tackling the issue of AMR and therefore endorsed the roll-out of a number of AMS projects at activities at the study hospital. There was not however organisational investment or the provision of sufficient resources (including personnel, IT infrastructure, staff education and training) to ensure that these projects were sustainable. While maintaining a high standard of IPC was recognised as part of the core quality and safety agenda of the hospital, it appears from the participants’ responses that AMS remains a relatively new concept and that AMS activities are project based rather than fully integrated into the clinical governance structure of the health service. It was identified that the central clinical champion made a major contribution by lobbying the executive team to acknowledge the importance of AMS and to support AMS activities at the study hospital.

Participants identified that a multidisciplinary approach to AMS that included all healthcare disciplines, including nursing, was an important gap that needed to be addressed before AMS activities could be integrated into clinical care across the whole organisation. The lack of a formal AMS policy, and resources to monitor antibiotic prescribing practice were identified as barriers to achieving full engagement of clinicians in AMS. It was also identified that without the appropriate organisational policies, and the provision of ongoing audit and feedback that it was not possible to make all prescribers accountable for their antibiotic prescribing choices. Variability in the educational preparation of prescribers’ and inadequate access to evidence –based resources were seen as important contributors to
variation in antibiotic prescribing practice. The need for a structured multidisciplinary AMS education program was seen as essential to address current perceived deficits in clinicians’ knowledge about AMS.
Table 5.1 Perceived strengths and weaknesses of current clinical governance in the case hospital

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<tr>
<th>Themes</th>
<th>Subthemes</th>
<th>Representative quotes from different profession groups</th>
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<tbody>
<tr>
<td>1. Executive seen to endorse but not support AMS activities</td>
<td>Authority delegated to clinical leaders but executive not actively engaged</td>
<td>Organisational leaders</td>
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<td></td>
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<td>Q1 &quot;I think the hospital director fully supports [AMS]. At the moment, we are focusing on Antibiotic Smart Use in the Rational Drug Use program.&quot; (P1)</td>
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<td>Q2 &quot;I think that the senior hospital administrators are very supportive. We know that ID specialists have been given authority to control antibiotic use in the hospital. If they [ID specialists] find antibiotics are prescribed inappropriately they can take action.&quot; (D4)</td>
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<td>Q4 &quot;It [executive support] depends on the level of administrator. The senior executive, they probably do not get into the details [of AMS programs]. But for the middle managers such as the IPC chairman, he is very involved&quot; (D3)</td>
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<td>Q5 “It [AMS leadership support] seems good but I’m not sure because there is no additional compensation and staff for AMS team” (D1)</td>
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<td></td>
<td>Central clinical champion acts as a lobbyist</td>
<td>Q6 “Personally I don’t think the senior executives are fully supportive of AMS programs. I found that only Dr. [name] is active in this program [AMS programs]. I have not seen other teams or staff support him properly. ….. Also, when Dr. [name] presents to hospital executive committees, the committee provided just intermittent support.” (P2)</td>
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<td>Q7 “Personally, I think because the IPC chairman is a doctor and has an authority to approach the hospital executive committee. He is also able to convince them that they should be concerned about this problem along with the IPC and AMS policies within the hospital.” (N3)</td>
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<td></td>
<td>IPC activities are part of core business</td>
<td>Q9 “Of course, we [the hospital executive] are very supportive. The IPC committee has the role in proposing the project, and we will find out the best solution” (D2) Q9 “I think the hospital executive committee support us very well especially in relation to IPC activities for example the hand hygiene campaign. I have never heard that they rejected even one project.” (N3)</td>
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<td>Q10 “When I identify problems and suggest a policy [IPC activities], the senior executives always support us.” (D3)</td>
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<td>Q11 “Once we had an outbreak of Vancomycin Resistant Enterococcus (VRE) in the hospital, that meant that everyone in the hospital was on full alert. From that experience, we also found that the senior executive committee launched quickly into action implementing a policy of strict patient isolation and infection control precautions along with controlling Vancomycin prescribing.” (N5)</td>
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<td>Representative quotes from different profession groups</td>
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</table>
| 2. Lack of AMS policies and resources to optimise track and enforce good antimicrobial prescribing practice | No formal AMS policy and antibiotic guidelines | Q12 “They [the senior executives] have not been consistent in establishing a formal AMS policy. This is very important barrier [to effective program implementation].” (P2)  
Q13 “The problem is we [the AMS team] report the volume of carbapenem use in the hospital to the Pharmacy and Therapeutics Committee. When the committee [Pharmacy and Therapeutics Committee] see the data, they said thank you and do nothing.” (P2)  
Q15 “We have not done the hospital antibiotic guidelines yet. At present, we are using international guidelines.” (D1)  
Q16 “We have anti-viral drug use guidelines and clear work flow plan that is regularly updated. They were developed as national guidelines. It is a very useful reference. However, there is no guideline for antibiotics which doctors who are able to prescribe from all departments ... [could consult]. When guidelines are absent, it is hard to control antibiotics use.” (L1) |
| | Inadequate IT infrastructure to support optimal antibiotic prescribing | Q17 “The missing program right now is the program that links the data between antibiotic prescribe and microbiology laboratory reporting sensitivities.” (P2)  
Q19 “We heard that the AMS team was trying to develop the guidelines of antibiotic prescribing in the hospital. Once we had some training about antibiotic use and we got some antibiotic use guidelines as a paper copy which was easy to lose. It would be better if we have a smart application or decision support software on the hospital intranet that we can access everywhere, whenever we have to prescribe antibiotics.” (D5)  
Q18 “If we had a system that identified particular bacteria and could indicate what antibiotics we should give to the patient [that match that organism’s bacterial sensitivities] that would help us. At the moment, we do not have anything like that.” (JRN4) |
| | Gaps in the current tracking and reporting of antimicrobial use | Q20 “We have a program to control carbapenem prescribing, but we should monitor the compliance with this program too.” (D2)  
Q21 “We do not have a systematic approach to reporting antibiotic use [to the clinical staff]. Although, if the healthcare staff would like to know this data they can access it through the hospital database.” (N4)  
Q22 “Dr. K is monitoring antibiotic use in the hospital but we do not systematically report either the volume of antibiotic use or the [incidence of] multiple drug resistant organisms. Personally I would like the data to be reported to frontline staff such as nurses and nurse assistants.” (N6)  
Q23 “These days we do not receive a report about antibiotic use in the hospital that is specific enough. I believed that every doctor would be interested in the overall use of antibiotics. Last time we [surgeons] received the surgical site infections report, I noticed that they all looked so excited to see their operation outcomes reported.” (D5)  
Q24 “We know that there is a serious problem of antimicrobial resistance in the hospital, ... for example, when there was an outbreak of VRE, we were on high alert. There is only a report specifically about patients with antimicrobial resistance. But we do not have an overview of the infections in the hospital overall.” (JRN4) |
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<tr>
<td>2. Lack of AMS policies and resources to optimise track and enforce good antimicrobial prescribing practice (Cont)</td>
<td>Gaps in the current tracking and reporting of antimicrobial use (cont)</td>
<td><strong>Organisational leaders</strong></td>
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<td>Q26 “I would like to have prospective audit and feedback system that included annual reporting. Say, each year every department receives feedback, an antibiotic prescribing report. Personally, I would accept the feedback because I am afraid that my patients may get AMR infections too. I believe everyone wants his or her patients to experience AMR infections as little as possible. If we don’t start taking action and no feedback is provided, we will never know when our prescribing practice is poor, and everyone has only excuses [for their prescribing choices].” (D5)</td>
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<td><strong>ICNs and Clinical nurses</strong></td>
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<td>Q25 “At the moment, we have not yet received a report about the amount of antibiotics we used and how much it cost. It would be good if we have those reports made available. It may make us more aware of using antibiotics wisely and we don’t want to waste money. At least reporting to us once a year would be good”. (SRN4)</td>
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<td>3. Lack of multidisciplinary engagement in AMS team</td>
<td>Not an ideal AMS team and training</td>
<td>Q27 “It [AMS leadership support] seems good but I’m not sure because there is no additional compensation and staff. They [the hospital executive] do not distribute pharmacists or nurses to be part of the team. It is not an ideal AMS team right now. At the moment, we ask each department for help but they already have their own duties. It’s not an AMS system like other countries that has a full-time job for members of the AMS team.” (D1)</td>
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<td>Q28 “…I found that only Dr K has been taking action in this program [AMS programs]. I have not seen other teams or staff support him properly. Dr K was trying to ask the pharmacist team and pediatric ID specialist team to participate AMS team.” (P2)</td>
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<td>Q29 “It seems like each profession has their training, but there is no multidisciplinary training or a multidisciplinary conference. We have not had a multidisciplinary conference in which, an ID specialist educates staff about antimicrobial resistance, a microbiologist presents on the microbiology of AMR, and pharmacists talk about dose adjustment yet” (P2)</td>
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<td>Lack of doctor engagement in AMS</td>
<td>Q30 “Although we realised that the senior executives give priority to this issue [AMS] more than before, but there is a group of doctors that still use antibiotics improperly even though several antibiotics have restricted prescribing. For example, one particular department has prescribed a lot of Augmentin even if [patients] only have a mild sore throat. The hospital policy is going to address this problem.” (N2)</td>
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<td>Q31 “I thought the senior executives have not been strong enough to control antibiotic prescribing in the hospital. Some doctors use high-level broad-spectrum antibiotics as prophylactic antibiotics prior to surgery. Even though the hospital leaders have discussed this with him... [that it is not ideal practice]...he doesn’t care and keeps on prescribing that antibiotic.” (N4)</td>
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<td>Q32 “Most importantly, in our country, doctors have too much power, so there would be no accepting of other professional groups [becoming involved in AMS] if it [the extension of their role] would interfere with doctors’ [professional] boundaries” (D1)</td>
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<td>Q33 “I think it’s about the power to make a decision, like, when we [nurses] notice that a doctor has prescribed antibiotics at a high dose, we [nurses] and the pharmacist tried to remind the doctor [that this is not ideal practice], but he/she insisted on the same order. Some doctors have huge egos. They think they have more power. They feel that they lose authority when we oppose them.” (JRN4)</td>
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<td>3. Lack of multidisciplinary engagement in AMS team (Cont)</td>
<td>Divergent opinions about the participation of nurses in AMS</td>
<td>Q34 “Personally, I thought that it is okay if nurses are not involved on this [AVWG] committee because they consider what antibiotics should be available in the hospital. The members consider in detail antimicrobial pharmacodynamics, which might not relate to nursing knowledge. If nurses would like to get involved on this committee those nurses should have an in-depth knowledge of the pharmacology of antibiotics.” (D4)</td>
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<td>Q35 “Currently, nurses have a role in infection and prevention control committee where they monitor prevention and control of antimicrobial resistance” (D1)</td>
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<td>Q36 “The Pharmaceutical Consideration sub-committees consider treatment choices for cardiovascular, pain, bone and joints, and digestive tract conditions, including the use of antibiotics. These committees do not include nurses because it is all about considering the list of medicines available in the hospital or to specify who can prescribe particular medications and to determine if [a patient] is eligible for a health insurance scheme. Actually, nurses were in those groups, but they said there is nothing related to their professional role. They do not have an authority to control or prescribe. However, I agree that nurses should be included in the Antibiotics and Vaccines team because there are other activities e.g. Antibiotics Smart Use program in OPD which is quite related to nursing care. I think nurses should be in this team because they could receive the policies and implement these in their practice” (P1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Q37 “If the Antibiotics and Vaccines team considers how medication are administrated such as how to drip [administer] each antibiotic. Nurses should be involved because all of the multidisciplinary team should be” (D4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Q38 “In my opinion, if this team [the Antibiotics and Vaccines committee members] have pharmacists, they should have a nurse as well. Pharmacists might have more knowledge about medicines, but my question is whether they know more about the patients or not? Do they check the lab results? I do not think so. Thus, I think this team should have physicians, nurses and pharmacists working together.” (N2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Q40 “I would like to have at least one infection control nurse involved on the Antibiotics and Vaccines team because at least infection control nurses do surveillance of AMR in the hospital. That would give us continuity and clarity to support the AMS work.” (N3)</td>
</tr>
</tbody>
</table>
4. Lack of clinician expertise and education about AMS is a major hurdle

Knowledge acquired through experience not education

Q43 “[as they have more knowledge...] ID specialists and pediatrics are more concerned about antibiotic use. Surgical doctors and gynecologists have less knowledge about this issue.” (N3)

Q45 “I have not much knowledge in antibiotic use, particularly the mechanisms of AMR, how to use antibiotics appropriately to reduce AMR, also the best route of antibiotic administration to use.” (D5)

Q46 “I have noticed that on weekends broad-spectrum antibiotics are prescribed a lot. Then on Monday the ID fellows and staff come to change that.” (N6)

Q47 “Nurses have a good knowledge about how to isolate patients who have infectious diseases. Probably they [nurses] have knowledge more than doctors in isolation precautions. But nurses do not have much knowledge about antibiotic use.” (N3)

Q49 “About antibiotic use, nurses who take care patients who have AMR infections would be more knowledgeable. For example, when there was CRE outbreak in the hospital, nurses would know that [a contributing factor] was that patients had used carbapenem inappropriately of or when there was a VRE outbreak, nurses knew that this is caused by Vancomycin. Nurses also realised that even though some patients did not use those antibiotics, but they still developed the infections [with resistant organisms], which meant that there had been the transmission of pathogens [between patients]. Through this experience, I believe that nurses have gained more knowledge.” (N6)

Q50 “In general, pharmacists have basic knowledge about antibiotic use particularly clinical pharmacists” (P3)

Q51 “Not all pharmacists know all about antibiotic use because they get less involved with AMR pathogens. Only clinical pharmacists have expertise in antibiotics. But they would know more about antibiotics than nurses.” (P2)

Q52 “It seems like each profession has their training, but there is no multidisciplinary training or a multidisciplinary conference. We have not yet had the conference that, an ID specialist educates about antimicrobial resistance, a microbiologist presents microbiology, and pharmacists talk about dose adjustment” (P2)

Q53 “We should have the conference like the IPC conference which have doctors nurses and pharmacists as speakers annually. Each department has to send their staff to attend to update their knowledge along with presenting antibiotic use of their own department. In addition, the report of the overall antibiotic use in the hospital, the top ten of adverse drug reactions to antibiotics should be presented at the conference.” (D5)

Need for organisation-wide, multi-disciplinary AMS education

Q54 “We should have a campaign to empower personnel to see the importance of it [antibiotic use and resistance].” (ICN1)

Q44 “For doctors, [I] think they have good knowledge about antimicrobial resistance and use, particularly ID specialists they have, well both knowledge about antibiotics and infection and prevention control practice. (ICN2)

Q48 “Actually from my experience, if we regularly use particular antibiotics for specific patient types, we eventually remember it [the indication for antibiotics], but [our knowledge] is not in depth.” (SRN2)
5.4 Discussion

Four major topics findings emerged from the key stakeholder interviews and focus groups. The discussion topics of leadership commitment, accountability and drug expertise, AMS Interventions and AMS training and education are presented in the section to follow.

5.4.1 Leadership commitment

To initiate AMS programs, international guidelines suggest that a clinical champion such as an ID physician and/or clinical pharmacist provide leadership as a minimum requirement for an effective program (CDC, 2014; Doron & Davidson, 2011; Duguid & Cruickshank, 2011). Participants perceived that at the study hospital there was a high profile, expert, who was successfully providing leadership and direction for new AMS initiatives. Previous studies in Australia also recommended ensuring support and authorisation from the organisation’s executive leadership and involvement of key clinical stakeholders before implementation of AMS programs as this would result in successful uptake of the program (Cotta et al., 2015; Loh et al., 2015a).

Several studies showed that clinical champions, from disciplines such as infectious diseases, pharmacy and microbiology, typically led successful AMS programs (Septimus & Owens, 2011; Yam, Fales, Jemison, Gillum, & Bernstein, 2012). In this, study the participants recognised that because the local AMS champion is a doctor and a recognised expert in the field, it was easier to convince the hospital executive committee and clinicians to support AMS activities. An American study that interviewed physicians and pharmacists about the key to successful AMS programs found that these stakeholders believed that the having a dedicated physician as a program champion increased the likelihood of success (Pakyz et al., 2014b). A study of the key influences on successful implementation of AMS programs in Canada found that having a strong program leader was the vital factor needed to inspire other clinicians to participate in AMS programs and to have an impact on optimal antimicrobial use (Jeffs et al., 2015).
The CDC recommendations for Core Elements of Hospital Antibiotic Stewardship Programs also identified that to achieve an effective AMS program, a highly respected and recognisable physician leader was needed to both oversee the program and to obtain support from the hospital executive (Pollack & Srinivasan, 2014). In this study, the AMS clinical champion is a doctor who is also the chair of the IPC committee, and this appears to have strengthened the integration of IPC and AMS activities at the study site. The strength of having the same person leading AMS and IPC programs is that it improves the flow of information and facilitates implementation of policy from the hospital executive level into practice by front line staff.

A potential disadvantage of this approach is that implementing IPC policies and AMS policies in tandem could confuse healthcare workers about reporting lines and the responsibilities of different members of the multidisciplinary team. Some participants in our study expressed the view that AMS is about doctors’ and pharmacists’ practice while nurses are the major professional group responsible for IPC activities. By integrating the leadership of these two programs, there is the potential to underplay the importance and contribution of nurses (Laundy, Gilchrist, & Whitney, 2016). This highlights the need to proactively encourage a multidisciplinary team approach to AMS implementation so that clinicians are aware that AMS is everyone’s business.

The CDC recommendations for the core elements of AMS programs suggest that the hospital administrators should provide ease of access to current clinical guidelines for all clinicians (CDC, 2014). It is recommended that guidance should be available to guide prescribing decision-making for both infection treatment and prophylaxis (CDC, 2014; Nathwani, 2006). Previous studies suggest, implementing clinical guidelines that take into account local microbiology and antimicrobial susceptibility patterns are an essential element in an effective AMS strategy (James et al., 2013; Pakyz et al., 2014b). In this study, the lack of local antimicrobial guidelines was mentioned as a substantial barrier to effective AMS implementation at a local level. Participants in this study reported that prescribers were using
international antimicrobial guidelines that did not take into account local bacterial ecology or resistance patterns. The lack of easily accessible, locally relevant decision support systems appeared to undermine local AMS initiatives. A recurring theme through the stakeholder interviews and focus groups was that prescribers lacked knowledge and skills around appropriate antibiotic choice and that accessing expertise was difficult in a busy clinical environment.

Inadequate IT resources to support decision-making and monitoring of antimicrobial use were reported as a gap in the local AMS program at the study hospital. Previous studies have identified that a lack of electronic decision-support tools deceases appropriate antibiotic prescribing (Pakyz et al., 2014b). At the study hospital, there are currently computerised surveillance systems being used to control carbapenem use, and a smart phone application has been introduced that provide clinicians with antiibiogram data. While acknowledging the usefulness of these initiatives, the study participants indicated that they needed additional access to locally relevant decision–support software at the bedside.

Clinical surveillance systems that are able to provide prescribers with updates and decision-support in real-time are considered to be key to effective implementation of AMS programs (Dellit et al., 2007; Pakyz et al., 2014b). A previous study showed that IT systems that provide clinical decision support when selecting appropriate antibiotic therapy improved antibiotic prescribing practices in Australia (Buising et al., 2008a; Dellit et al., 2007) suggest that a software program that analyses patients’ antibiotic prescriptions and matches these with their microbiology results to provide clinicians with automated updates and real-time information could be used to improve antibiotic prescribing practice. This type of data linkage and decision support is however dependent on having adequate IT infrastructure in the health service, and electronic prescribing

5.4.2 Accountability and drug expertise

International AMS guidelines such as those from the USA, Australia, Scotland and the UK recommend that hospital-wide multidisciplinary approach is considered
to be effective and best practice in AMS programs (CDC, 2014; Duguid & Cruickshank, 2011; Lin et al., 2013a; Nathwani, 2006; SACAR, 2007). In this study however, the lack of a multidisciplinary team approach was identified as one of the barriers in the current AMS programs. From the key stakeholder interviews, it appears that not all members of the multidisciplinary team were engaged with the hospital AMS program. As several studies have demonstrated that a multidisciplinary AMS team impacts on patient safety and healthcare cost outcomes, this is an important gap in AMS activities at the study hospital.

One Australian study of a rapid review by a multidisciplinary AMS team found improvements in the time to and use of appropriate antimicrobial therapy (Cairns et al., 2016). In a tertiary hospital in Singapore, the AMS multidisciplinary team provided prospective review with immediate concurrent feedback to prescribers and found a decrease in the duration of antimicrobial use in renal patients (Cai et al., 2016). In Taiwan, the cooperation of an AMS multidisciplinary team including infection diseases specialists, attending physicians, clinical pharmacists, nurses, and laboratory scientists resulted in decreasing antibiotic cost and consumption in a community healthcare hospital (Lin et al., 2013b). Another Australian study concluded that AMS programs would be effective if all healthcare staff participate and understand how they could contribute to the program (Cotta et al., 2014). These studies confirm that a multidisciplinary team needs to be established at the study hospital to support AMS implementation.

In the current study a lack of clarity about the AMS clinical governance structure and the roles and responsibilities of clinical staff was identified as a barrier for clinicians, as they were unclear when and how they could be involved in AMS activities. Core Elements of Hospital Antibiotic Stewardship Programs (2014) recommended that barriers to effective implementation of AMS could be overcome by providing a formal hospital AMS policy. This policy should describe key AMS related activities, specify performance criteria in staff job descriptions, and include participation in AMS activities in staff members’ annual performance reviews. Additionally, a full-time dedicated multidisciplinary team was recognised as
fundamental to maintaining AMS activities and improving clinical and economic outcomes (Paskovaty et al., 2005b). Therefore, developing a clear clinical AMS structure, establishment of a multidisciplinary AMS team and a policy that describes AMS responsibilities for clinical staff (including nursing and allied health) is suggested as important next steps to imbed AMS activities into clinical care at the study hospital.

5.4.3 Antimicrobial stewardship interventions

The study participants reported that current interventions to improve antibiotic use in the hospital were operating in both outpatient and inpatient departments. The introduction of a number of quality improvement projects targeting antimicrobial prescribing such as the ‘Antibiotic Smart Use’ campaign in the outpatients department (OPD) and the carbapenem control program in inpatient department were perceived as strengths of the current AMS initiatives at the study hospital. The outpatient project is a syndrome specific intervention that focuses on improving prescribing for Upper Respiratory Tract Infection (URTI) and diarrhoea. This is in-line with international AMS initiatives for ambulatory and outpatient care; a systemic review in 2015 showed that most AMS activities in outpatient settings target treatment of respiratory tract infections (Drekonja et al., 2015a). Similarly, acute respiratory tract infections (ARTIs) were prioritised for AMS programs in a network of 25 pediatric primary care practices in USA (Gerber et al., 2013).

Previous studies showed that majority of antibiotics are prescribed in outpatient settings (Drekonja et al., 2015b; Gerber et al., 2013). A US study of antibiotic use for upper respiratory infections in outpatient settings found that 65% patients were treated with antibiotics (Gill et al., 2006). Similarly, community-based studies in Thailand found that most patients with upper respiratory tract infection were treated with antibiotics (Apisarnthanarak & Mundy, 2009; Suttajit, Wagner, Ross-Degnan, Tantipidoke, & Sithi-amorn, 2005). These findings may explain why improving antibiotic prescribing for respiratory tract infections is a priority in outpatient settings. Initiating an AMS intervention that provides guidelines for URTI and diarrhea is therefore considered as a good starting point when introducing AMS
programs in a new context. These outpatient-based interventions also provide the AMS team with insights about current practice in the community and the incidence of AMR in the general Thai population. As this is a new program at the study hospital there has been limited evaluation of its impact, further assessment of the programs impact on prescribing, patient outcomes and costs would be informative to the organisation.

An AMS intervention that restricts prescriber access to specific antibiotics had been established in the inpatient setting, the ‘carbapenem control program’ uses a computerised software program to monitor and limit the use of broad-spectrum beta-lactam antibiotics. This program has started by focusing on improving the appropriate use of carbapenems and there are plans to expand this process to other classes of antibiotics. This type of AMS intervention to restrict access and use of specific antibiotics has been described as a ‘behavioural intervention’ that uses ‘rules to reduce the opportunity to engage in the target behaviour or increase the target behaviour by reducing the opportunity to engage in competing behaviours’ (Davey et al., 2017). A previous review suggested that restrictive strategy in AMS had better impact on prescribing behaviours than education or persuasion (Davey et al., 2013). Several studies confirmed that interventions that restrict antibiotic use are affective in improving antibiotic use in inpatient settings. For example, a US study found that using computerised monitoring software, with AMS team oversight, for active monitoring of restricted antibiotic orders had a positive impact decreasing antibiotic use and hospital expenditure (McGregor et al., 2006). Another American study found that the use of restrictive interventions to limit prescribing of broad-spectrum antibiotics and restrict the maximum daily dose of antibiotics resulted in a reduction in antibiotic use and pharmacy costs (Coleman, Rodondi, Kaubisch, Granzella, & O'Hanley, 1991). In the Australian context a study of using a computerised antimicrobial approval system to limit use of restricted antimicrobials decreased the use of third and fourth-generation cephalosporins (Buising et al., 2008b). These studies demonstrate that AMS strategies that restrict access and provide consumer feedback improve antibiotic use and healthcare cost. At the study hospital, the
impact of this program needs to be formally evaluated and reported, before this approach is extended to include other classes of antimicrobials.

5.4.4 AMS training and education

In this study healthcare professionals who have more experience in treating and taking care of patients with antibiotic resistant organisms were recognised as having more knowledge about appropriate antibiotic use. Most of the participants perceived that they do not have enough knowledge about AMR, and the evidence underpinning antibiotic prescribing choices to lead AMS activities. These results are similar to previous studies in which the lack of up-to-date knowledge regarding antimicrobial use was reported by some senior specialists in an Australian private hospital (Cotta et al., 2015).

Participants in this study reported that they would like to have more education and training related to antimicrobial use. Similar to previous studies, nurse practitioners and medical students agreed that a sound knowledge of antibiotics is important and they would like more education in antibiotic selection, timing and duration of treatment (Abbo et al., 2012; Abbo et al., 2013a). Another study reported that residents and advanced trainees perceived that more education about antibiotic use during residency would decrease inappropriate prescribing by junior medical staff (Stach, Hedican, Herigon, Jackson, & Newland, 2012).

Insufficient staff education and training related to antimicrobial usage have been commonly identified in previous studies. For example, a lack of training and education in antimicrobial use was reported as a major barrier to AMS implementation in Australian hospitals (James et al., 2015; James et al., 2013). Insufficient education and training for nursing staff on aspects of AMS is a common barrier to effective implementation of AMS programs in Australian hospitals (Chen, Khumra, Eaton, & Kong, 2011). The AMS in Australian hospitals guidelines suggest that providing education to prescribers, pharmacists and nurses about good antimicrobial prescribing practice and AMR should be the priority and that this underpins effective AMS implementation (Duguid & Cruickshank, 2011).
At the study hospital it is recommended, based on the participants feedback, that staff are provided with greater access to resources such as: eHealth applications to support clinicians in AMS (Wentzel et al., 2014), and other web-based educational resources (CDC, 2014) In addition it would be beneficial to provide staff with access to face-to-face or peer-to-peer education sessions run at the hospital (James et al., 2015).

5.5 Chapter summary

In this chapter, the results relating to the current clinical governance structure and activities at the study hospital are presented. In addition the perceived strengths and weakness of the current clinical governance structures among key stakeholders, ICNs and clinical nurses are explored.

The major findings showed that although there is executive level endorsement of AMS projects at the study hospital and there is a recognised clinical champion who provides strong leadership for AMS activities across the organisation, that the AMS program has not yet matured to the stage where it is fully integrated into the clinical governance structure of the organisation. The findings also highlighted that the AMS program had not reached clinicians from different disciplines to the extent necessary for their engagement and consistent implementation in clinical practice.

The organisational leaders identified a range of AMS initiatives and projects that demonstrate AMS activities related to each of the core elements recommended in the CDC framework. This range of activities provides evidence of willingness on the part of both the organisational leaders and the executive to take steps to address the problem of AMR. It is noteworthy that the majority of AMS activities involved staff awareness raising and provision of access to resources to support and inform better prescribing choices. These initiatives can be considered to be ‘facilitating’ interventions designed to reinforce and improve prescribing practice, rather than ‘restrictive’ interventions. Although the organisational leaders identified that there were some restrictions on the use of specific classes of antibiotics (such as the
carbapenems) and potentially moved to extend this approach, that prescribers at the study hospital were not yet sufficiently supportive of AMS to accept extensive restrictions on their prescribing choices.

The study participants identified a range of important barriers that need to be addressed before a sustainable, organisation-wide, comprehensive AMS program is established at the study hospital. Key issues that were identified included: the need to develop formal AMS policies and to embed these into the clinical governance structure; the need for organisational investment in personnel, information management systems, and staff education; and the need to establish a multidisciplinary approach to AMS with identifiable roles and responsibilities for each member of the team.

In the following chapter the results of patient participation in AMS is presented.
Chapter 6
Patient Participation in Antimicrobial Stewardship

In this chapter, the findings pertaining to the third aim of this research are presented and discussed. Patient participation is defined as “...the involvement of patients in the decision-making process regarding health issues” (Longtin et al., 2010, p. 54). The findings of the patient survey are presented first, followed by the analysis of the data derived from organisational leader interviews and nurse focus groups. The chapter concludes with a discussion of the current and potential status of patient participation in AMS in acute healthcare in Thailand.

Aim and objectives

The third aim of this research program was to explore current and potential patient participation in AMS in Thailand. The specific objectives of this phase of the study were to:

I. Explore patients’ perceived behaviours, attitudes and knowledge relating to antibiotic use in the community using a patient survey.

II. Determine how patients participate in AMS in the community and during hospital admission from patients’ and nurses’ perspectives.

6.1 Patient survey results

6.1.1 Methods

The methodological approach for this research program is described in detail in Chapter 3. A paper-based survey was distributed to patients from selected medical and surgical wards at the case hospital between January and March 2016. Patients were invited to participate in this survey if they had been prescribed antibiotics, had been in the hospital for at least two days and were able to communicate verbally in Thai with the researcher. Consecutive sampling was used to recruit patients to this study. The survey was self-administered however, patients who had a limited ability to complete the survey themselves either due to literacy or
physical issues were assisted by the researcher. The average time to complete the survey was 15 minutes.

6.1.2 Patient characteristics

In 2016, there were 47,058 patients admitted to the case hospital, and a total of 22,628 patients were admitted to the medical and surgical wards. Between January and March 2016, 205 inpatients completed this survey. Participant characteristics are presented in Table 6.1. Overall, 53.7 % (n=110) of the participants were female and the median age was 56 (IQR=46-65) years. The youngest participant was 17 years of age and the oldest was 89 years of age. Almost half the participants (42.4%, n=87) had completed primary school and 33.7% (n = 69) university level education. Fifty-one percent of the participants reported having one or more chronic diseases (n=111). The most common chronic disease was hypertension (20.5%, n=42).

Table 6.1 Patient characteristics (n=205)

<table>
<thead>
<tr>
<th>Demographics</th>
<th>n</th>
<th>%</th>
<th>Median</th>
<th>Q1-Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>110</td>
<td>53.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>95</td>
<td>46.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>56</td>
<td>56</td>
<td>46-65</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>3</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>87</td>
<td>42.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>46</td>
<td>22.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>60</td>
<td>29.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post graduate</td>
<td>9</td>
<td>4.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One or more chronic diseases</td>
<td>111</td>
<td>54.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.1.3 Patients’ perceived behaviors, attitudes and knowledge regarding antibiotic use in the community

Patients’ self-reported use of antibiotics in the community is presented in Table 6.2. Almost half of the participants (47.3%, n=97) reported that they took
antibiotics once in the past year. The three most common reasons reported for
taking antibiotics were colds (n=82, 40%), wound infection (n=63, 30.7%) and
respiratory tract infections (n=51, 24.9%).

Table 6.2 Patients’ reported antibiotic use in the community (n=205)

<table>
<thead>
<tr>
<th>How many times did you take antibiotics in the past year</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>62</td>
<td>30.2</td>
</tr>
<tr>
<td>1</td>
<td>97</td>
<td>47.3</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>10.7</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>5.4</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>2.9</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>2.0</td>
</tr>
</tbody>
</table>

• Why did you take antibiotics? *
  o Cold                                                 | 82 | 40.0|
  o Wound infection                                      | 63 | 30.7|
  o Respiratory tract infections                         | 51 | 24.9|
  o Gastroenteritis                                      | 19 | 9.3 |
  o Mouth ulcer                                          | 7  | 3.4 |

* Note: participants could choose ≥ 1 response

Patients’ behaviors regarding acquisition of antibiotics in the community are
presented in Table 6.3. About 70 % of participants reported that they purchased
antibiotics from a drugstore when they had a cold (70.2%, n=144) and 73.7 % (n=151)
got to see a doctor when they had a cold. Two thirds of participants (62.4 %
n=128) reported that they stopped taking antibiotics when feeling better. The
majority of participants reported that they never shared antibiotics with others
(82.0%, n=168), nor did they keep antibiotics for subsequent illnesses (76.6%,
n=157). Furthermore, 84.9% (n=174) of participants reported that they had never
bought extra antibiotics after completing a course of antibiotics, despite continuing
to feel unwell.
Table 6.3 Patients’ reported acquisition of antibiotics in the community (n=205)

<table>
<thead>
<tr>
<th>Attitudes and behaviors</th>
<th>Never</th>
<th>Sometimes</th>
<th>Frequently</th>
<th>Every time</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. I buy antibiotics from a drugstore when I get a cold.</td>
<td>61 (29.8%)</td>
<td>108 (52.7%)</td>
<td>35 (17.1%)</td>
<td>1 (0.5%)</td>
</tr>
<tr>
<td>4. I go to see a doctor when I get a cold.</td>
<td>54 (26.3%)</td>
<td>105 (51.2%)</td>
<td>39 (19.0%)</td>
<td>7 (3.4%)</td>
</tr>
<tr>
<td>5. I stop taking antibiotics when I feel better.</td>
<td>77 (37.6%)</td>
<td>65 (31.7%)</td>
<td>39 (19.0%)</td>
<td>24 (11.7%)</td>
</tr>
<tr>
<td>6. I share antibiotics with others.</td>
<td>168 (82.0%)</td>
<td>31 (15.1%)</td>
<td>6 (2.9%)</td>
<td>0</td>
</tr>
<tr>
<td>7. I keep antibiotics at home for next time.</td>
<td>157 (76.6%)</td>
<td>39 (19.0%)</td>
<td>7 (3.4%)</td>
<td>2 (1.0%)</td>
</tr>
<tr>
<td>8. If I complete antibiotics but I am still not feeling well, I will buy extra antibiotics from a drug store.</td>
<td>174 (84.9%)</td>
<td>30 (14.6%)</td>
<td>1 (0.5%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Patients’ beliefs and attitudes regarding antibiotic use in the community are presented in Table 6.4. About half of participants (54.1%, n=111) believed that patients should not be able to buy antibiotics over the counter. More than one-third of participants were unsure if antibiotics can reduce symptoms of a cold (41.5%, n=85) and/or prevent complications of a cold (43.4%, n=89). Approximately half of participants did not have a preference whether they received antibiotics from a doctor (50.7%, n=104) or a drug store (49.8%, n=102).

Table 6.4 Patients’ beliefs and attitudes regarding antibiotic use in the community (n=205)

<table>
<thead>
<tr>
<th>Attitudes and perceptions</th>
<th>Disagree or Strongly disagree</th>
<th>Neutral/Unsure</th>
<th>Agree or Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. I believe that patients should be able to buy antibiotics</td>
<td>111 (54.1%)</td>
<td>21 (10.2%)</td>
<td>73 (35.6%)</td>
</tr>
<tr>
<td>10. I believe that antibiotics can reduce symptoms of a cold.</td>
<td>61 (29.8%)</td>
<td>85 (41.5%)</td>
<td>59 (28.8%)</td>
</tr>
<tr>
<td>11. I believe that antibiotics can prevent complications of a cold.</td>
<td>54 (26.3%)</td>
<td>89 (43.4%)</td>
<td>62 (30.2%)</td>
</tr>
<tr>
<td>12. I expect to be prescribed antibiotics by a doctor when I get a cold.</td>
<td>64 (31.2%)</td>
<td>104 (50.7%)</td>
<td>37 (18.0%)</td>
</tr>
<tr>
<td>13. I expect to receive antibiotics from a drug store when I get a cold.</td>
<td>62 (30.2%)</td>
<td>102 (49.8%)</td>
<td>41 (20.0%)</td>
</tr>
</tbody>
</table>
Patients’ knowledge of antibiotic use in the community is presented in Table 6.5. More than half of participants knew that an incomplete course of antibiotics could reduce antibiotic effectiveness (58.5%, n=120) and contribute to AMR (60.0%, n=123). Nearly 60% of participants agreed that antibiotics may cause a drug allergy (59.0%, n=121). However, 97.1% (n=199) of participants indicated that they would like more information about the best way to use antibiotics.

Table 6.5 *Patients’ knowledge about antibiotic use* in the community (n=205)

<table>
<thead>
<tr>
<th>Attitudes and perceptions</th>
<th>Disagree or Strongly disagree</th>
<th>Neutral/Unsure</th>
<th>Agree or Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. I believe that an incomplete course of antibiotics can reduce its effectiveness.</td>
<td>7 (3.4%)</td>
<td>78 (38.0%)</td>
<td>120 (58.5%)</td>
</tr>
<tr>
<td>16. I believe that an incomplete course of antibiotics can contribute to antibiotic resistance.</td>
<td>1 (0.5%)</td>
<td>81 (39.5%)</td>
<td>123 (60.0%)</td>
</tr>
<tr>
<td>17. I believe that antibiotics may cause a drug allergy.</td>
<td>0 (0.00%)</td>
<td>84 (41.0%)</td>
<td>121 (59.0%)</td>
</tr>
<tr>
<td>18. I want to have more information regarding the best way to use antibiotics.</td>
<td>1 (0.5%)</td>
<td>5 (2.4%)</td>
<td>199 (97.1%)</td>
</tr>
</tbody>
</table>

6.1.4 Sources of information regarding antibiotic use in the community

The sources of information patients used regarding antibiotic use in the community are shown in Figure 6.1. Participants reported that they normally received information about antibiotic use from doctors (n=139, 67.8%), drug store staff (n=60, 29.2%) and nurses (n=35, 17.1%).
6.1.5 Patient participation in AMS during hospital admission

Patients’ responses to questions regarding participation in AMS during hospital admission are presented in Table 6.6. More than half the participants did not expect to receive antibiotics while in hospital (61.0%, n = 125) or were ambivalent regarding receiving intravenous antibiotics (55.1%, n=113) during their hospital care. The majority of participants believed intravenous antibiotics were stronger than oral antibiotics (84.9%, n=174). During hospital admission, 97.6% (n=200) of participants reported that they would not ask relatives to buy antibiotics from outside the hospital and the majority (74.6%, n=153) were afraid of getting an infection from multidrug-resistant organisms.

The majority of participants wanted to tell doctors or nurses about antibiotics that they have taken previously (96.1%, n=197) and wanted to know if they were receiving antibiotics during their hospital admission (91.2%, n=187). Further, the majority of participants also wanted information about the reason for (91.7%, n=188), the duration (92.2%, n=189) and possible side effects of antibiotics (95.6%, n=196).
Table 0.6 *Patient participation in antibiotic use and AMS during hospital admission*  
\( (n=205) \)

<table>
<thead>
<tr>
<th>Attitudes and perceptions</th>
<th>Disagree or Strongly disagree</th>
<th>Neutral/Unsure</th>
<th>Agree or Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>19. I expect to receive antibiotics.</td>
<td>18 (8.8%)</td>
<td>125 (61.0%)</td>
<td>62 (30.2%)</td>
</tr>
<tr>
<td>20. I expect to receive intravenous antibiotics.</td>
<td>22 (10.7%)</td>
<td>113 (55.1%)</td>
<td>70 (34.1%)</td>
</tr>
<tr>
<td>21. I believe that intravenous antibiotics are stronger than tablets.</td>
<td>11 (5.4%)</td>
<td>20 (9.8%)</td>
<td>174 (84.9%)</td>
</tr>
<tr>
<td>22. I would ask my relatives to buy an antibiotic from outside if doctor does not prescribe it for me.</td>
<td>200 (97.6%)</td>
<td>3 (1.5%)</td>
<td>2 (1.0%)</td>
</tr>
<tr>
<td>23. I expect to be asked by doctors and/or nurses about antibiotics that I’ve taken in the past year.</td>
<td>3 (1.5%)</td>
<td>5 (2.4%)</td>
<td>197 (96.1%)</td>
</tr>
<tr>
<td>24. I would tell the doctor/nurse if my relatives bring antibiotics from outside to me.</td>
<td>7 (3.4%)</td>
<td>4 (2.0%)</td>
<td>194 (94.6%)</td>
</tr>
<tr>
<td>25. I want to tell the doctor/nurse about antibiotics that I have taken recently.</td>
<td>3 (1.5%)</td>
<td>5 (2.4%)</td>
<td>197 (96.1%)</td>
</tr>
<tr>
<td>26. I want to know whether I’m receiving antibiotics.</td>
<td>4 (2.0%)</td>
<td>14 (6.8%)</td>
<td>187 (91.2%)</td>
</tr>
<tr>
<td>27. I want to know the reason why I have to take antibiotics.</td>
<td>4 (2.0%)</td>
<td>13 (6.3%)</td>
<td>188 (91.7%)</td>
</tr>
<tr>
<td>28. I want to know how long I have to take antibiotics.</td>
<td>3 (1.5%)</td>
<td>13 (6.3%)</td>
<td>189 (92.2%)</td>
</tr>
<tr>
<td>29. I am afraid of getting multi-drug resistant infections that may be difficult to treat.</td>
<td>18 (8.8%)</td>
<td>34 (16.6%)</td>
<td>153 (74.6%)</td>
</tr>
<tr>
<td>30. I want to know the side effects of antibiotics that I am taking.</td>
<td>2 (1.0%)</td>
<td>7 (3.4%)</td>
<td>196 (95.6%)</td>
</tr>
</tbody>
</table>
6.2 Nurses’ perspectives on patient participation in AMS

Nurses’ perspectives of patient participation in AMS were drawn from the nurse participants in the organisational leader interviews and focus groups with clinical nurses and infection control nurses (described in detail in Chapter 4).

6.2.1. Nurse participant characteristics

The total number of nurse participants in the interviews and the focus groups was 24 (Table 6.7). There were six nurse participants in the organisational leader group and 18 nurses in the three focus groups. The interviewed participants consisted of the Director of Nursing, nurse manager of the IPC department, infection control specialists (2), nurse manager in operating room (1) and nurse manager in ICU (1).

The three different groups of nurses who participated in the focus group discussions were: seven infection control nurses; five senior nurses and six junior nurses. The participants in the senior and junior nurse group were working in either the medical or surgical wards at the hospital. Senior nurses had more than 10 years’ experience in nursing and junior nurses less than three years.

Table 0.7 Participant Categories: Individual interviews and focus group (N=24)

<table>
<thead>
<tr>
<th>Categories</th>
<th>Number of interviews/ Focus groups</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual interviews</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Focus group</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Total interviews</td>
<td>9</td>
<td>24</td>
</tr>
</tbody>
</table>

The analysis of interview and focus group data identified nurses’ perspectives in relation to patients’ understanding of antibiotic use in the community and in hospital.

6.2.1.1 Patient participation in AMS in the community

Nurse participants perceived patient participation in antibiotic decision making in the community as having a negative impact on antibiotic use because of
the interrelated problems of antibiotic availability without prescription and their perceptions that patients had very little understanding of appropriate antibiotic use.

Because antibiotics are available over the counter in Thailand, Thai people can access antibiotics without a formal prescription. Over the counter availability of antibiotics raised concerns about inappropriate community antibiotic use by patients. One nurse stated that

“In our country we can buy drugs at the drugstores. A seller does not give a proper recommendation. If patients want antibiotics, they would sell them without asking about the condition or indication for use, so this causes excessive and irrational antibiotic use [by consumers in the community].” (JRN2)

Nurse participants perceived that patients’ knowledge regarding antibiotics and antibiotic use was poor and that lack of knowledge was a major factor influencing patients’ behaviours related to antibiotic use. Perceived poor knowledge included misconceptions about the indications for antibiotic use, patient expectations of the effect of antibiotics and poor adherence to antibiotic treatments. These knowledge deficits were expected to affect the quality of patient decision making related to antibiotics and hinder effective patient participation in AMS in the Thai community.

“When they [consumers in the community] have flu, they buy medicines themselves without knowing whether they are infected with a virus or bacteria.” (ICN4)

“[A] friend of mine told me that when she had flu, [she] went to see a doctor at a clinic because she wanted antibiotics.” (ICN5)
“I’ve had an experience with a high-class patient and his/her relatives. The patient asked for strong or imported antibiotics because he/she could afford the medical fee and wanted to fully use his/her right [to the most advanced treatments] (SRN2)

“And when they [patients] feel better, they instantly stop taking medicines without taking it for the full course.” (ICN4)

6.2.1.2 Patient participation in AMS during hospitalisation

Patient participation in antibiotic use during hospitalisation was considered an important element of AMS. Nurses described patients’ involvement in ensuring the safe administration of antibiotics and in the appropriate use of antibiotics once patients are discharged from hospital.

Nurse participants perceived that patients did participate in AMS while in hospital, both during the hospital admission period and also at the point of discharge. During hospitalisation, patient participation was seen as one element in the safe use of antibiotics use by providing a history of drug allergies on first admission,

“Nurses always ask patients about their history of drug allergy when they are admitted to a ward. We don’t know if patients have a history of drug allergies. So our role is to ask both patients and their relatives.” (SRN3)

and by reporting any side-effects of antibiotic use. Nurses described the importance of informing patients having antibiotics about the possible side effects and hypersensitivities of antibiotics and that this information would enable patients to participate in AMS by self-monitoring for signs and symptoms of adverse drug reactions and notifying nurses if these occur,
“In surgical wards, most of the antibiotics we use are known to us. We know the side effects of those antibiotics. So, every time we administer them to patients, we inform them about the possible side effects that may occur. So patients can tell us early if they experience these symptoms.” (SRN1)

“For some antibiotics, such as, Amphotericin B, we inform patients about any side effects, like, fever and chills. We confirm with the doctor first if a patient is hypersensitive to that antibiotic. .... Nurses must know patients’ histories and cooperate with pharmacists and doctors at all times.” (JRN6)

Patient participation in the use of antibiotics was also considered an element in discharge planning. Nurses described their role in educating patients in appropriate infection prevention and control practices and appropriate antibiotic use in the community. Nurses provide education to patients and their carers about how they can prevent AMR in the community through strategies such as hand hygiene.

“Before discharge, if patients have an antimicrobial resistant infection, we [nurses] educate them about how to prevent the spread of antibiotic resistance in the hospital. Before they go home, nurses educate patients and their carers again about basic infection prevention control such as, washing hands and wearing gowns.” (JRN4)

Nurses also noted the importance of ensuring that patients have a good understanding about antibiotic use at discharge from acute care. Nurse participants reported educating patients to complete their antibiotic course once at home, avoid buying antibiotics at drug stores and to see a doctor at the hospital if they were feeling unwell. In addition nurses perceived that patients could participate in AMS if they understood their antibiotic treatment regimen.
“In terms of educating patients at discharge, we [nurses] always educate patients to complete antibiotics that they are prescribed from the hospital and inform patients not to buy antibiotics themselves. Some patients have the misunderstanding that they have to take antibiotics until the appointment date so they buy antibiotics from drug stores to continue taking antibiotics.” (SRN2)

“When give advice to patients about taking antibiotics at home, we insist that they must complete the course of antibiotics. They cannot decide to stop taking it [the antibiotic course] themselves because it may result in antimicrobial resistance.” (JRN1)

“We remind patients before they are discharged that if they feel sick, they have to see a doctor and not buy antibiotics or other medications themselves.” (JRN3)

6.3 Discussion

Patients’ beliefs, attitudes and expectations about the utility of antibiotics during episodic illness are known factors in influencing antibiotic prescribing. In Thailand, availability of antibiotics for consumers without health professional involvement is an additional potential influence that underscores the importance of involving patients in antibiotic decision-making and providing education for patients and families in optimal antibiotic use. This phase of the research provides another dimension to our understanding of the contextual influences on antibiotic use in Thailand and informs AMS activities when patients are admitted to hospital.

The patient survey findings confirmed the high use of antibiotics in the Thai community, misconceptions about the utility of antibiotics in viral illness, and the frequency of patients acquiring antibiotics without health professional involvement. The majority of patients however, did want to know more about safe use of
antibiotics and did fear acquiring antimicrobial resistant organisms, indicating a readiness to be better informed about safe use of antibiotics.

Nurses were aware of the risks associated with the availability of antibiotics in the community and patients’ access to antibiotics without health professional involvement. Nurse were also supportive of patient participation in the safe use of antibiotics during treatment in hospital and recognized their role in ensuring that patients had a sound understanding of the principles of safe continuation of antibiotic treatment once patients are discharged from hospital care.

**6.3.1 Patients’ attitudes and behaviors towards antibiotic use in the community**

Reported previous antibiotic use was high with 69.8% of patients reporting that they had used antibiotics at least once in the past year. In leader interviews and focus groups, nurses identified the easy access to antibiotics for Thai people without the need for a formal prescription and that this contributes to excessive and inappropriate antibiotic use. Antibiotics are the most commonly used medication worldwide (Grosso, Marventano, Ferranti, & Mistretta, 2012). Previous studies conducted in community settings such as Qatar, Syrian Arab Republic, Mongolia and India have also reported the widespread use of antibiotics (Barah & Gonçalves, 2010; Kotwani & Holloway, 2011; Moienzadeh, Massoud, & Black, 2017; Togoobaatar et al., 2010). Indeed, antibiotics are the most sold medications in developing countries (Cagri Buke, Ermertcan, Hosgor-Limoncu, Ciceklioglu, & Eren, 2003). There are many countries including Thailand that allow the purchase of antibiotics over the counter without prescription (Apisarnthanarak et al., 2008; Kagashe et al., 2011; Morgan et al., 2011a). In this study, 70.2% of patients reported that they had purchased antibiotics from drugstores when they had a cold. The reasons that people buy antibiotics from drugstores needs further investigation, but it is likely that decisions to buy antibiotics without prescription are related to convenience, cost and rapid service delivery (Smith, 2009).
The misconception that antibiotics are useful for treating viral infections is a problem because it is a leading cause of AMR. In our study, patients reported that the most common reasons to take antibiotics were for viral infections (40.0% for cold, 24.9% for respiratory tract infections and 9.3% for gastroenteritis). This was recognised by the nurse participants who discussed patients’ misunderstandings about the use of antibiotics to treat colds and lower respiratory tract infections. Misconceptions that antibiotics are needed for viral illnesses have also been reported in previous studies. For example, the European Commission (EC) found that colds and flu were among the top five leading reasons for taking antibiotics (EC, 2013). A public survey related to beliefs about antibiotics and respiratory tract infections in the Netherlands, found that almost half of all responders (47.8%) believed that antibiotics can treat viral infections (Cals et al., 2007). Also, a public survey by WHO regarding widespread public misunderstanding about antibiotic resistance across 12 countries reported that 65% of respondents incorrectly believed that colds and flu can be treated with antibiotics (WHO, 2015a).

Patients’ level of knowledge and perceptions about antibiotic therapy have been linked to the unnecessary use of antibiotics particularly in primary care (Edgar et al., 2009b). Promoting awareness of antibiotic use and antibiotic resistance amongst health professionals and the public is one strategy to decrease inappropriate antibiotic use (Sabuncu et al., 2009; Sumpradit et al., 2012a). Public campaigns about antibiotic use create social norms and increase public understanding of the consequences of inappropriate antibiotic use (Pinder, Sallis, Berry, & Chadborn, 2015). There are several campaigns promoting appropriate antibiotic use in both hospitals and the community across the world (Earnshaw et al., 2009; Sumpradit et al., 2012a). For example, in the USA, ‘The Get Smart program’ was initiated in response to the problem of AMR and promotes appropriate antibiotic prescribing and decreased use of antibiotics for conditions commonly treated in the community or ambulatory care settings (CDC, 2017a).

A public campaign for ‘appropriate antibiotic use’ in Korea was launched using posters, e-learning programs and mass media campaigns (Chung & Song,
The European Antibiotic Awareness Day in Europe takes place annually on the 18th of November to increase public awareness of AMR and responsible antibiotic use (ECDC, 2017). The ‘Antibiotic Guardian Campaign’ was developed in the United Kingdom to increase people’s commitment to reducing AMR by providing knowledge through an online pledge system (Kesten, Bhattacharya, Ashiru-Oredope, Gobin, & Audrey, 2017). Public campaigns for improving the use of antibiotics in outpatients in high-income countries have been associated with positive outcomes, namely reduced antibiotic use (Huttner, Goossens, Verheij, & Harbarth, 2010).

In Thailand, Antibiotics Smart Use (ASU) was a major public campaign, introduced in 2007. The ASU program was initiated to promote rational antibiotic use in district hospitals and primary health centres in Thailand. After demonstrating initial effectiveness in one province, the ASU project has since been expanding across the country (Sumpradit et al., 2012a). As a consequence, the ASU project has been approved as a practical project to decrease antibiotic use in a series of pilot communities in Thailand. However, misconceptions about antibiotic use are still reported in the Thailand (Saengcharoen et al., 2012) and in this study. To improve the public’s knowledge of appropriate antibiotic use, multisectorial collaboration between bodies such as Ministry of Public Health and Ministry of Agriculture for national action plans on the AMR issue is needed. Additionally, further monitoring and sustainability of the AMS campaign along with intermittent evaluation of antibiotic awareness in Thai people needs to be continued.

In our survey, patients’ knowledge about antibiotics in general was moderate. Patients knew that antibiotics might cause a drug allergy (59.0%) and that an incomplete course of antibiotics could reduce antibiotic effectiveness (58.5%) and contribute to AMR (60.0%). Nurses’ perceptions were that patients’ knowledge regarding antibiotic use was suboptimal and that poor adherence to antibiotic treatments was a major contributor to the development of AMR in Thailand. These findings are similar to a previous study in Thailand that reported 66% of participants knew that unnecessary use of antibiotics causes AMR (Saengcharoen et al., 2012). However, 97.1 % of patients in this Phase 3 study, wanted more information
regarding the best way to use antibiotics. Patients also reported that in the community, they relied on doctors, drugstores, nurses and pharmacists for antibiotic information. Patients’ desire for information about optimal antibiotic use in this study suggests that although patients are talking to health professionals, they may not be receiving adequate information.

Patient’s reported antibiotic use in the community showed that their management of antibiotic use was reasonable. Most patients reported that they did not share antibiotics (82.0%) and did not stockpile antibiotics (76.6%). These specific findings were similar to those in a previous Thai study where 64.2 % and 69.2% of participants reported that they did not share and stockpile antibiotics respectively (Porisutiwutiporn & Hemchayat, 2014a). One possible explanation is that antibiotics are cheap and easy to get in Thailand and therefore stockpiling is not necessary.

Findings of previous studies have shown that in low and middle-income countries (LMIC), pharmacy practices is suboptimal because of limitations in professional practices regarding advice-giving and the supply of medicines along with the lack of availability of trained staff (Smith, 2009). In Thailand, although pharmacists typically own the drugstores, relatives or employees who are not formally qualified, work in the business and provide consumers with advice and information. There is also the problem of a potential conflict of interest, where high sales rather than provision of information about the appropriate care of different conditions may be a priority.

### 6.3.2 Patient participation in AMS during hospital admission from patients’ and nurses’ perspectives

During hospitalisation, patients were unsure whether they wanted antibiotics. However, patients reported that if they do have antibiotics, they would prefer intravenous antibiotics with 84.0% of participants believing that intravenous antibiotics are stronger than oral antibiotics. Evidence shows that the oral and injection forms of some antibiotics such as amoxicillin have equal effectiveness (Addo-Yobo et al., 2004; Lodha, Randev, & Kabra, 2016) and empowering patients in shared decision-making about treatments has positive outcomes (Davey et al.,
For example, informing parents about how to choose intravenous or oral therapy for their children promoted higher satisfaction, and oral therapy was more likely if parents were involved in shared decision making (Rosati et al., 2014). Promoting shared decision-making by training family physicians has also been shown to decrease antibiotic use (Legare et al., 2013; Legare et al., 2011b). Therefore, informing patients about the relative effectiveness of oral and intravenous antibiotic treatment accompanied by encouraging shared decision-making between clinicians and patients is suggested as a strategy to increase patients’ knowledge of antibiotic use and promote patient satisfaction.

During hospital admission, patients expected healthcare professionals to control antibiotic use. One possible explanation is that Thai patients have a high level of trust in health professionals and believe that they should not question their treatment plan. Other studies have found that patients have a high degree of trust and confidence in physicians to prescribe appropriate antibiotics (Heid et al., 2016). Further, patients have not been found to be concerned about potential adverse effects (such as developing a resistant infection or experiencing side-effects of treatment) as a result of inappropriate use of antibiotics (Heid et al., 2016). However, blind trust in healthcare professionals might result in patients not questioning the prescribed treatment plan or being fully aware of potential adverse effects associated with antibiotic treatment (Kraetschmer, Sharpe, Urowitz, & Deber, 2004). If patients rely on health professionals to control and monitor their antibiotic use some side effects of treatment may go unreported and patients cannot participate in monitoring their own safety if they are not aware of their treatment program.

In this study, patients wanted more information during their hospital admission, about antibiotic use including the reason and duration of treatment, and potential side effects. Previous studies have shown similar findings. For example, patients have indicated wanting to review their hospital medication list for accuracy because this could potentially reduce medication errors (Cumbler, Wald, & Kutner, 2010). Patients who are informed about the pros and cons of each medication and
have a high degree of involvement in decision making are still likely to agree with their doctor’s decision (Heid et al., 2016). There is emerging evidence that empowering patients to share decision-making can lead to positive outcomes including attitude change and behaviours conducive to appropriate antimicrobial therapy, and reduction in the development of AMR (Davey et al., 2002).

Nurse participants in this study perceived that patient participation in AMS was about patient safety in antibiotic administration rather than shared decision-making in antibiotic use. Nurses stated that informing patients about possible hypersensitivities during antibiotic administration along with educating patients about IPC and appropriate antibiotic use in the community was major element of patient participation in AMS. Patient participation is the involvement of patients in decision-making processes in relation to health concerns in order to promote patient safety (Longtin et al., 2010, p. 54; Rathert et al., 2011). Our results show that nurses were playing an active role in educating patients however there was no evidence that nurses actively engaged patients in shared-decision making about their treatment choices. Previous studies have also identified that nurses fail to enable true patient participation in health care by eliciting patient preferences for participation. In Sweden, a study of patient participation in clinical decision-making showed that nurses perceived that patients preferred to be more active in clinical decision-making about nursing care whereas patients preferred to have a passive role in nursing care. Misinterpreting patient preferences by nurses in this Swedish study was seen as a barrier in engaging patients and meeting their needs regarding communication and pain management (Florin, Ehrenberg, & Ehnfors, 2006). Similarly, an Australian study of patient participation in medication management found that nurses provided insufficient opportunities to engage patients in medication management during hospital admission (McTier, Botti, & Duke, 2015). The authors concluded that during an acute care admission, providing opportunities for patients to engage in medication management by nurses is needed to support quality and patient safety care.
A systematic review on the barriers and facilitators to implementing shared decision-making in clinical practice as perceived by health professionals, concluded that lack of time was the major barrier to patient participation in shared decision-making (Legare, Ratte, Gravel, & Graham, 2008). However, provider motivation and promotion of the positive impacts of shared decision-making on clinical care and patient outcomes have been suggested as strategies to overcome the problem of time constraints to shared decision-making (Legare et al., 2008). Therefore, educating clinicians about potential positive patient outcomes of participation may be a useful strategy to increase patient participation and nurses’ role in patient participation in AMS.

6.4 Chapter summary

The findings presented in this chapter detail patients’ attitudes and reported behaviours towards antimicrobial use in the community and patient participation in AMS from patients’ and nurses’ perspectives. In the Thai community, patients and nurses confirmed the common use of antibiotics and the misconceptions associated with their use. Patients appeared to rely on health professionals for information about antibiotic use in the community and wanted more information about the best way to use antibiotics. When in hospital, patients expected health professionals to control antibiotic use although patients did want to participate in AMS-related activities. Nurses perceived that encouraging patients to monitor their safety during antibiotic use and educating patients about antibiotic use and side effects were strategies to support patient participation in AMS. Further work is required to develop strategies for more active patient participation and shared decision-making regarding antibiotic use involving clinicians, patients and families.
Chapter 7
Nurses’ Role in Antimicrobial Stewardship

In this chapter, the analyses of the interviews and focus group data related to the role of nurses in AMS are presented in three major sections in line with the objectives of this component of the research.

Aim and objectives

The fourth specific aim of this research program was to explore how key stakeholders and nurses perceive potential future roles for nurses in AMS in Thailand within the current governance, educational and practice context. The specific objectives were to:

I. Describe the current roles of nurses in AMS.
II. Identify perceived barriers and facilitators to nurses taking a broader role in AMS.
III. Explore the potential roles of nurses in AMS.

7.1 Methods

The methodological approach used in this research program is described in detail in Chapter 3. Organisational executive and clinical leaders involved in AMS programs (referred to as organisational leaders, or leaders), ICNs and clinical nurses were invited to participate and a combination of semi-structured interviews (key stakeholders) and focus groups (ICNs and clinical nurses) were used to explore concepts related to the roles of nurses in AMS. The full interview guide is available in Appendix A and B.

7.2 Findings

The findings are presented in the following sections: i) the current role of nurses in AMS, ii) the perceived barriers and facilitators to nurses taking a larger role in AMS and iii) the potential role of nurses in AMS.
7.2.1 Participant characteristics

The combined number of participants in the interviews and the focus groups was 33 (Table 7.1). There were 15 individual leader interviews and three focus groups conducted. The interviewed participants consisted of the Director of the hospital, the Director of Nursing, the Director of Pharmacy, the Chair of the IPC committee, the nurse manager of the IPC department, infection control specialists (n=2), surgeons (n=2), an ID specialist, the nurse manager of the operating room, the nurse manager of the ICU, AMS and clinical pharmacists (n=2) and the Head of the Virology Department.

The three different groups of nurses who participated in the focus group discussions were: seven participants from the infection control nurse group, five participants in the senior nurse group and six participants in the junior nurse group. The participants in the senior and junior nurse groups were working in either the medical or surgical wards in the hospital. The senior nurses had over 10 years’ experience in nursing and the junior nurses less than three years.

Table 7.1 Data collection: Individual interviews and focus groups (N=33)

<table>
<thead>
<tr>
<th>Data Collection</th>
<th>Method (n)</th>
<th>Participants (n)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Focus group</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>33</td>
</tr>
</tbody>
</table>
7.2.2 Current roles of nurses in antimicrobial stewardship

Thematic analysis of the interview and focus group data identified five themes reflecting areas of activity in which nurses currently participate in AMS: i) supporting system processes, ii) monitoring for safety, iii) monitoring for optimal antibiotic use, iv) patient education and v) AMS leadership by specialty nurses. The data are presented in Summary Table 7.2 according to stakeholder or focus group respondents.

Theme 1. Supporting system processes

The majority of participating clinical nurses identified the role of nurses in supporting system processes in AMS. Related activities included identification and documentation of patient allergies, monitoring for signs of infection, alerting doctors to microbiology results to prompt treatment, and promoting timely review of antibiotic sensitivity reports. Clinical nurses reported that one of their roles in AMS was to ensure that patients’ allergies to antibiotics were recorded on the hospital database when patients were admitted to the hospital. When a patient’s drug allergy history was identified for the first time, nurses not only reported this to the patients’ treating doctors but also liaised with the ward pharmacists to investigate the type of allergic reaction and record this on the hospital database (Table 7.2, Q1).

During hospital admission, nurse participants in the clinical nurse and leader groups identified nurses’ role in further supporting system processes by monitoring patients for signs of infection, along with reviewing culture results and antimicrobial sensitivities. For example, for postoperative patients, if patients exhibited signs of infection nurses would alert the treating doctor so that a septic work up could be performed (Table 7.2, Q2). In terms of timely review of cultures, in the hospital ICU and high dependency wards, nurses described a proactive process in which they established a schedule to systematically track what specimens had been collected and when the culture results became available for review (Table 7.2, Q3). Both senior and junior nurses described processes nurses used to expedite review of microbiological data by printing out patients’ microbiology results as a hard copy and
putting these in the patients’ charts to remind doctors to consider or review the current antibiotic treatment regimen or by contacting the Microbiology Unit directly if reports of results were delayed (Table 7.2, Q5). Nurses described strategies to prompt review of prescribed antimicrobials and reported microorganism sensitivities by printing out results and highlighting if the current microorganism was not sensitive to the prescribed antibiotic. (Table 7.2, Q4).

Theme 2. Monitoring for safety

The majority of clinical nurses identified that nurses have current roles in monitoring for safety in antibiotic use. Ensuring patients’ drug allergies are documented when patients are admitted to the ward, monitoring for side effects and hypersensitivity reactions to antibiotics during administration, and identifying antibiotic side effects in specific populations were current roles of nurses in AMS.

Monitoring patients for hypersensitivity reactions during IV antimicrobial administration was also a current nurses’ role in AMS. The junior nurse participants were the major group to identify the AMS role of monitoring patient safety during antibiotic administration. These activities involved ensuring that when patients were admitted to the ward, their drug allergies were recorded and, during antibiotic administration, nurses monitored patients for any effects associated with antibiotic therapy. Junior nurses reported that asking a patient about their medical history, previous drug allergies or adverse drug reactions was one of the most critical pieces of information in nursing care planning for individual patients. Clinical nurses would review patients’ past history of drug allergies on admission and notified doctors immediately if patients informed them of previous allergies or sensitivity reactions to antibiotic therapy (Table 7.2, Q6). Monitoring of routine antibiotic orders was considered important because if information about patients’ allergies was missed this could lead to patient harm. For example, some doctors may routinely prescribe prophylactic antibiotics and could miss patients’ history of allergic reactions to the prescribed antibiotics (Table 7.2, Q7).

Nurse participants also identified the importance of educating and informing patients about their antibiotic treatment as a nurses’ role in AMS. Informing patients
about possible side effects of antibiotics was identified as an important process to prevent unintended events and support patient engagement in AMS (Table 7.2, Q8). One junior nurse participant gave an example of concerns raised by nurses related to specific antibiotic side-effects and the policy and practice changes that occurred to ensure safer administration of antibiotics (Table 7.2, Q9).

In addition, junior nurse participants reported that nurses play an active role in monitoring for antibiotic side effects in specific patient populations or for some specific antibiotics. Nurses coordinate with other professionals such as doctors and pharmacists to ensure the safe administration of antibiotics (Table 7.2, Q10-Q11). A pharmacist also confirmed that nurses play an active role in safety monitoring for adverse effects when administering antibiotics (Table 7.2, Q12).

Theme 3. Monitoring for optimal antibiotic use

Participants in both key stakeholder and clinical nurse groups identified nurses’ roles in monitoring antibiotic prophylaxis, antibiotic timeout and switching from IV to oral therapy to support optimal antibiotic use. Nurse participants highlighted their role in evaluating patients’ need for ongoing treatment after antibiotic initiation. Monitoring patients’ antibiotic use by checking doctors’ progress notes in patient charts was identified as a routine nurses’ role in AMS to ensure that doctors’ treatment plans were being followed (Table 7.2, Q13). For some specific antibiotics commonly used for surgical prophylaxis, clinical nurses would question if antibiotics had been used for more than 24 hours and whether the treatment should be ceased (Table 7.2, Q14).

In terms of participating in antibiotic timeout, clinical nurses monitor current antibiotic therapy and remind prescribers to review treatment for the therapeutic duration (Table 7.2, Q15). A doctor stakeholder also recognised that nurses play a vital role in antibiotic timeout because nurses work consistently with patients and are aware of their patients’ longer-term treatment plan and the therapy they have already received (Table 7.2, Q16). Moreover, participants from key stakeholder and clinical nurse groups perceived that a number of nurses, particularly senior staff, played a role in ensuring that the switch from the IV to oral route of antibiotic
administration occurred at the appropriate time. For example, on the surgical wards, nurses would ask doctors to switch from the intravenous (IV) to oral route once patients were able to tolerate oral intake postoperatively (Table 7.2, Q17). Clinical nurses’ awareness of the importance of switching antibiotic therapy from IV to oral was also acknowledged by the clinical pharmacists. One pharmacist participant recognised the importance of this role and that nurses were taking the lead in ensuring that this principle was implemented in practice (Table 7.2, Q18).

Theme 4. Patient education

Participants in the clinical nurse group, particularly junior nurses, identified that patient education was an important role nurses play in AMS. During hospitalisation, nurses inform patients about the reason antibiotics are prescribed along with the possible side effects of their treatment (Table 7.2, Q19). In terms of IPC practice, doctor and nurse participants recognised nurses’ role in educating and modeling IPC practices to ensure that patients and family members were aware of processes to prevent infection appropriately in the hospital and on their discharge home (Table 7.2, Q20-Q21).

Educating patients and their caregivers about appropriate use of prescribed antibiotics once patients are discharged from hospital was also recognised as a nurses’ role. This education includes the need to complete an antibiotic course, when that course is complete, the side effects of antibiotics (Table 7.2, Q22-Q24), and the importance of reporting the symptoms of adverse effects to their treating doctor (Table 7.2, Q25).

Theme 5. AMS leadership by specialty nurses

This theme relates to the expanded and advanced roles of specialty nurses related to the supportive and monitoring roles identified in the previous themes. The activities of nurses described in this theme build on the recognised current roles of nurses described above, however specialty nurses act as clinical leaders, their activities are supported by a greater knowledge base and they are seen to actively (or explicitly) contribute to the AMS team.
Leaders and clinical nurse groups discussed the leadership and team roles of nurses within some specialty areas such as ICU and those of Infection Control Nurses and senior nurses in remote or provincial areas. Because ICU wards provide care to patients with high acuity and the standard nurse-patient ratio is 1:1, nurses were seen to have an important role in AMS. The ICU medical team in being based within the unit, spent less time outside the unit compared to other medical teams who review patients on wards throughout the hospital. Nurses and doctors therefore work closely together and there is a stronger sense of teamwork within the ICUs; a doctor participant stated that “The relationship between doctors and ICU nurses is quite good, we work like colleagues” (D3). Doctor participants further identified ICU nurses’ contribution to the AMS program in developing the infection surveillance protocol and as having a key role in monitoring patients with severe infections along with supporting appropriate antibiotic use within the ICU (Table 7.2, Q26). Additionally, senior nurses in ICU wards who have many years of experience were recognised as providing prescribing advice when clinical pharmacists were not available (Table 7.2, Q27).

Infection Control Nurses’ advanced practice roles in AMS were addressed by both doctor and ICN participants in terms of ongoing surveillance, support and education. ICNs were recognised by doctor participants as the central repository of knowledge regarding AMR across the hospital (Table 7.2, Q28) who regularly discuss issues related to optimal antibiotic use with doctors, in particular, congruity between sensitivity results and antibiotics prescribed (Table 7.2, Q32-Q33). ICNs reported that their expertise was demonstrated by such activities involved in consulting with doctors and nurses, as knowledge providers and as role models for ward nurses in AMS whereby nurses can develop their communication skills related to AMS by using the ICNs as role models (Table 7.2, Q34-Q35). Further, ICN participants reported that when ward nurses have an issue or concerns about AMR or AMS, they would often consult ICNs first, before discussing their concerns with the doctors (Table 7.2, Q29-Q30). ICNs provide training courses relating to IPC and AMR for nurses across the hospital (Table 7.2, Q31).
A small number of participants in the key stakeholder group spoke about the substantial role that nurses in provincial hospitals played in AMS. One doctor participant noted that because the provincial hospitals have fewer ID specialists, ICNs or senior nurses played an important role in encouraging rational use of antibiotics in their hospitals (Table 7.2, Q36). Another leader participant also confirmed that nurses in provincial hospitals perform a vital extended role in antiviral medication management. It is important to note that these nurses were recognised as having high-level competence and, because the turnover rate of doctors in these provincial centers is high, nurses manage antiviral medications as prescribers (Table 7.2, Q37).
Table 7.2 Current roles of nurses in antimicrobial stewardship in acute healthcare in Thailand – themes, subthemes and exemplar quotes

<table>
<thead>
<tr>
<th>Themes</th>
<th>Subthemes</th>
<th>Organisational leaders</th>
<th>ICNs/ Clinical nurses</th>
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<tr>
<td>(1) Supporting system processes</td>
<td>Ensuring patient allergies are recorded on the hospital database</td>
<td><strong>Q1</strong> “When asking about medical history of patients, if patients have a history of drug allergy, we ask for a drug allergy card and if they don’t have it, we put a record in the database and request the pharmacist to do an assessment and also handover this information to nurses in the next shift.” (JRN6)</td>
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<td></td>
<td>Monitoring signs of infection and timely review of cultures</td>
<td><strong>Q2</strong> “If a patient has a fever after the operation, we [nurses] report to a doctor to see whether a doctor wants to do a septic work up and reconsider antibiotic use.” (JRN4)</td>
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<td>Printing out microbiology results to prompt doctors</td>
<td><strong>Q3</strong> “Some units have developed a list that includes information about what is the infection, and when it was discovered. They have a form to collect information about the culture results and the date that antibiotics were started. If the antibiotic is insensitive, nurses notify this finding to the doctors.” (N2)</td>
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<td>Timely review of antibiotic sensitivity</td>
<td><strong>Q4</strong> “When we [nurses] receive sensitivity results, we [nurses] print them out and put them on the charts for doctors to easily see. Sometimes if we [nurses] find that the antibiotic is not sensitive to the bacteria, we would mark it with a magic pen to make it obvious to doctors or we discuss it with the doctors straight away.” (JRN2)</td>
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<td><strong>Q5</strong> “We [nurses] make a tracking list for each patient on what date we have obtained microbial cultures and what date the results should be reported. We will make a call to the microbiology unit if the results are not reported on time.” (SRN3)</td>
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| (2) Monitoring for safety   | Identifying patient drug allergies when patients admitted to the ward | Q6 “Nurses always ask patients about their history of drug allergy when they are admitted in a ward. We don’t know if patients have a drug allergy history from outside the hospital or not. So our role is to ask both patients and their relatives. We will caution the doctors right away if they prescribe antibiotics that patients are allergic to.” (SRN3)
|                             | Monitoring for drug allergies and hypersensitivities to antibiotics during antibiotic administration | Q7 “We ask patients’ their history of drug allergy when patients are admitted in the ward. Sometimes a doctor prescribes antibiotic prophylaxis as a routine but that antibiotic is what the patient is allergic to. Nurses have to ask and remind doctors again. It happens quite often that doctors do not ask patients about past drug allergies.” (JRN5)
|                             |                                                     | Q8 “In a surgical ward, most antibiotics are the regular ones we use. We know the side effects of those antibiotics. So, every time we administer them to patients, we inform them about the possible side effects that may occur. So patients can tell us early if they experience these symptoms.” (SRN1).
<p>|                             |                                                     | Q9 “We [nurses] monitor if patients have any adverse events during antibiotic administration. The concern about adverse effects has been increasing because of a previous incident where a patient had a severe allergic reaction to Ceftriaxone via IV push in the Emergency Department. Since this occurred we now give Ceftriaxone via IV drip in 0.9% NSS over 90 minutes. In the medical wards, we have a regulation that IV antibiotic therapy must take at least an hour and that nurses must keep monitoring [the patients] closely for adverse effects.” (SRN3) |</p>
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| (2) Monitoring for safety (cont)            | Monitoring for side effects of antibiotics in special populations | Q10  “For patients who receive particular antibiotics such as patients with kidney disease and are prescribed Vancomycin... We specifically monitor the side effects and coordinate with pharmacists and doctors. If we [nurses] find that the Creatinine blood levels are getting high, we confirm the drug dose with doctors right away.” (JRN4)  
Q11  “Some antibiotics, such as, Amphotericin B, we inform patients about any side effects, like, having fever and chills. We confirm with the doctor first if a patient is hypersensitive to that antibiotic. Doctors will adjust administration times according to the information we give. Nurses must know patients’ information and cooperate with pharmacists and doctors all the time.” (JRN6) |
| (3) Monitoring for optimal antibiotic use   | Monitoring antibiotic prophylaxis              | Q13  “We always read the doctors’ progress notes to see the treatment plans, so that we can monitor how many days doctors prescribe antibiotics or when to stop.” (JRN2)  
Q14  “When doctors keep prescribing antibiotic prophylaxis more than 24 hours for patients who have undergone a surgical procedure, we [nurses] would ask in as polite a way as possible, do you want to give it more than 24 hours for this case? Or were there any complications in the operating room?” (SRN1) |
|                                             | Participate in antibiotic timeout              | Q16  “In our hospital residents rotate to new departments frequently, we found a number of antibiotics were not stopped appropriately during this transitional period. I think no one knows better than the nurses [on the ward] about patients' medications. Nurses know best anyway.” (D5)  
Q15  “We remind doctors such as by asking, this antibiotic will be due for re-prescription soon after 15 days [of therapy], do you want to discontinue?” (JRN1) |
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<td>(3) Monitoring for optimal antibiotic use</td>
<td>Facilitate switching therapy from IV to oral</td>
<td>Q18 “I noticed that when patients are being cared for by student nurses, the clinical nurse educator emphasises the importance of switching antibiotic to oral therapy” (P2)</td>
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<td>(4) Patient education</td>
<td>Educating patients and caregivers about IPC during hospitalisation</td>
<td>Q17 “In changing antibiotics from injection to oral route...we experience this a lot in surgical wards. We always ask the doctors, this patient has now started eating, do you want to change from IV into oral antibiotic?” (SRN1)</td>
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<td>Q20 “At the moment I think, nurses perform the role of IPC practices very well. And that could be a role model for the patients.” (D1)</td>
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<td>Q19 “During antibiotic administration to patients, we inform patients about names and purposes of antibiotics, and what bacterial infections we found. Also when changing antibiotics we also have to tell them. Some drugs, such as, Amphotericin B, we tell the patients about any side effects such as fever and chills.” (JRN 6)</td>
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<td>Q21 “Before discharge, if patients have got antimicrobial resistant infections, we [nurses] educate them on how to prevent the spread of antibiotic resistance in the hospital. Before they are going home, nurses educate patients and their carers again about basic infection prevention control such as washing hands and wearing gowns.” (JRN4)</td>
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<td>Q22 “About educating patients at discharge, we always educate patients to complete antibiotics that they are prescribed from the hospital and inform patients not to buy antibiotics themselves. Some patients misunderstand and think that they have to take antibiotics until the next appointment date so they buy antibiotic from the drug store to continue taking antibiotics.” (SRN2)</td>
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<td>Q23 “When giving advice to patients about taking antibiotics at home, we insist that they must complete the antibiotics prescribed. They cannot stop taking them because it may cause antimicrobial resistance.” (JRN1)</td>
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| (4) Patient education (cont) | Educating patients about appropriate antibiotic use post discharge (cont) | Q24 “Before patients are discharged from the hospital, we work with the pharmacist in giving information about taking antibiotics correctly and reminding them about their history of drug allergy.” (JRN4)  
Q25 “We remind patients before they are discharged that if they feel sick, they have to see a doctor and not to buy antibiotics or other medications themselves.” (JRN3) |
| (5) AMS leadership by specialty nurses | Nurses in ICU: teamwork between doctors and nurses strengthen nurses’ role in AMS | Q26 “In heart surgery in the ICU, now we do surveillance surveys and cultures every three days or 72 hours and follow-up patients in the ICU. The ICU nurses worked with me to design the protocol. They introduced it into routine nursing care and set up the program to follow-up white blood cell (WBC) count every day. When nurses notice that WBCs of patients’ blood test are abnormal, they notify me then take blood for cultures right away”. (D3)  
Q27 “I understand that, at the moment, we do not have a clinical pharmacist working on the pediatric ICU wards, so the nurses play a big role in this context. Particularly, by providing surveillance of culture results, and reminding the clinical team about how many days we have been giving the antibiotics. Especially the senior nurses who know and are familiar with the drug dose, they sometimes ask me “Are you sure?” which is reminding me. I think nurses in the ICU, have a high level of capacity because we have been working together for many years. (D3) |
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| (5) AMS leadership by specialty nurses      | Infection control nurses (ICNs): role in surveillance, support and education | Q28 “Infection control nurses are a source of knowledge about antimicrobial resistance.” (D1)  
Q29 “Ward nurses would ring us [ICNs] when their patients are infected by multidrug resistant organisms. They want to determine whether their patients should be referred to the ID doctor or not.” (ICN5)  
Q30 “In ICU, when we [ICNs] see sensitivity results [for organisms] that are getting close to becoming multidrug resistant organisms, we would talk to nurses to be cautionary.” (ICN6)  
Q31 “We [ICNs] provide knowledge about AMS to ward nurses individually. We [ICNs] also have a training program about basic knowledge in IPC and AMR for nurses throughout the hospital.” (ICN4)  
Q32 “Sometimes we talk to doctors directly if the microbiology results and antibiotics are not matching such as by asking, “Did you see the Lab result?” as a reminder.” (ICN2)  
Q33 “In the morning, we all have to look at the Lab results to see whether the patients have multidrug resistant organism infections. Especially in the ICU ward, we do check whether antibiotics that doctors prescribe are appropriate with the microbiology results or not. If not, we would let a primary nurse know so that ward nurses can inform and discuss this with the doctors.” (ICN4)  
Q34 “When we [ICNs] are playing the role of monitoring and reminding doctors about antibiotic use in the ward, I think, ward nurses could learn the AMS role from us.” (ICN1)  
Q35 “When see microbiology results that are of concern, sometimes we will call the primary nurse first to tell him/her to call the doctor to look at the patient or ask “Is this case where there is a plan to consult with the ID?” In order to motivate a primary nurse to tell case doctors.” (ICN2) |
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<td>5) AMS leadership by</td>
<td>Provincial nurses: advanced and</td>
<td>ICNs/ Clinical nurses</td>
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<td>specialty nurses (cont)</td>
<td>extended roles</td>
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<td>Q36 “They [Provincial nurses] often email me and</td>
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<td>ask me questions about why doctors use particular</td>
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<td>antibiotics. Even in patients with sepsis, the</td>
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<td>ICNs [in provincial hospitals] have a major role</td>
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<td>in setting up protocols to facilitate antibiotics</td>
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<td>being administered on time.” (D1)</td>
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<td>Q37 “In hospitals outside of Bangkok, anti-HIV</td>
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<td>drugs are prescribed by non-physicians. I have</td>
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<td>this impression when I attend meetings in those</td>
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<td>hospitals. Nurse’s role is more like a doctor’s</td>
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<td>role. However, they consult doctors sometimes</td>
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<td>when they are not sure about the treatments.” (L1)</td>
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(D1)
7.2.3 The barriers and facilitators to nurses taking a broader role in antimicrobial stewardship

Throughout the interviews and focus group discussions it was clear that although participants were supportive of nurses’ current roles in AMS and in taking a greater role in AMS in the future, they perceived that there were many barriers to be overcome before this could be fully realised in practice. The specific barriers identified by participants emerged as two major themes: (i) nurses’ role in AMS is not well articulated; and (ii) engagement in AMS-related activities by nurses is inconsistent (Table 7.3).

Theme 1. Nurses’ role in AMS is not well articulated

The majority of the organisational leader participants identified that an important barrier to further developing nurse participation in AMS was the lack of recognition and formal delineation of nurses’ roles in formal AMS policies at the hospital. In addition, traditional professional hierarchies limited active participation of nurses in AMS.

At the time of interview, according to participants, there were no formal policies for AMS much less policies regarding nurses’ participation in AMS programs. Current policies did not include formal performance descriptions for nurses outlining their roles and responsibilities in AMS and participants stated that this impacted on the willingness of frontline nurses to engage in AMS activities (Table 7.3, Q1, Table 7.3, Q3).

Leader participants stated that in order to support and develop nurses’ role in AMS there was needed a formal AMS committee that included nursing representation. It was noted that although the hospital currently had an Antibiotics and Vaccines Working Group whose primary purpose was the selection of which antimicrobials would be available for prescription within the hospital, this team did not currently include a nurse representative. Therefore the perception was that the role of nurses in AMS was not formally recognised within the organisation (Table 7.3, Q2).
A perception held by doctor participants and a pharmacist was that written policy and nursing leadership endorsement of nurses’ participation in AMS would influence nurses’ willingness to participate in AMS programs and increase their understanding of the importance of AMS-related initiatives in the hospital. One doctor participant stated that currently the nursing leadership at the hospital did not recognise that taking a role in AMS was an important aspect of nurses’ responsibilities (Table 7.3, Q4).

Traditional hierarchies and lack of recognition by other health professionals of the potential role nurses could play in AMS was a common thread in discussions by senior executive and nurses, particularly the junior nurses’ group. One doctor participant discussed doctors’ power position in the Thai health service context and that challenging traditional roles for nurses (such as becoming more involved in AMS) would be a major undertaking within this context (Table 7.3, Q5). Similarly, nurse participants also talked about their concerns about crossing boundaries, for example encroaching on pharmacists’ roles, and being respectful to doctors when challenging prescriptions (Table 7.3, Q6). Nurse participants talked about their experiences in clinical units where they had failed to develop their role in AMS because there was a lack of recognition of nurses’ contribution to AMS initiatives (Table 7.3, Q7-Q8). Nurse leaders also emphasised the importance of doctors’ acceptance of nurses’ involvement in AMS programs (Table 7.3, Q9-Q10). If nurses were recognised by other healthcare professionals, nurses would be more active and willing to participate in AMS programs and this would influence antibiotic use in the hospital (Table 7.3, Q10). One senior doctor participant supported the idea of providing nurses with opportunities to engage in AMS programs in the future, “Actually, I think we should work together and further discuss this issue [nurses’ role in AMS].” (D1).

The junior nurse participants suggested that a facilitating strategy to support nurses to engage in AMS activities would be written protocols regarding antibiotic use, for example, switching from IV to oral antibiotic therapy in postoperative care. These protocols would support all nurses but in particular, junior nurses to feel more
comfortable raising questions and prompting treatment with doctors. As one junior nurse stated,

“I work in the cardiovascular ward, sometimes we advise doctors against [prescribing antibiotics]. We have a protocol (in this unit), such as, after removal of an ICC [Intercostal Catheters]…. we also have a protocol for changing antibiotics from injection to oral administration. That makes me brave enough to remind doctors [that it is time to switch]” (JRN4)

Theme 2. Inconsistent engagement in AMS by nurses

Although study participants identified that nurses currently played an important role in AMS as described in Section 7.2.2, engagement in AMS-related activities by nurses was seen to be inconsistent. There were perceptions that AMS-related activities were not a priority in the context of a high workload; existing IT systems were not conducive to engagement, and that inadequate knowledge of the principles of antibiotic use inhibited day-to-day engagement and that nurses were not educationally prepared to engage fully in AMS.

The majority of leader participants asserted that AMS was not a priority for nurses in a high workload environment. There appeared to be a consensus within nurse, doctor and pharmacist participants that AMS was not a primary responsibility associated with direct patient care and there were concerns about the effect of expanding responsibilities on nurses’ workloads (Table 7.3, Q11-Q14). Also given that nurses were not prescribing antibiotics, AMS was not their priority or responsibility in a high workload environment (Table 7.3, Q15-Q17). Some doctors interpreted the focus on patient care as nurses lacking interest in taking on additional responsibilities related to AMS activities [Table 7.3, Q18-Q19]. One doctor participants contrasted this with his/her perception of doctors being more willing to take risks and provide interventions even when this was not their primary area of expertise [Table 7.3, Q20]. One doctor participant discussed the consequences of nurses’ focus on direct patient care as impacting on the implementation of AMS-related initiatives within the hospital (Table 7.3, Q21).
In addition to workload, well-developed IT systems have been recognised as pivotal to the development of sustainable AMS programs. At the time of interview, participants perceived that the IT system at RH was inadequate to support AMS programs. The current IT systems did not have mechanisms to track antibiotic prescribing or duration of treatment and was not linked to the hospital pathology services. All microbial sensitivities therefore needed to be reviewed individually. The introduction of audit and feedback systems would require manual chart audits and would therefore be labour intensive. If nurses were asked to take on the role of monitoring antibiotic use in their clinical area using the current IT systems this would have a significant impact on their workload. If nurses took on more responsibilities in monitoring antibiotic use, it was highly unlikely that this role would be sustainable without IT systems to support these activities (Table 7.3, Q22-Q23).

Most study participants both within the leader and clinical nurse groups were concerned about the adequacy of nurses’ knowledge about antibiotic use and this was one of the most commonly cited barriers to engaging nurses in AMS activities. A nurse leader participant perceived that nurses were more likely to have knowledge about IPC than other health professionals, but they did not know enough about antibiotic use (Table 7.3, Q24-Q25). Clinical nurses also discussed having superficial or lack of up-to-date knowledge of antimicrobial therapy (Table 7.3, Q26-Q27).

Many of the participants, again in both leader and clinical nurse groups asserted that because nurses are not educationally prepared to engage fully in AMS, education and training programs relating to AMR and AMS to address knowledge gaps for nurses as well as a stronger focus on microbiology and pharmacology in nursing undergraduate curricula are needed (Table 7.3, Q28-Q32). A nursing academic participant also suggested that if AMR and AMS were to be considered as important by Thai nursing professionals, the problems of AMR and the principles of antibiotic prescribing should be compulsory topics in nursing educational curricula (Table 7.3, Q33). One doctor participant stated that given nurses’ role in caring for patients with multi-drug resistant organisms, all nurses in the hospital should have fundamental knowledge of appropriate antibiotic use and matching antibiotics to
bacterial sensitivities (Table 7.3, Q34). This view was supported by a nurse leader participant who stated that greater knowledge of AMS would enable nurses to take a stronger role in monitoring the appropriate use of antibiotics and patients’ response to treatment. (Table 7.3, Q35).
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| (1) Nurses’ role in AMS is not well articulated | Nurses’ role in formal AMS policies not evident | Organisational leaders: Q1 “So far the hospital does not have a written policy for [nurses] to be involved in AMS. So it is difficult for all nurses to participate.” (N4)  
Q2 “Even though we have the Antibiotics and Vaccines working group, nurses and ICNs are not members [of the working group] at the moment” (N1)  
Q3 “From my experience when working with nurses, I have learned that nurses work very well if there is a clear formal policy.” (P2)  
Q4 “Nurse leaders should not be too conservative [in their perceptions of nurses’ role] but creative” (D2) |
| | Traditional roles exclude nurses | Q5 “Most importantly, in our country, doctors have too much power, so there is no accepting of other professionals if it [the extension of their role] will interfere with doctors’ [professional] boundaries” (D1)  
Q8 “I suggested a protocol for antibiotic prescribing on the ward. One doctor suddenly threw back at me [this challenge] ‘How do you know more than I do?” (N4)  
Q9 “That would be great if the hospital recognised and respected nurses as being members of the AMS team.” (N4)  
Q10 “I think that the hospital [leadership] might think nurses are not supposed to be AMS team members. So they do not give nurses a chance at the moment [to get involved]. If they really want nurses to participate in the AMS team, then nurses could learn a lot about AMS. Finally, it would impact by improving antibiotic use in the hospital.” (N3) |
| | | ICNs/ Clinical nurses: Q6 “We remind doctors such as by asking, this antibiotic will be due for re-prescription soon after 15 days [of therapy], do you want to discontinue? Just remember that we should tell them [doctors] in a way that is providing information only, don’t make them feel like they are being dominated.” (JRN1)  
Q7 “I think it’s about the power to make a decision, like [for example], when we [nurses] noticed that doctors had prescribed an antibiotic at a high dose, we [nurses] and the pharmacist tried to remind the doctor but he/she insisted on the same order. Some doctors have huge egos. They think they have more power. They feel they will lose authority if we question them. Especially junior nurses, doctors would not listen to them. But for senior nurses, they may be able to speak up.” (JRN4) |
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| (2)    | Inconsistent engagement in AMS by nurses | **Organisational leaders**
|        | AMS not a priority in a high workload environment | Q15 “Nurses focus on nursing care but do not have a direct role in prescribing antibiotics. So taking a role in AMS is quite difficult.” *(N1)*
|        |        | Q16 “The thing is nurses do not have authority to prescribe so they (nurses) feel they are not involved in AMS.” *(N3)*
|        |        | Q17 “The decision making related to use of antibiotics is the doctors’ role, it’s not the nurses’ role.” *(N6)*
|        |        | Q18 “I think because nurses have to focus on patient care they do not focus on medications.” *(D1)*
|        |        | Q19 I think at the moment nurses do not want to be proactive to take a role in AMS because they are concerned about the workload. *(D5)*
|        |        | Q20 “Nurses in general are not concerned about this [AMS] issue and think it is not their role. Doctors are the opposite, they will try to extend their practice as much as possible even though [these activities] sometimes overlap [with other medical specialties’] jobs or area of expertise” *(D2)*
|        |        | Q21 “We had asked nurses when they are dressing infected wounds to do a wound swab for culture but the nurses [continued to] just dress the wounds without doing the culture. Then how do we know that the antibiotic we used is appropriate to the infection? I think nurses should take [wound] swabs for culture if they find patients with suspected surgical site infections. But they do not want to and this throws a burden on to the doctors. We had a campaign for six months, but it was not as successful as we wanted……” *(D3)* |
|        |        | **ICNs/ Clinical nurses**
<p>|        |        | Q12 “I’m afraid that if we take on this AMS role, we are taking over the pharmacists’ role. Nurses’ main role is taking care of patients. If we take on a major role in AMS, it may be too much.” <em>(SRNS5)</em> |</p>
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<td>(2) Inconsistent engagement in AMS by nurses (cont)</td>
<td>IT systems are not conducive to engagement</td>
<td>Q22 “Currently we have to track laboratory results manually; that would be much easier for nurses if the IT system could pop up the results automatically especially in cases of patients with serious infection.” (N5)</td>
<td>Q23 “When the culture result shows a particular bacteria, if we had a system that could identify that particular bacteria and could indicate what antibiotics we could give to the patient it would be possible. At the moment, we do not have anything like that.” (JRN4)</td>
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<td>Inadequate knowledge of the principles of antibiotic use inhibit day to day engagement</td>
<td>Q24 “Nurses have good knowledge about how to isolate patients who have infectious diseases. Probably they [nurses] have more knowledge than doctors in isolation precautions. But nurses do not have much knowledge about antibiotic use.” (N3)</td>
<td>Q26 “For me to be honest, I have superficial knowledge about antibiotic use. We only know the principles of how to take care of patients with antimicrobial resistance but we do not know how to use each antibiotic, what risk it may cause with what bacterial infections. We don’t know even the basics of antibiotic use for example, what type of bacteria that are able to treat by Ceftriaxone?” (SRN1)</td>
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<td>Q25 “I don’t think nurses have much knowledge about antibiotic use. If I had not taken the nursing course in infection prevention and control, I would not have much knowledge in this area.” (N4)</td>
<td>Q27 “There was a situation that a doctor prescribed two antibiotics at the same time and nurses did not know and gave them to a patient for 2 days. When the ID specialist came and asked why the patient was given two antibiotics, we realised that nurses did not know, even the senior nurses, so there was no alert.” (SRN2)</td>
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<td>Nurses are not educationally prepared to engage fully in AMS</td>
<td>Q28 “We [nurse educators] realise that we do not have subjects or courses regarding antibiotics in the undergraduate nursing curriculum. The nursing curriculum at our university provides a basic pharmacology subject in the second year in which there is only superficial knowledge about antibiotics use.” (N3)</td>
<td>Q29 “Even though we [nurses] have studied microbiology in the Bachelor’s degree we have already forgotten [the material].” (SRN1)</td>
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<td>Q30 “When I was a 2nd year nursing student, we studied Pharmacology, bacteria and antibiotics but in a big picture. When working as an RN, we cannot use that knowledge much.” (JRN4)</td>
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<td>we can learn and be aware of it [AMR problems and antibiotic use].” (SRN3)</td>
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| (2) Inconsistent engagement in AMS by nurses (cont) | Nurses are not educationally prepared to engage fully in AMS (cont) | **Organisational leaders**

Q33 “In fact, if we want this issue (of AMR and AMS) to impact on nursing practice across the whole country, then nurses are one of the healthcare professions who should be educated about this when they study undergraduate nursing. Then nurses would have the knowledge to educate other people.” *(N3)*

Q34 “I think nurses should have as much knowledge as doctors or at least basic knowledge of bacteria and how many antibiotic groups or which group can treat particular bacteria.” *(D3)*

Q35 “If you want nurses to be engaged in AMS, you have to provide them with the knowledge to support this. To engage in AMS is not just meant to be prescribing antibiotics but also to question whether the antibiotic is appropriate or not. Particularity when patients are prescribed broad-spectrum antibiotics, if nurses had sufficient knowledge we would be able to monitor and discuss with doctors whether the antibiotic choice was appropriate or not. Nowadays nurses just administer antibiotics according to doctors’ orders.” *(N4)*

**ICNs/ Clinical nurses**

Q31 “It would be good if we were taught about this topic [AMR and antibiotic use] in the 4th year because we had a leadership course in which we learned about working in a ward. When receiving orders, we can learn and be aware of it [AMR problems and antibiotic use].” *(SRN3)*

Q32 “We should have knowledge about antimicrobial resistance and antibiotic use from the first day when we start working as RNs. And then nurses should regularly update this [knowledge about antimicrobial resistance and antibiotic use].” *(SRN2)*
7.2.4 The potential role of nurses in antimicrobial stewardship

When participants were asked about potential roles for nurses in AMS, many discussed furthering or supporting the current role of nurses so that this could be implemented consistently across the organisation. The potential roles for nurses that were identified emerged in two major themes: (i) Strengthening existing roles by integrating nurses in multidisciplinary teams and (ii) Advancing existing roles (Table 7.4).

Theme 1. Strengthening existing roles by integrating nurses in the multidisciplinary team

Participants in all groups discussed the idea that the AMS team round should be multidisciplinary including doctors, nurses and pharmacists in the future. The purpose of the AMS team round is to monitor and support AMS by, for example, authorising the use of restricted antibiotics, reviewing patients to switch from IV to oral use and reviewing patients on selected broad spectrum antibiotics (SARI, 2009). Participants in both leader and clinical groups acknowledged that if the AMS team round was set up formally in the hospital, then clinical nurses could play on the AMS team round. Nurse participants asserted that nurses’ could explicitly participate in AMS in the AMS team round by contributing to the patient care plan including antibiotic use as members of the multidisciplinary team (Table 7.4, Q1). A clinical nurse participant felt that the potential benefit of nurses being made part of the AMS team round would be the recognition, by other health professionals, of nurses’ knowledge of their patients’ condition and response to treatment (Table 7.4, Q2). For another nurse participant, including nurses in a multidisciplinary AMS round would increase patients’ and families’ satisfaction (Table 7.4, Q3).

One junior nurse participant who supported the idea of nurses being part of the AMS team round, believed this would enable nurses to play a larger role in ensuring that patients received safe and high-quality care by monitoring and preventing medication errors (Table 7.4, Q4). Pharmacist participants also supported the potential role of nurses in AMS team rounds because it would be a vehicle for
nurses to provide supportive information about patients’ antibiotic use that would be valuable to the team’s decision making. (Table 7.4, Q 5). A pharmacist participant noted that if nurses were recognised as part of the AMS team round this would impact on overall antibiotic use in the hospital stating that, “If that role [nurses’ role in the AMS team round] happened, my department [pharmacy department] would buy less medicines particularly antibiotics. Currently we spend approximately $114 million USD in buying all medicines, and antibiotics are at the top of the list.” (P1).

Although the theme of monitoring for optimal antibiotic use was identified in the current role of nurses, a greater more consistent role in monitoring antibiotic use along with questioning the use of certain antibiotics was seen as an essential future role for clinical nurses in AMS. Most of the participants in all groups thought that nurses should have a basic understanding of appropriate antibiotic use and be able to monitor whether the antibiotic choice was appropriate given the culture results. Doctor and ICN participants asserted that nurses should play an active role in monitoring and questioning antibiotic orders and the need for continuing treatment (Table 7.4, Q6) because they work closely with doctors (Table 7.4, Q7-Q8).

Although the potential for clinical nurses to take a greater role in AMS was recognised, the need to provide them with clinical decision support tools to support this role was also identified. Availability of an AMS decision support software program at the bedside was seen by a junior nurse participant as an important device to support nurses and give them the confidence in taking a greater role in AMS in monitoring antibiotic prescribing, “I want a [software] program to confirm whether the antibiotic prescription by the doctors is appropriate or not.” (JRN4)

Theme 2. Advanced and extended existing roles

Participants in all groups identified that the future role for nurses in AMS could be developed from existing roles. Organisational leaders spoke about developing AMS ward nurse specialist roles, increasing ICN’s roles as consultants in antibiotic use, and the potential development of health promotion roles of nurses in primary health in Thailand.
Participants noted that currently, most inpatient wards in the hospital have a nurse within the nursing team who has a portfolio related to issues associated with IPC. While these nurses are recognised as taking a proactive role in IPC, the scope and responsibilities of the role are still unclear (Table 7.4, Q9). Doctor participants agreed with the idea of developing these positions for infection control ward nurses stating that if these nurses were more involved with the AMS team, this would impact on prescribers’ behaviours (Table 7.4, Q10) and that patients would ultimately benefit. One doctor stated that nurses were the most appropriate healthcare professionals to take the lead in AMS activities as they were the professionals who were more intimately involved in patient care, “I think that even pharmacists could not do this role as appropriately as nurses because they [pharmacists] spend less time working in the clinical [environment] (D5)”. One pharmacist participant who agreed with the concept of developing ward nurse specialists in AMS, acknowledged that there were not enough pharmacists to oversee antimicrobial use across the organisation (Table 7.4, Q11)

Nurse participants in all groups discussed the potential role of ICNs as AMS consultants in the Thai context. A nurse leader participant noted that although the ICNs do not provide direct nursing care to patients, they have a sounder knowledge base related to the principles of AMS than ward nurses. ICNs could therefore take on advanced practice roles in providing expert consultation about AMS to ward staff (Table 7.4, Q12). In addition, another senior nurse felt that ICNs should play a greater role in AMS consultations because ICNs are already involved in practice relating to the management of AMR and AMS across the organisation (Table 7.4, Q13). An ICN participant stated that ICNs should not only provide consultations for ward nurses as is presently the case, but could also provide consultations and expert advice to junior doctors about appropriate antibiotic use. As a nurse leader participant reflected, ICNs could consult with junior doctors because doctors often feel uncomfortable consulting with ID specialists about their treatment decisions and would feel more comfortable consulting ICNs before prescribing antibiotics (Table 7.4, Q14). ICN participants also identified that they would like to have more
authority to provide feedback on patients’ charts to prescribers about the appropriateness of antibiotic therapy (Table 7.4, Q15). One ICN discussed a potential advanced role in AMS where ICNs could be authorised to stop antibiotic treatment when there is evidence of unnecessary antibiotic prescribing (Table 7.4, Q16). A small number of stakeholder participants discussed the potential role of nurses in AMS as educators in primary health to promote better use of antibiotics in the community overall. (Table 7.4, Q17, Q18).
### Table 7.4 The potential role of nurses in antimicrobial stewardship

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<td>(1) Strengthening existing roles by integrating nurses in the</td>
<td>Attend and contribute to the AMS team round</td>
<td><strong>Organisational leaders</strong></td>
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<td>multidisciplinary team.</td>
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<td>Q1 “For example, on the AMS ward round, we could contribute not just to information about patient care (administering proper antibiotics) but we could also [be involved in] the discussion of the patients’ treatment and care plan, because nurses know the patients’ condition the most.” (N3)</td>
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<td>Q2 “I think it would be good if we could be members of the AMS team...because Dr. K used to discuss patients that I was responsible for with me, he listened to my information and respected my opinion, because I know these patients the best.” (SRN1)</td>
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<td>Q3 “I strongly agree that we should join the AMS team round. That would be good in terms of knowing the treatment plans in detail. [this would mean that]...when patients’ relatives ask for information, we would not have to wait for the doctors but could give information to patients and their relatives straightaway.” (SRN2)</td>
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<td>Q4 “I would like to see nurses as part of a patient team round about antibiotic use. From my experience, there was a doctor who came on a ward round and changed the antibiotics to one that a patient was allergic to without knowing, so I told them that the patient is allergic to that antibiotic. The doctor said “Really? I didn’t know”. Then he changed [the prescription] to another antibiotic. I think nurses know patients’ information thoroughly. If we are in the team, it could reduce errors and the time taken in getting information and confirmation of treatment plans.” (JRN6)</td>
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<td>Q5 “I would like to see nurses as one of the members of a multidisciplinary AMS team, such as when we have the AMS grand round. This activity would support nurses and give them the opportunity to understand the antibiotic treatment plan along with providing feedback...” (P3)</td>
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<td>Q6 “Nurses should be a part of the team monitoring what doctors do, whether they prescribe any inappropriate medicines,... more or less, why or why not are antibiotics needed?” (D1)</td>
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<td>Q7 “Ward nurses work closely with doctors, so they should be able to have a discussion about antibiotic use. If any patients are prescribed antibiotics, nurses should question the use of antibiotics as well.” (ICN 2)</td>
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<td>Q8 “Nurse work closely with doctors on the wards. They [nurses] could be both monitoring and giving feedback to doctors when they [nurses] find inappropriate antibiotic orders. (ICN1)</td>
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**Themes**
- Monitoring and questioning appropriateness of antibiotic prescriptions.
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| (2) Advanced and extended existing roles   | Allocated AMS role for ward nurse specialists  | Q9  “We have wound care nurses, IV nurses and IPC nurses. I would like the infection [prevention] and control ward nurses to have a clearer role and act as a central resource in regards to this topic [AMS issue]”  
Q10  “It would be good if every ward had a position for nurses who are interested in AMS. The nurse who is working in this position would collect and provide data regarding antibiotic use and AMR in their ward. If that happened then this would impact on doctors’ antibiotic prescribing behavior” (D5)
Q11  “In term of AMS consultations that should be a direct role of pharmacists, pharmacists would play this role properly. But the problem is the hospital does not have enough pharmacists to play this role systematically, it would be good if nurses wanted to participate in this role [AMS role] because patients would be advantaged.” (P2) |
|                                            | Advanced AMS roles for ICNs to consult on appropriate antibiotic use. | Q12  “Actually, infection control nurses get involved in AMS more than ward nurses, we [ICNs] are the key people to be consultants in AMS for the ward nurses”  
Q13  “About being a consultant in AMS, I think infection control nurses should take part in that as their [current] role in infection prevention and control involves [components of] AMS. We normally consult them [the ICNs] if we have any questions in terms of IPC issues. If they played a greater role in AMS activities, that would be helpful to us [ward nursing staff] and the patients.” (SRN1) |
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<td>(2) Advanced and extended existing roles (cont)</td>
<td>Advanced AMS roles for ICNs to consult on appropriate antibiotic use (cont)</td>
<td>Q14 “For infection control nurses, [I] think a role of being a consultant in choosing antibiotics ought to be something they do, for example, some doctors feel awkward about consulting with ID doctors. They may call infection control nurses to consult before prescribing. “From [my] experience, some doctors order antibiotics inappropriately. Sometimes, we [ICNS] know that this antibiotic should be used to treat UTI [urinary tract infection] but it is prescribed to a patient with an URTI [upper respiratory tract infection]. This makes us want to give them [the doctors] prescribing advice.” (N1)</td>
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<td>Health promotion – providing consumer education about appropriate antibiotic use</td>
<td>Q17 “When I was studying my master degree in public health nursing, people in the community were educated to prevent diseases such as diabetes and hypertension. I would like to see nurses in primary health settings educate people about appropriate antibiotic use too.” (N4)</td>
<td>Q15 “It would be great if infection control nurses were able to write feedback about the appropriateness of antibiotic therapy in the patients’ progress notes. For example, we could write in the notes when we find they [doctors] had inappropriately prescribed antibiotics or patients have a high chance of developing an AMR infection if they continue using those antibiotics.” (ICN6)</td>
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<td>Q16 “I would like to be able to discontinue an antibiotic in cases where they have been used longer than necessary.” (ICN4)</td>
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7.3 Discussion

Analysis of the data collected via semi-structured interview of key stakeholders, ICNs and clinical nurses revealed that nurses currently play a role in AMS in acute healthcare by supporting AMS system processes, monitoring for patient safety, monitoring for optimal antibiotic use and patient education. Further, specific advanced and extended roles in AMS are performed by specialty nurses in both acute and primary health care settings. However, the lack of existing policies that formally describe nurses’ scope of practice and responsibilities related to AMS, professional hierarchies that limit nurses’ role within the context of a poorly defined role for nurses, and inconsistent engagement of nurses in AMS were perceived barriers to full involvement of nurses and the attainment of potential benefits of their involvement in managing AMR.

Potential future roles for nurses discussed were to strengthen existing roles by integrating nurses into the multidisciplinary team and further development of advanced and extended existing roles. In the discussion to follow, study findings are explored in relation to the international literature relating to nurses’ role in AMS.

7.3.1 Current nursing roles in AMS in Thailand

Clinical nurses are actively involved in AMS by supporting system processes, monitoring for patient safety, monitoring for optimal antibiotic use and through patient education, however these activities are informal and not well-defined, nor articulated in hospital policy and procedures. Key stakeholders and clinical nurse participants agreed that there was the potential to develop an explicit and recognised role for nurses as part of a multidisciplinary AMS team. These findings are in line with the international literature in which recommendations have been made to develop the nursing workforce and roles in AMS (ANA & CDC, 2017; Edwards et al., 2011c; Manning et al., 2016; Olans, Olans, & Witt, 2017b; Olans et al., 2016).

Both stakeholders and clinical nurses identified that nurses played a key role in supporting AMS system processes needed for effective implementation of the
principles of AMS at the bedside, such as ensuring patient allergies were identified, recorded and communicated, monitoring for signs of infection, timely review of antibiotic cultures and sensitivities, and the use of strategies to prompt doctors to review treatment orders. System and process support is a recognised fundamental role of nurses in AMS. Nurses play an essential role in monitoring for signs and symptoms of infection (Gallagher & Storr, 2012b; McGoldrick, 2014), reviewing antibiotic histories of patients on admission and during clinical handover (Aziz, 2013), and ensuring that antibiotic treatment is in line with microbiology results (Edwards et al., 2011c; Lim, 2010; Manning & Giannuzzi, 2015). Olans et al. (2016) identified the importance of nurse participation in AMS through ensuring that allergies and potential drug reactions are identified.

Monitoring for safety is a fundamental AMS activity that has implications for patient safety outcomes (ANA & CDC, 2017; Ladenheim et al., 2013a; Turkoski, 2005). In this Thai study, nurses monitored for safety in AMS by ensuring patient drug allergies, hypersensitivities and side effects of antibiotics were recorded and communicated. Previous research has confirmed nurses’ roles in monitoring for safety; for example, in a study of the awareness of patients’ adverse drug reactions related to penicillin, nurses were the professionals most aware of patients’ previous history compared with doctors and pharmacists (Fehily et al., 2015). According to the American Nurses’ Association/Centers for Disease Control and Prevention, nurses have always taken a role in stewardship activities to ensure patient safety by monitoring histories of allergies and performing and communicating medication reconciliations, but these roles are under-recognised in AMS in comparison to the roles of pharmacists in monitoring prescription therapy (ANA & CDC, 2017).

Appropriate use of antibiotics is another recognised area of influence by nurses in AMS (Dyar et al., 2016). In this Thai study, nurses currently played a role in monitoring optimal antibiotic use by reviewing antibiotic prophylaxis, participating in antibiotic time out and facilitating the switching of therapy from intravenous (IV) to oral use. The majority of clinical nurses in this study reported that they monitored doctors’ treatment by reading the doctors’ progress notes to see the treatment
plans and then respectfully asking doctors to review treatment once the original plan was completed. This contribution to AMS principles was also recognised by doctor and pharmacist participants. Nurses highlighted the importance of communication style and the need to demonstrate respect for the medical team. Nurses described indirect strategies to communicate the need to review existing medical orders by placing them in a way that would be obvious to the medical team or highlighting results of interest. These described interpersonal and indirect communications are in line with the findings of Burnard and Naiyapatana (2004) who investigated communication in nursing. Communication is more likely to be ‘roundabout’ than direct in order to avoid conflict. Respect for hierarchies and showing respect is a strong cultural expectation of nurses in Thailand and this was evident in the nurses’ data.

One of the most important elements of the WHO strategy to fight AMR is to actively educate patients about appropriate antibiotic use. Nurses, through provision of 24-hour care to hospitalised patients, have the most direct patient contact and hence, are considered to be in an optimal position to provide health promotion education. Nurses can play an important role in educating patients and their family members about infection and prevention control practices and optimal antibiotic use, along with raising awareness about patient self-management of common infections (Amalia, 2014; Clark, 2000; Crombie, 2012b; Curry et al., 2014; Edwards, Loveday, Drumright, & Holmes, 2011f; Fry, 2012; Gallagher & Storr, 2012b; Glover, 2000b; Turkoski, 2005). In this Thai study, nurses were recognised as having a role in educating patients and caregivers about the appropriate use of antibiotics both during their hospitalisation and following discharge from acute care. However, the focus of activities described was on the immediate use of antibiotics following discharge from hospital, very few nurses identified a broader health promotion role in the appropriate use of antibiotics within the context of their easy availability in the community in Thailand. One nurse leader saw this expanded health promotion activity as an important potential role for nurses.
Nurses in specialty areas such as intensive care units (ICU), infection control nurses (ICNs) and provincial nurses described current activities that suggested leadership in AMS. Examples of these activities were the initiation of a surveillance protocol for monitoring signs of infection and timely review of cultures and providing suggestions about antibiotic dosing. This activity occurred in the ICU where participants described collegial relationships between nurses and doctors. ICNs provided information about AMR and AMS to ward nursing staff across the hospital, and were proactive in questioning doctors about antibiotic treatment. For nurses working in provincial areas, setting up protocols to facilitate timely antibiotic administration, and acting as a nurse prescriber for anti-viral medication (under supervision of doctors) were identified as some of these leadership activities. The findings suggest that nurses who have particular expertise or more specific knowledge of AMR and AMS or work in environments where there are collegial relationships between disciplines were more confident to extend their scope of practice to include AMS activities. These findings highlight that nurse participation in AMS activities needs to be facilitated by promoting a strong multidisciplinary team culture, advancing nurses’ knowledge base, and explicit recognition of nurses’ roles.

There was widespread support for nurses in both acute healthcare and community settings to initiate and lead AMS activities in their own areas that would improve the quality of patient care. This was particularly evident in the organisational leaders’ discussions. Previous similar studies have shown that nurses in specialty areas have established a greater AMS role. For example, nurses in an emergency department in the Netherlands implemented a sepsis care bundle protocol followed by staff training and feedback about their performance. Similarly, emergency nurses in a hospital in the USA also implemented a sepsis protocol to improve compliance with serum lactate level collection in emergency departments (Bruce et al., 2015). In residential aged care facilities (RACF), in Australia, infection control clinical nurse consultants (CNC) demonstrated that they could drive the management of a urinary sepsis program for residents (Stuart et al., 2015).
7.3.2 Current governance, educational and practice barriers

Participants in this study identified gaps in current governance, education and the practice context that were perceived as barriers to developing both the current and future roles of nurses in AMS.

In terms of clinical governance, professional hierarchies were perceived by nurses to limit their participation in AMS. The majority of nurse participants in both clinical and leader groups identified this issue as a main barrier for nurses in participating in AMS, while only one doctor recognised that traditional roles could exclude nurses from AMS participation. Less experienced nurses in particular, identified the lack of recognition by doctors that questioning whether antibiotic treatment orders were in-line with best practice recommendations could be part of clinical nurses’ role. As this role implicit rather than specified in any protocols or practice guidelines, clinical nurses felt that they could not refer to hospital policies to give them the authority to voice their opinions or concerns. This combined with a strong sense of Thai cultural expectations in regards to respecting seniority and avoiding conflict meant that many of the clinical nurses interviewed in this study expressed reticence about greater involvement in AMS. This appeared to be reinforced by the senior nurses interviewed for this study who also expressed the importance of respecting professional hierarchies in healthcare. Concerns about scope of nursing practice and respect for the medical profession may in part explain why nurses’ contribution to AMS activities was not visible in the AMS governance structure. These findings highlight the importance of developing a clear governance framework that acknowledges clinical nurses’ role in AMS and also developing ward-based AMS projects that are sensitive to the Thai Cultural context and address some of the challenges less experienced nurses face in contributing to multidisciplinary team discussions.

Concerns about the impact of professional hierarchies in healthcare on practice change have been reported in previous studies and are not unique to Thailand. For example, hospital hierarchical structures were found to influence nurses’ engagement in an AMS program to change antibiotic use in patients
hospitalised with respiratory hospital pulmonary infections in Australia (Broom, Broom, Kirby, Gibson, & Post, 2017).

The issue of hierarchy and clinical autonomy affect all members of the healthcare team not only nurses. Active consultation between doctors and Infectious Diseases’ specialists and with clinical microbiology was found to be limited by perceived autonomy in a UK hospital (Broom, Broom, Plage, Adams, & Post, 2016). The results of the study: *Understanding the determinants of antimicrobial prescribing within hospitals: the role of “prescribing etiquette”* showed that junior doctors were influenced by the antimicrobial prescribing behaviours of senior doctors (Charani et al., 2013).

In this Thai study, junior nurse participants felt more comfortable participating in AMS activities when there were formal protocols that outlined best practice and therefore they could use the protocols to support and validate their concerns or requests. Similarly, the study of a nurse- initiated sepsis protocol in an emergency department showed that providing a formal structured and agreed role for nurses reduced the time to start antibiotic administration and improved compliance with all components of a sepsis care bundle (Bruce et al., 2015) suggesting that nurses, when supported by protocol were more likely to engage in active communication with medical team members. To overcome hierarchical barriers to AMS implementation, support is needed from hospital executives, such as through the development of institutional AMS policies and guidelines and the development of antibiotic care bundles, as a part of patient safety initiatives. In addition mechanisms to encourage and foster appropriate interdisciplinary communication and teamwork between different healthcare professionals is suggested as fundamental to supporting and embedding the principles of AMS into care (Bal & Gould, 2011; Lim et al., 2014b; Loh et al., 2015b; Pakyz et al., 2014a).

A further barrier to greater participation in AMS by Thai nurses was their perceived lack of knowledge in regards to best practice guidelines for antibiotic use. Clinical nurses and nurse leaders did not perceive that they had the knowledge base or specialist training to contribute substantially to clinical decision-making about
appropriate antibiotic use. Importantly however, this perception was not shared by ICN nurses who were clear that in specific clinical areas they did have the skills and knowledge to provide expert advice about antibiotic prescribing and to identify when prescriptions were not in accordance with best practice. This difference in perspectives between the ICN nurses and other nurses interviewed demonstrates with the potential value of providing more extensive academic training and preparation for practice in breaking down hierarchical boundaries and giving nurses more confidence in their own skills to participate in AMS activities. Previous studies have also shown that nurses may not be adequately prepared educationally to engage in AMS (ANA & CDC, 2017; Lim et al., 2014b). Findings of studies evaluating knowledge, beliefs, and confidence regarding infection and AMS have shown that healthcare professionals with higher knowledge scores of infection and AMS were more confident to narrow or stop antimicrobial treatment than healthcare professionals with lower knowledge scores (Jump et al., 2015). Therefore, the outcomes of this Thai study would support initiatives by the hospital leadership team to provide more in-service educational programs about AMS and rational antibiotic use as these educational programs have the potential to empower nurses to take a greater role in AMS that could impact on both patient outcomes and costs associated with antimicrobial therapy.

The inadequacy of baseline education in microbiology and AMS in the nursing undergraduate curriculum was also identified as a gap in the Thai study that impacted on consistent engagement in AMS by nurses. It has been noted previously that nurses are taught subjects covering microbiology and pharmacology as pure rather than applied sciences (ANA & CDC, 2017; Olans et al., 2016; Schellack et al., 2016) and this makes it difficult for nurses to apply this knowledge in practice. Similarly, in this Thai study the nurse participants reported that in the second year of the nursing undergraduate curriculum, there learning of microbiology and pharmacology was superficial, and that it was difficult for them to recall this knowledge and apply the theoretical principles in practice. It was particularly noted that the concepts of AMR and AMS were not provided in the current undergraduate
nursing curriculum. Provision of training and education regarding AMS in both undergraduate nursing curricula and in-service training would help nurses perform their role in AMS (Monsees, Goldman, & Popejoy, 2017). In 2014, The Royal College of Nursing in the UK recommended that AMR and its associated impact should be taught as part of pre-registration nursing programs (Peate, 2015). In 2017, the American Nurses Association (ANA) in collaboration with the Centers for Disease Control and Prevention (CDC) released a white paper redefining ‘the Role of Registered Nurses in Hospital Antibiotic Stewardship Practices’ and suggested that nursing schools should reconsider the content of their current microbiology and pharmacology courses, so that principles taught were more applied and would provide greater practical support for nurses to improve patient care (ANA & CDC, 2017). Suggested topics included the principles of applied microbiology such as: how to both obtain cultures and interpret the results, the differences between infection versus colonisation, assertiveness and communication training to engage in discussions with the health care team, information on intravenous to the oral switch criteria, and training on taking an allergy history (ANA & CDC, 2017). Additionally, in the USA, practical topics relating to empiric guideline-based antibiotic prescribing versus individualised patient therapy and the role of clinical practice guidelines in antibiotic selection were suggested as crucial topics to support staff nurses in playing their role in AMS (Olans et al., 2016). Updating the Thai nursing curriculum along with professional training and education regarding AMR, AMS and antibiotic use in Thai hospitals is required to prepare Thai nurses for their their role AMS.

Another influencing factor in the inconsistent engagement in AMS by nurses was the shared perception by organisational leaders and nurses in particular, that since they did not prescribe antibiotics, AMS in terms of appropriate antibiotic usage was not their priority or responsibility in the context of a high workload environment. This was recognised by all participants as a significant barrier to greater nurse participation in AMS. Similarly, previous studies have found that although nurses contribute to AMS activities, nurses do not perceive themselves as key AMS stakeholders because they are not typically prescribers (ANA & CDC, 2017;
However, nursing participation is recognised as important in improving patient safety (Monsees et al., 2017). The nursing executive can play a dominant role in leading nursing engagement in healthcare organisations (Manning & Giannuzzi, 2015). What is needed in order to engage and empower nurses in AMS, is that the nurse executive of an organisation provides greater leadership support by co-developing a clear AMS structure and policy, and ensuring that sufficient nurses across an organisation are provided with appropriate AMS education and training to become active participants in and leaders of AMS activities.

### 7.3.3 Future potential roles

Strengthening existing roles by integrating nurses within multidisciplinary teams and advancing and extending practice roles in both acute health care settings and the community were identified as future potential roles of nurses in AMS in Thailand.

Overcoming perceived governance barriers by integrating nurses into the multidisciplinary team was seen as an important strategy to strengthen nurses’ existing roles. Consensus in support of clinical nurses’ participation in the AMS team round was evident in all participant responses. However, there was a noticeable difference in perspectives between nurse participants and non-nursing professionals. Nurses supported their engagement in the AMS team because they perceived that they would impact on patient safety and patient satisfaction because of their comprehensive knowledge of their patients’ histories and responses to treatment, whereas doctors and pharmacists supported their engagement as an opportunity for nurses to learn more about antibiotic treatments. These different perspectives raise questions about whether doctors and pharmacists recognise the unique contribution that nurses can make to the AMS multidisciplinary team and this contribution may need to be more explicit.

The concept of a multidisciplinary approach is recommended so that AMS programs can achieve optimal outcomes (Lin et al., 2013a). Internationally, the findings of several studies have shown that the success of AMS activities is increased
by including nurses in the AMS team. For example, the presence of multidisciplinary rounds including nurses, a pharmacist and respiratory therapists was considered an important facilitator in managing ventilator-associated pneumonia in intensive care units in the USA (Safdar et al., 2016). An evaluation of an infection team review including doctors, nurses and antibiotic pharmacists in UK hospitals reported positive results in terms of improved antimicrobial use, IV to oral switching and a probable impact on decreasing the potential of healthcare associated infections (Dryden et al., 2012). In Ireland, a multidisciplinary AMS team round including nurses was established to guide antibiotic use in terms of the duration of therapy, alternative agents, switching from IV to oral, dose recommendations and therapeutic drug monitoring (Galvin & Fennell, 2012). In Hong Kong, infection control nurses and doctors initiated an immediate concurrent feedback model that resulted in improvements in the cost-effectiveness of treatments (Cheng et al., 2009).

Participants in this Thai study identified the potential for clinical nurses (particularly those within specialty areas) to actively lead AMS initiatives and that these nurse-led initiatives could improve adherence to best practice and patient outcomes. For clinical nurses in general wards, doctor, nurse and pharmacist participants in the leader group supported the development of AMS ward nurse specialist roles that may impact on doctors’ antibiotic prescribing behaviours and provide patient benefits by supporting the use of appropriate antibiotics across a range of clinical areas in the hospital. It was noted however that pharmacists saw this initiative as a way of filling a gap in the availability of pharmacists across all clinical areas. The pharmacist participant views were that clinical pharmacists should be taking a lead in AMS activities on the wards by reviewing the appropriateness of antibiotic prescribing. Nurses should be encouraged contribute to this process largely because there were insufficient clinical (ward-based) pharmacists in the hospital. The perspectives expressed by the pharmacists interviewed appear to reflect the belief that nurses can be trained up to fulfill the responsibilities of other professional groups when there is an identifiable skill or personnel shortage. By implication the expertise and body of knowledge informing AMS would remain the
domain of infectious diseases specialists, doctors and pharmacists, but that nurses would ensure that the principles of AMS were translated into practice.

In this study, ICNs appeared to be recognised by clinical nurses as potentially playing a more advanced role in AMS by extending their focus on the management of IPC to include AMS related activities. Whereas ICN participants were ready to take a greater role in AMS by acting as consultants in antibiotic decision-making for junior doctors and having the authority to stop antibiotic treatment if required.

The potential role of nurses in AMS as educators in primary health to promote better use of antibiotics in the community was identified as a future role development for nurses in this study. Approximately 80 percent of antibiotics are prescribed in community settings (Olans et al., 2016) and, in Thailand, the availability of antibiotics over-the-counter without prescription underscores the importance of the health promotion role in the community. The conclusions of a recent narrative review of antibiotic stewardship in primary care in high and high-middle income countries were that nurses should take a leading role in AMS in primary care through for example, educating patients on judicious use of antibiotics and IPC practice (Dyar et al., 2016). In South Africa and Latin American countries, primary care nurses play an important role in the management of antiretroviral and anti-tuberculosis medications (Fairall et al., 2012; Giyose & Tshotsho, 2015; Lekhuleni, Kgole, & Mbombi, 2015; Musayón Oblitas et al., 2010). Similarly, public health nurses in Japan have a key position in supporting patients with tuberculosis in treatment adherence (Shimamura et al., 2013). Therefore there are opportunities to broaden nurses’ role in AMS by formally developing their role in health promotion in communities to provide patients and family members with high quality information about appropriate antibiotic use (Gallagher, 2014). Support from government, hospital and nursing executives is required to develop nurses’ current role in health promotion to include key messages related to AMS so that nurses in Thailand are formally recognised as providing evidence-based information relating to appropriate antibiotic use and IPC practice for the general public and patients once they are discharged into the community.
7.4 Chapter summary

The findings of this study are that nurses do engage in AMS but that engagement has significant governance, hierarchical and educational impediments. Further, there are opportunities to extend and advance practice roles for clinical and specialist nurses in the hospital and in primary care. Strategies are needed to make explicit and consistent, clinical nurses’ support for AMS activities through system processes, monitoring for patient safety, monitoring for optimal antibiotic use and patient education. These functions could be extended so that members of the clinical nursing team develop experience and contribute to AMS leadership by becoming members of AMS clinical teams, and by participating in committees that oversee the clinical governance of antibiotic use within the hospital. In addition, the study findings demonstrated the potential to further develop advanced practice roles for nurses in AMS. In this study, the descriptions of the current roles of ICNs and provincial nurse leaders provided exemplars of how leadership roles and consultant roles for advanced practice nurses could be developed to provide AMS expertise both in acute care settings and regional and remote settings in Thailand.

Gaps in the current governance, educational and practice context need to be addressed before clearly defined roles for nurses in AMS can be developed and embedded into clinical practice. The conclusion and integration of research findings are presented in Chapter Eight.
Chapter 8
Integrated discussion and conclusions

This research program was designed to explore the current and potential roles of nurses in AMS in acute healthcare in Thailand within the broader context of clinical governance, and attitudes and perceptions to AMR and AMS. A participant triangulated survey and interview approach was used in a case study at a 1,000-bed university hospital in Bangkok, Thailand to explore four different perspectives to aid in understanding and provide a more comprehensive view of the current and potential roles of nurses in AMS in acute healthcare in Thailand. Methodological triangulation was used to address the specific aims of the research.

A review of the literature identified that AMR is a global healthcare problem with significant consequences, particularly in Thailand where antibiotics are sold without prescription. Antimicrobial stewardship programs have been initiated to respond to the growing problem of AMR and ensure optimal antimicrobial use with the goal of minimising AMR (MacDougall & Polk, 2005). A multidisciplinary approach is considered best practice in AMS (CDC, 2014; Duguid & Cruickshank, 2011; Lin et al., 2013a), however not all AMS programs include nurses (Edwards et al., 2011c) who are the largest group of healthcare professionals and the only healthcare professionals with patients 24 hours a day in acute care environments. In addition, the role of nurses in AMS has not been fully described or evaluated in the international research literature. Therefore, to develop an understanding of nurses’ contribution to AMS in the unique context of Thailand it was essential to obtain views from organisational leaders, doctors, pharmacists and clinical nurses, and patients. The study was conducted within a single institution in central Bangkok.

The findings of this study identified gaps in current governance and policies to support nurses in developing their role in AMS, and the challenges in the educational and practice context that will need to be addressed before clearly defined roles for nurses in AMS can be developed and fully embedded into clinical practice in Thailand. Barriers and impediments to nurses’ consistent engagement in
AMS activities included a lack of AMS policies and procedures in the organisation that clearly articulated a role for nurses; a need for greater executive support for AMS, the need to develop decision support tools that are specific to the Thai context; and the need for additional IT infrastructure to support AMS. In addition, an educational program to provide nurses with the knowledge, skills and confidence to contribute to AMS activities is needed. To realise the potential contribution of nurses, the outcomes of this study can be used to inform nursing education and professional development, and health service governance related to AMS.

The patient survey of perceived behaviours, attitudes and knowledge of antimicrobial treatments added another dimension to our understanding of the context in which AMS is developing in Thailand and potential roles for nurses. The findings revealed the potential for greater patient participation in AMS. Enhanced roles for nurses in facilitating participation through the provision of information, education and health promotional messaging about appropriate antibiotic use were identified.

In this chapter, the findings related to the aims and objectives are summarised and integrated in Section 8.1. The potential to develop the role for nurses in AMS is discussed in relation to the current international literature in Section 8.2. The implications of the research findings for governance, practice, education and professional development and significance of the findings are integrated in Sections 8.3 to 8.5. The strengths and limitations of the research and recommendations for future research are detailed in Sections 8.6 and 8.7.

8.1 Summary of findings

The first aim of the study was to explore clinicians’ perceptions and attitudes towards AMR and AMS in Thailand among clinicians. A clinician survey, semi-structured interviews with organisational leaders (executives and clinical leaders) and focus groups with clinical nurses were used to explore clinicians’ perceptions and attitudes towards AMR and AMS in Thailand. There were total of 1,087 multidisciplinary clinicians who completed the survey and 33 participants in
organisational leadership roles and clinical ward and infection control nurses were interviewed individually or participated in focus group discussions. The major findings were that all participants surveyed, interviewed or in focus groups perceived AMR as a major problem and that improved prescribing and use of antibiotics was important. There was variability between professions regarding their perceptions of AMR and AMS. Nurses were less likely to agree that community antibiotic use ($p<0.001$) or patient pressure for antibiotics contributes to AMR and fewer nurses had heard of AMS terminology in English than doctors and pharmacists (10.9% vs. 20.4% vs. 48.8%, $p<0.001$). The findings highlighted the potential barriers and facilitators to effective implementation of AMS programs in Thai hospitals that are based on health professionals understanding of the problems of AMR and variability in exposure to the concept of antimicrobial stewardship.

In the second aim of the study, the current AMS clinical governance structure and activities within the institutional case study were described using organisational leaders as key informants. The CDC recommendations for core elements of hospital AMS programs were used as a framework for the analysis (CDC, 2014). In addition, the perceived strengths and weaknesses of the current clinical governance structures among organisational leaders, ICNs and clinical nurses were explored. The major findings were that although there is strong leadership endorsement of the organisation-wide implementation of the principles of AMS, these initiatives are hampered by suboptimal information management systems and a lack of tangible support from the hospital executive in terms of staff and resources. The findings also highlighted that current clinical AMS activities had not reached multidisciplinary clinicians to the extent necessary for their engagement and consistent implementation of AMS principles into clinical practice. Nurses were not part of the membership of the two main teams responsible for AMS polices and activities in the study hospital.

The third aim of the research was to explore the current and potential for patient participation in AMS in Thailand. A total of 205 patients completed the patient survey. Relevant data of the nurse interviews and focus groups were
analysed to provide an understanding of patients’ perceived behaviours, attitudes and knowledge of antibiotic use and utility and how nurses address patients’ needs in relation to safety and information. Both patients and nurses perceived that antibiotics were a commonly used medication and the acquisition of antibiotics without health professional involvement in Thailand confirmed. Misconceptions of the utility of antibiotics in treating viral infections were evident in patients’ responses and nurses were aware of these misconceptions. Patients also reported that they relied on health professionals for information about antibiotic use in the community and wanted more information about the best way to use antibiotics. When in hospital, patients were unsure if they needed antibiotics, expected health professionals to control antibiotic use and were unlikely to seek antibiotics. Patients wanted to participate in AMS during hospitalisation.

Nurse participants perceived that their role was focused on monitoring patient safety during antibiotic administration, and to a lesser extent they identified that nurses had a role in educating patients about antibiotic use following discharge from hospital. There was limited expressed recognition by clinical nurses of the potential to engage patients to take an active role in AMS or to facilitate more active participation and shared decision-making regarding antibiotic use. It is noteworthy, that the results of the Phase 1 clinician survey indicated that clinical nurses were less concerned than other professionals about the community use of antibiotics in Thailand, suggesting the need for greater educational preparation for nurses so they can take the lead in promoting appropriate use of antibiotics to consumers.

In the final phase of the research, organisational leaders’ and clinical nurses’ perspectives of the current and potential role of nurses in AMS in Thailand within the current governance, educational and practice context were explored. The findings revealed that nurses currently play a role in AMS in acute healthcare by supporting AMS system processes, monitoring for patient safety, monitoring for optimal antibiotic use and patient education. Clinicians identified that in specific acute care contexts (such as the intensive care unit), nurses had a more extended role in AMS activities and in rural and remote areas of Thailand and that ICNs and
senior nurses undertook advanced practice roles. The lack of existing policies that formally describe nurses’ scope of practice and responsibilities related to AMS, and professional hierarchies that do not facilitate active engagement of nurses were identified as barriers to greater nurse involvement in AMS activities. In addition, the current lack of educational preparation limited the potential for nurses to develop and extend their current role. Importantly the current contribution of nurses to AMS was perceived to be largely unseen and not acknowledged and this appears to contribute to inconsistent engagement of nurses in AMS activities.

Study participants identified that there was the potential to develop roles for nurses in AMS by strengthening and consolidating existing roles and by integrating nurses into the multidisciplinary AMS team. The potential to develop nurses to fulfil advanced practice and or AMS leadership roles was acknowledged with participants perceiving the greatest potential for advanced practice roles for ICN nurses. The potential for ICNs and other advanced practice nurses working in more remote settings in Thailand to act as advisers for sound use of antibiotics was identified as one context in which nurses with expertise in AMS were currently needed.

8.2 Integration and discussion of the key study findings

8.2.1 Professional identities and crossing boundaries

The findings identified that professional identities and professional boundaries are major factors that influences nurses’ engagement in AMS activities in Thailand.

The influence of professional identity on participants’ perceptions of nurses’ current and potential role in AMS was a key finding. The multidisciplinary survey, organisational leader interviews and focus group discussions revealed cross-disciplinary agreement about the importance of the AMR problem in Thailand with the majority of clinicians agreeing that it is necessary to implement an AMS program to address this issue in the hospital.

There were however, differences between professional groups in their preferences for how AMS activities should be operationalised at the study site.
Doctors wanted to maintain their professional autonomy and did not want limitations placed on their prescribing, and pharmacists understood the importance of their role in AMS and had a clear sense of their professional responsibilities. It is noteworthy that the pharmacist participants were willing to support nurses’ engagement in AMS as long as their activities were under their supervision and control. In contrast, the nurse participants (with the exception of the ICNs) expressed a lack of clarity about their role in AMS and some hesitation about extending their responsibilities to include AMS activities. In contrast to nurses, doctors were more likely to take risks and to cross professional boundaries even in areas of practice that were not their primary area of expertise.

Nurses had a limited perception of their current role in AMS that focused on medication safety and antibiotic administration. Nurses focused their attention on provision of direct patient care and because they were not antibiotic prescribers, felt that AMS was not a priority in their busy workload. Nurses also recognised that they were not educationally well prepared to comment on antibiotic prescribing and this perceived lack of knowledge may also have contributed to their hesitation about taking responsibility for AMS activities at the study site.

It appears from the study findings although not explicit, that cultural norms and social expectations about the appropriate role and behaviour of women in Thai culture may have also been influencing the professional identity boundaries expressed by the participants. Previous researchers have explored how the role of nurses in Thai hospitals closely reflects traditional expectations of women in Thai culture. The importance of facilitating social harmony, avoiding conflict, and respect for social and professional hierarchies are important expectations of nurses within Thai society and hospital culture (Burnard & Naiyapatana, 2004). These cultural norms may create barriers to greater nurse participation in AMS activities, particularly for less experienced nurses, where the role expectations involve the need to act assertively and question antibiotic prescribing choices.
8.2.2 Nurses’ willingness to take leadership roles was heterogeneous

Another significant finding of this study was that there were also professional differences within the nurses’ as a professional group that impacted on their acceptance of leadership roles in AMS. Important differences between nurses (junior nurses, senior nurses or ICNs) emerged in this study, whereas the attitudes of other professional groups, namely doctors and pharmacists, were relatively homogeneous. The differences found between nurses are substantial and were dependent on their level of clinical experience, sub-specialty training and organisational role. This phenomenon may be explained by the social context in which nurses work. When nurses do not have organisational authority, they use social influence and relationships to achieve their desired outcomes. More senior nurses may have greater confidence in their capacity to influence prescribers’ behaviour without creating interprofessional conflicts than less experienced nurses which may in part explain why junior nurses were more hesitant about developing a role in AMS. In contrast senior clinical nurses were prepared to be involved in the AMS team and the ICNs expressed an interest in developing advanced practice or consultative roles in AMS.

Another potential contributing factor to junior nurses perceived hesitancy in participating in AMS programs is that clinical nurses have so many delegated roles within their practice. In acute care areas where the workload is high, more junior nurses appeared to feel the most comfortable focusing on their own direct nursing care role. It is noteworthy that in a large portion of clinical nurses’ work, for example medication administration, nurses have a delegated role, they are not prescribers but are responsible for safe medication administration and monitoring of effects and side-effects. In these delegated roles they do not have direct autonomy over their work. Therefore, if nurses want to have a role in AMS, they have to deal with navigating these professional and organisational boundaries. Furthermore, the need to fulfil duties for which they have a high level of responsibility and accountability (to deliver safe patient care) but low authority may create tensions for nurses. Previous studies in a range of occupational areas have found that roles in which responsibility
is high but authority is low are associated with substantial occupational stress (Marmot, 2006; Marmot et al., 1991).

The ICNs interviewed in this study demonstrated greater professional confidence that was underpinned by greater educational preparation and clinical experience. The ICNs were already able to distinguish a clear role for themselves in AMS and were willing to extend their role and take on increased levels of responsibility. ICNs demonstrated that they were interested in taking on leadership roles in AMS and saw themselves as role models for junior nursing and medical staff. Their confidence in their professional ability appeared to be supported by both a high level of training and well-developed skills in inter-professional communication and relationship building. Although junior nurses have experience working in a multidisciplinary clinical environment they have less experience in building effective team communication and relationships, as a consequence they appeared to be less willing and less likely to voice their concerns or challenge prescribers’ decision-making. Importantly ICNs expressed a willingness to be role models for more junior nurses, by contributing to multidisciplinary team discussions around AMS and modelling effective communication skills.

It is evident from these findings, that if clinical nurses are to contribute to AMS activities then role modelling (by senior nurses) of affective approaches to team communication is necessary. Based on these study findings, one recommendation to increase clinical nurses’ participation in AMS, is to develop team models of care that include junior, senior and ICNs working closely together so that junior staff have regular, direct exposure to professional role models (Cioffi & Ferguson, 2009).

8.2.3 Imbalance between expectations and the available resources to support nurses’ role in AMS

Another key finding was that nurses’ current contributions to AMS activities are invisible and have been driven by the needs of other disciplines not by their level of knowledge or expertise. It appears that there is a huge gap in current AMS governance, particularly related to the role of nurses. There is an imbalance between
the expectations of nurses to contribute to AMS compared to the resources available to support them and the recognition of their role in the organisational governance structure. In this study, participants reported that nurses worked to support AMS activities despite a perceived lack of role clarity and policies detailing nurses’ scope of practice relating to AMS. It appears that despite all the support provided by nurses to facilitate AMS implementation at a ward level, these activities are not seen or acknowledged at an organisational level and remain largely invisible. Nurses were also working in a space that they do not feel educationally or organisationally supported to perform. The perspectives of other professional groups were that nurses are gap filling rather than providing a skilled professional contribution.

Nursing expertise includes coordination of care, maintaining multidisciplinary communication, and engaging patients and consumers in their care. If nurses were formal members of the AMS clinical team, they could develop their knowledge and support consistent implementation of AMS in clinical care and this was acknowledged by a leader participant. In the future nurses could become key players in AMS teams and their role could include: coordination of AMS activities, facilitating multidisciplinary team communication, and ensuring consistent implementation of AMS principles in clinical practice. However, to achieve this level of nursing participation in AMS, nurses would need a greater level of organisational support. The potential strengths of the discipline of nursing and its contribution to knowledge translation needs to be acknowledged at an organisational level. As nurses are present in the hospital 24 hours per day and have contact with all members of the team, they are in a key position to influence care, build relationships and raise the importance of systematic implementation of AMS at the bedside.

8.2.4 Patient participation in AMS

The findings suggested that nurse participants’ conceptualisation of patient engagement in AMS was narrow and only two participants discussed the importance of broader health promotion. One explanation for this finding is that nurses in this case study work in a university tertiary referral hospital and the focus of their activities is on providing advanced care for complex patients. In this context nurses
may perceive that they have limited opportunities for health promotion and limited exposure to the community setting. The results of the patient survey identified that patients’ use of antibiotics in the community setting is commonplace. The organisational leaders recognised that a lack of regulatory control and over-the-counter availability of antibiotics contributed to high rates of antibiotic consumption in the community. Consumer access to antibiotics without prescription places patients in a more powerful position when it comes to making choices about antibiotic use. The nurse participants did not however focus on providing patients with the knowledge and skills to be informed consumers once they were discharged from acute care, despite repeated comments that patient antibiotic use outside of the hospital was a key influence on AMR. The focus of education was on the immediate use of discharge medications. It was not explicitly acknowledged by nurses that once discharged into the community, patients have responsibility for making complex decisions about their ongoing care. Of note patient participants indicated that they would like more information about their antibiotics treatment. This is an important area that needs to be explored in future research.

Importantly the nurse participants expressed willingness to develop this aspect of their role in AMS. Nurse participants were willing to undertake a role in patient education about antibiotic use in hospital and recognising side effects of treatment, and identified this as part of their scope of practice. This implies that nurses believed they could develop a more autonomous role in patient education.

8.3 Developing nurses’ role in antimicrobial stewardship in Thailand

The study findings indicate that there was a willingness on the part of both the organisational leaders and clinical nurses to develop the role and contribution of nurses to AMS activities at the study hospital, however there was some hesitation by study participants as they identified a number of barriers that needed to be overcome before this could be achieved. Two important barriers identified by participants were: defining the role and responsibilities of nurses and making these parts of hospital policy and; secondly providing nurses with adequate educational preparation so they had the knowledge and confidence to perform these roles.
One of the concerns raised by clinical nurses in the general ward area was that traditional professional hierarchies meant that it was difficult for them to comment on prescribers’ decision-making. The challenge of nurses and junior doctors commenting on senior prescribers’ decisions has been previously reported as a barrier to AMS implementation (Charani et al., 2013; Livorsi, Comer, Matthias, Bair, & Perencevich, 2015; Rawson et al., 2016). In contrast, some of the organisational leaders interviewed commented on the strong team culture in specialty units such as ICU and how nurses working in these areas were prepared to take a more proactive role in AMS (Henkin et al., 2016). These findings highlight a common issue in healthcare settings in developing more advanced roles for nurses and asking nurses to think critically and to communicate proactively when they identify activities that may not be best practice (Boyle & Kochinda, 2004). A number of studies have identified that nurses find it difficult to voice concerns about clinical practices that are perceived to be the domain of other clinicians, doctors, physiotherapists, pharmacists etc. (Churchman & Doherty, 2010; Krogstad, Hofoss, & Hjortdahl, 2004; Lim et al., 2014a). This was less of a barrier in clinical areas where there was a close working relationship between all members of the team (Boyle & Kochinda, 2004; Pronovost et al., 2008). A number of international studies have also identified problematic inter-professional communication as a common barrier to both practice change and the development of a safety focused healthcare culture (Huang et al., 2007; Pronovost et al., 2008).

The nursing responsibilities to ensure safe administration of all prescribed medication are well recognised (NSQHS, 2012; Supachutikul, 2008) confirming that clinical nurses have a high level of awareness of their role in patient safety. To promote greater nurse participation in specific AMS related activities, such as monitoring for optimal antibiotic use, it is suggested that setting up a formal policy that specifically outlines nurses’ responsibilities and the specific AMS activities that they should be in engaged in would facilitate more consistent engagement of clinical nurses in AMS activities at the bedside. It is recognised however that there is limited literature evaluating whether, if nurses take a more proactive role in activities such
as ‘antibiotic time-out’, this results in improved uptake of AMS activities and/ improved patient outcomes. Further research evaluating whether greater participation by nurses in supporting AMS system processes should be undertaken, to determine the most effective approach of integrating nurses into the multidisciplinary AMS team.

In Australia, national standards for safety and quality in health care have been in place since 2006 (Australian Commission on Safety and Quality in Health Care, 2014). The experiences in Australia of introducing the national quality and safety framework, integrating this into healthcare policies, governance and establishing health service key performance indicators may provide useful insights into how the role of nurses in AMS could be developed and supported (Duguid & Cruickshank, 2011). It is noteworthy that a number of undergraduate and post graduate nursing education programs have also been developed to provide nurses with the skills to contribute to the quality and safety agenda (Durham & Alden, 2008; Jang & Lee, 2017; Mansour, 2015). If nurses are to be involved in quality and safety there is a need to change the focus of their undergraduate programs with a greater emphasis on quality and safety processes (Cronenwett et al.; Hession-Laband & Mantell, 2011).

Cultural expectations about the role of nurses and their contribution to AMS need to be addressed at a local level so that strategies to engage nurses are appropriate to the Thai context (Burnard & Naiyapatana, 2004). As the clinical nurses in this study identified their role in AMS as focusing on safe medication administration, it is possible that approaching their role using a quality and safety lens rather than a prescribers’ perspective may be one way to facilitate greater nurse engagement in AMS. If clinical nurses understood their contribution to AMS activities as an extension of their responsibility for safe medication administration and that the primary purpose of AMS is to achieve optimal patient outcomes with minimal intervention and to prevent the development of AMR, then perceptions that nurses are crossing professional boundaries when questioning antibiotic use might be decreased (Currey, White, Rolley, Oldland, & Driscoll, 2015; Durham & Alden, 2008;
Jang & Lee, 2017). This approach can contribute to creating a clinical culture in which nurses are expected to contribute to discussions around choice, duration and appropriateness of antimicrobial use.

Although not all nurses interviewed in this study were willing to be involved in AMS activities related to antibiotic use in acute care, their potential role in health promotion and patient education was clearer (Brink et al., 2016; Dyar et al., 2016). If nurses are to develop a broader role in health promotion, a stronger educational foundation and better understanding of appropriate antibiotic use in ambulatory care, community and primary care settings is needed (Olans et al., 2015; Wilson et al., 2017). In Australia for example, the not-for-profit and evidence-based organisation called ‘NPS MedicineWise’ was initiated to promote quality use of medicines and support prescribers in primary care settings (MedicineWise, 2017). This organisation also provides guidance and direction on the safe and wise use of medicines and health technologies.

The finding that clinical nurses were less concerned about community use of antibiotics and AMR in the Thai community and that the education they provide to patients focuses on the processes of care directly related to discharge planning such as finishing a post-hospital antibiotic course or when to see the doctor, suggested a narrow focus when they were talking about health promotion. To undertake a more expanded role in patient education and health promotion in the community, there would need to be a structured education program that provided nurses with knowledge of appropriate antibiotic use, effective communication skills and resources to support the engagement of patients in their care (ANA & CDC, 2017; Hanucharurnkul, 2007; Monsees et al., 2017; Olans et al., 2017b; Schellack et al., 2016).

The organisational leaders interviewed for this study identified that the widespread availability of antibiotics throughout Thailand and inadequate regulatory control of the manufacture and distribution of antimicrobials meant that there was limited data available on current antimicrobial use across Thailand (Sumpradit et al., 2017; WHO, 2010b). This lack of effective government control over antimicrobial
distribution and a lack of data on actual antimicrobial consumption made it extremely difficult to implement effective nation-wide AMS strategies. Over the last decade, the Thai government has recognised that there is the major problem with AMR in Thailand and is taking steps to both regulate antimicrobial use and to persuade prescribers and consumers to change current practices (Sumpradit et al., 2017). Although these changes to government policy are positive, it is clear that the clinical leaders of AMS programs in Thailand do not have access to the well-developed policy frameworks and decision-support resources for AMS that are now available in many high-income countries (CDC, 2014; Duguid & Cruickshank, 2011; Nathwani, 2006). At the health service level this makes development and implementation of sustainable AMS programs more difficult and challenging in the Thai context.

It is striking that many of the themes that emerged related to the role of nurses in AMS in Thailand resonated with what has been reported internationally (ANA & CDC, 2017; Edwards et al., 2011c; Olans et al., 2017b; Olans et al., 2016). It appears that many of the barriers to developing a role for nurses in AMS in Thailand are similar to those experienced in developed countries. The Thai context does however raise some unique challenges. Although similar to many low and middle income countries, Thailand is undergoing a demographic transition with the relative burden of chronic disease becoming higher, and infectious diseases still associated with a substantial disease burden (WHO, 2017c, 2017d). In addition there are distinct epidemiological factors of infectious diseases that make Thailand unique (CDC, 2017b).

One theme that has emerged from this and previous studies was that ICNs are the most willing to take on more advanced practice roles in AMS (Hanucharurnkul, 2007; Kruth, 2017; Langkarpint, 2005; Wongkpratoom, Srisuphan, Senaratana, Nantachaipan, & Sritanyarat, 2010). In order for ICNs to take on advanced practice roles in AMS in the Thai context education and training programs are needed that not only introduce them to the principles of AMS, but also address the specific infectious disease problems currently being faced in Thailand. Education
and training programs to advance ICN practice need to include content on hospital-acquired infections, multiple drug resistance as well the potential for new, emerging infectious diseases (CDC, 2017b; Sommanustweechai, Iamsirithaworn, Patchararanumol, Kalpravidh, & Tangcharoensathien, 2017).

8.4 Potential benefits of consistent sustained engagement of nurses in AMS

There is emerging evidence that nurse engagement in AMS improves patient safety outcomes and decreases healthcare costs. Studies in which the potential benefits of nurses’ taking an active role in monitoring antibiotic use have shown beneficial outcomes; for example, when surgical nurses ensured compliance with best practice for antibiotic prophylaxis following caesarean section there was an associated decrease in wound infections (Shimoni et al., 2009). In Australia, an educational intervention to promote switching from intravenous (IV) to the oral route for antibiotics, found that when nurses actively questioned patients’ need for IV antibiotics this resulted in reduced duration of parenteral antibiotic therapy and a decreased rate of bacteraemia (Gillespie et al., 2013).

In community settings, studies in South Africa, Latin American countries and Japan have demonstrated nurses’ crucial role in AMS in managing antimicrobials such as antiretroviral and anti-tuberculosis medications (Giyose & Tshotsho, 2015; Lekhuleni et al., 2015; Musayón Oblitas et al., 2010; Shimamura et al., 2013).

Establishing a greater AMS role of nurses in specialty areas have been shown to improve AMS system processes and antibiotic use. For example, a study of nurse-initiated the sepsis protocol in an emergency department showed reduced time to start antibiotic administration and improved compliance with sepsis bundles in the USA (Bruce et al., 2015). In residential aged care facilities (RACF) in Australia, infection control clinical nurse consultants (CNCs) demonstrated that they could drive the management of urinary sepsis programs in residents with a significant decrease in antibiotic use in RACF {Stuart, 2015 #220}.

A multidisciplinary approach is vital to the success of AMS programs (Lin et al., 2013). Several studies have shown increased success of AMS activities of
multidisciplinary teams that included nurses. For example, the presence of multidisciplinary rounds including nurses, pharmacist and respiratory therapists was considered an important facilitator to manage ventilator-associated pneumonia in intensive care units in USA (Safdar et al., 2016). An audit of an infection control team including doctors, nurses and antibiotic pharmacists in UK hospitals was reported as having positive results such as improving antimicrobial use, IV to oral antibiotic switching, and decreasing the risk of healthcare associated infections (Dryden et al., 2012). In Ireland, a multidisciplinary AMS team including nurses was able to guide antibiotic use in terms of the course length, alternative agents, switching from IV to oral route, dose recommendations and therapeutic drug monitoring (Galvin & Fennell, 2012). In Hong Kong, ICNs and doctors initiated an immediate concurrent feedback model that resulted in improvements in the cost-effectiveness of care (Cheng et al., 2009). Including nurses and increasing nurses’ engagement in AMS teams has the potential to improve patient safety outcomes and healthcare costs.

8.5 Summary of the implications of the findings

The findings of this study have implications for governance, practice, education and professional development of the multidisciplinary team.

8.5.1 Implications for governance

The lack of a clear policy that supports a multidisciplinary team approach to AMS was identified as a gap in the current governance structure supporting AMS programs at the study site. In order to support the multidisciplinary team in providing consistent, high quality stewardship, a clear clinical AMS governance structure is needed. To support nurses involvement in AMS, this structure need to involve nurses and the policies developed need to provide explicit guidance for the responsibilities of the multidisciplinary team, including nurses. To facilitate nurses’ engagement in AMS activities, leadership support from the nurse executive is needed to provide the necessary staffing and educational resources and ensure that policies and guidelines developed reflect a multidisciplinary approach to AMS that includes both engagement of and accountabilities for the nursing workforce.
Structured education and skills development programs are required for clinical nurses and provision should be made to ensure that nurses can participate either at induction to the hospital or as ongoing professional development. Organisation-wide initiatives and strategies are needed to address the culture of clinical interactions that perpetuate hierarchical and professional boundaries that can impact on patient safety outcomes.

8.5.2 Implications for practice

Organisation-wide initiatives and strategies are needed to address the shared perceptions that AMS-related activities were not a priority for nurses in the context of a high clinical workloads and concerns about the effect on workload of expanding nurses’ responsibilities to include AMS.

These strategies could include open multidisciplinary and uni-disciplinary forums to allow concerns to be voiced and to achieve greater clarity in regards to individual and multidisciplinary roles and responsibilities and improve inter-professional communication. Anti-microbial stewardship should be incorporated within nurses’ roles and responsibilities related to maintaining patient safety through safe and therapeutic administration of all medications.

8.5.3 Implications for education

There is a need for reform of undergraduate curricula of all health professionals, but nurses in particular, in regards to the teaching of microbiology and pharmacology in Thailand. Revisions should focus on the acquisition of applied knowledge rather than the current pure science approach with a focus on AMR, the principles of AMS and effective multidisciplinary communication as core curriculum.

Within the clinical environment, the issues related to AMR and the principles and role expectations of AMS should be integrated in induction programs for new staff in the hospital. Continuing professional development of staff should be multidisciplinary and include updates in the status of AMR, government policy and initiatives in Thailand, governance and policy for AMS at the organisational level and reinforcement of the principles of AMS and the rational use of antibiotics. Annual
local updates of current AMR status in the hospital, performance in relation to AMS, along with information about the impact of AMS on both patient outcomes and costs associated with antimicrobial therapy would contribute to sustainability of AMS. It is suggested that these updates should include examples of both high performing areas and target areas for further improvements. A requirement for staff to undertake annual educational updates of their knowledge of AMR and AMS is suggested, as well as greater access to resources such as: eHealth applications, web-based educational resources and peer-to-peer education sessions.

8.5.4 Implications for professional development

Further development and formalisation of leadership roles in AMS for ICNs in acute care, and advanced practice roles for nurses in provincial, regional areas of Thailand could provide AMS expertise both in acute care settings and regional and remote settings in Thailand. Expansion of Infection Prevention and Control nurses’ roles towards leadership through consultancy for clinical nurses and medical staff would require professional development and should be underpinned by a formal policy and clear career pathway. In regional and remote settings in Thailand, ICNs or primary health nurses are already assuming advanced practice roles in management of infection and are in ideal positions to initiate AMS programs in collaboration with multidisciplinary teams or university hospitals in areas with limited resources, or in remote areas.

8.6 Strengths and limitations of the study

8.6.1 Strengths of the study

This research program is the first comprehensive investigation of nursing roles in AMS in Thailand. The concept of the role of nurses in AMS is new concept in Thailand; the findings of this study provided fundamental analysis of the current role of nurses in AMS in Thailand that can inform the development of: nursing education and professional development materials and programs, health service AMS governance, and strategies to engage patients in AMS in hospitals.
The research, in using a participant triangulation design, elicited a range of different perspectives that covered key organisational leaders and executive, clinical nurses, and patients. Those different perspectives provided a more comprehensive view of the current and potential roles of nursing in AMS in acute healthcare in Thailand along with the ability to propose a strategy to encourage nurses’ participation in AMS governance and within AMS multidisciplinary team.

Clinicians’ perceptions and attitudes towards AMR and AMS were explored using an organisation-wide clinician survey, there was a high response rate (62%), and a total of 1,087 participants who completed the survey. This was the first large-scale survey of doctors, nurses and pharmacists regarding AMR and AMS in Thailand. It is anticipated that the survey results will raise awareness amongst healthcare professions in the study hospital and in Thailand of the problem of AMR and the importance of AMS in Thailand.

Third, in this study, participation of clinical and organisational executive leaders such as the director of the hospital, director of nursing and director of pharmacy demonstrates their interest in and commitment to developing a robust AMS program in the hospital and potentially their receptiveness to recommendations for improvement and hence, the likelihood that the findings and recommendations will be considered for future implementation. It is anticipated that the outcomes of this study will be used to inform development of policies related to patient safety and AMS governance, as well as encouraging leader groups to support nurses in participating in AMS governance and recognising the importance role that clinical, and ICN nurses can play in AMS.

8.6.2 Limitations of the study

The research program had limitations. Data collection was through a single engagement with key informants and this may have limited the richness of the data for several reasons. First, participants, during the interviews and focus groups may not have had sufficient time to engage with the topic under investigation and to fully consider potential roles for nurses. Providing participants with scenarios or
exemplars that represented the range of potential participation of nurses may have provided richer data. There was evidence that nurse and non-nurse respondents had not previously considered potential nurses’ roles in any depth prior to the interviews. Responses therefore were limited therefore by their imagination and this was evident in the relatively few potential roles they put forward.

Compounding the problem discussed above, the concept of AMS is a relatively recent in Thailand, particularly the use of the term ‘antimicrobial stewardship’. The survey results showed that only 17.2% of clinicians had heard of the English term AMS and nurses were least likely to have heard the term (10.9%). Although the meaning was explained, there were limitations to the depth of explanation that could be given without contaminating the data retrieved through the in-depth interviews.

This research was conducted within a single institution. Further the case study site was a well-resourced university hospital in Thailand. This raises questions about the external validity and transferability of the data derived from the clinician surveys and interviews. Whether the study findings can be generalised to other Thai hospitals, particularly smaller rural hospitals is not known and needs further investigation. In addition, although participants in the organisational leader groups were purposively selected to participate, participants in clinician survey and the nurse focus groups generally self-selected and it is not known how much selection bias may have limited how representative the findings were to those who did not participate.

8.7 Recommendations for future research

This research through its design, has provided a range of perspectives from clinical nurse leaders, clinical nurses, key organisational leaders and patients on the current status of AMS governance and activities, current nurses’ roles and potential future roles in antimicrobial stewardship (AMS) in acute healthcare in Thailand. In doing so, the findings have identified the need for advancement in terms of governance, education, professional practice and patient engagement.
The single institution design provided a multidimensional and multi-lens view of the role within the governance, practice and cultural context however further research is needed for a broader perspective by exploring the current and potential role of nurses in different acute care settings in different level hospitals and in remote or provincial areas in Thailand. Further, the descriptive exploratory design did provide an understanding of AMS from the perspectives of key stakeholders however, an ethnographic design using naturistic observation and repeated engagement with clinicians would provide a deeper and wider lens for understanding the barriers and facilitators to nurses’ engagement in AMS.

Future interventional research would include the investigation of the effects of specific education, professional development and protocols and guidelines on nurses’ engagement in AMS and in facilitating patient participation in AMS. Nurses support AMS activities through system processes, monitoring for patient safety, monitoring for optimal antibiotic use and patient education. There has been limited research of the effects of nurses’ contribution to AMS on patient safety outcomes and the use of antibiotics and needs further exploration.

8.6 Conclusions

Nurses play a fundamental role in AMS activities in acute care through the 24-hour care provided to patients and their delegated role in medication administration and management. In the Thai acute healthcare context, there are barriers and impediments to nurses’ full involvement in AMS that are related to current organisational and clinical governance and the absence of policy and guidance to formally describe nurses’ scope of practice and responsibilities related to AMS, inadequate educational preparation to fully participate in review of antibiotic prescribing and use, and cultural elements of the practice context and professional hierarchies that hinder inter professional communication. The findings have implications for organisational and clinical governance, the culture of clinical practice, undergraduate and continuing education, and professional career development for Thai clinical nurses and infection control and prevention nurses in particular who were ready to take on advanced practice roles in AMS in Thailand.
Further research is needed for a broader perspective by exploring the current and potential role of nurses in different acute care settings in different level hospitals and in remote or provincial areas in Thailand.
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Shaban, R., Cruickshank, M., Christiansen, K., & Committee, t. A. R. S. (2013). *National Surveillance and Reporting of Antimicrobial Resistance and Antibiotic Usage for Human Health in Australia*


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**Appendix A: Interview Guides/Organisational Leader Interviews**

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<tr>
<th>Topic heading</th>
<th>Question</th>
<th>Prompts</th>
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<tr>
<td>Opening &amp; Icebreaking:</td>
<td>• Can you please talk a little about your position and your role in the hospital and your role in relation to AMS?</td>
<td>Thai animal/agricultural sector, Thai hospital, patient factors, infection control practices</td>
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<tr>
<td></td>
<td>• How long have you been in role in AMS?</td>
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<tr>
<td>1A: Perceptions of the AMR problem:</td>
<td>• Antimicrobial resistance (AMR) is a growing healthcare problem worldwide, can you please tell me what you think are the main issue regarding this problem in Thailand?</td>
<td>What are the main issues regarding AMR in the hospital?</td>
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<td></td>
<td>• In this hospital, are the problems you described in Thailand similar or different?</td>
<td>Such as <em>A. baumannii</em>, Multi drug resistant TB, <em>P. aeruginosa</em>, Antimicrobial resistant TB, <em>E.coli</em> (ESBL)</td>
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<td></td>
<td>• Currently, at the hospital, do you believe we have substantial problems/ challenges managing multi-drug resistant bacteria?</td>
<td>Are you concerned about emerging resistance patterns for vanco, carbopenem, cephalosporins or other antibiotics at the hospital?</td>
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<tr>
<td>1B: Establishing a common understanding of antimicrobial stewardship (AMS):</td>
<td>• Can you tell me the aims of an AMS program in Thailand? (if not sure - AMS is about optimising antimicrobial use in order to improve patient outcomes)</td>
<td>• Staff skill and knowledge, training, culture of organisation, ownership of AMS activities, clinical</td>
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<td></td>
<td>• Can you tell me, what you think are the main issues</td>
<td></td>
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<td>2: Current AMS governance in the hospital:</td>
<td>• Let’s talk about current AMS governance in the hospital.</td>
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<tr>
<td>• 2A: Leadership support</td>
<td>• In terms of leadership support, can you tell me how the senior leadership support AMS activities in the hospital?</td>
<td>• Staff, money, IT support, training</td>
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<td></td>
<td></td>
<td>• A formal, written policy to improve antimicrobial use</td>
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<td></td>
<td>• Can you talk about the challenges of providing leadership support?</td>
<td>• Committees in relation to improving antimicrobial use</td>
</tr>
<tr>
<td>• 2B: Accountability and drug expertise</td>
<td>• In terms of antimicrobial committees, in your opinion, which key health professions should be involved in these committees?</td>
<td>• Do you think nurses should be involved in these committees? why?</td>
</tr>
<tr>
<td>• 2C: Actions/interventions to support optimal antimicrobial use</td>
<td>• Let’s talk about current AMS current AMS interventions in the hospital?</td>
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<td>Topic heading</td>
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| • 2C: Action/intervention to support optimal antimicrobial use (Cont.)        | • What current policies support AMS interventions?                        | • Requirements for prescribers to document dose, duration, and indication of antibiotics  
• Guidelines to assist with antibiotic selection  
• Development and implementation of facility specific treatment recommendations  
• Formulary restrictions  
• Pre authorisation  
• Prospective audit and feedback  
• Antibiotic time outs  
• A parenteral to oral conversion  
• Utilising dose optimisation  
• Time sensitive automatic stop order for specified antimicrobial prescriptions  
• local antimicrobial guidelines/staff/money/time/clinical leadership/ownership of AMS activities, culture of organisation |
<p>| • What are current system-wide AMS interventions in the hospital?             |                                                                          |                                                                                                                                                                                                                                                                         |
| • Do nurses have a role in these interventions?                              | • Can you talk about the challenges of implementing those interventions? |                                                                                                                                                                                                                                                                         |</p>
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<th>Topic heading</th>
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<tr>
<td>• 2D: Tracking: monitoring antimicrobial prescribing, use, and resistance</td>
<td>• Let’s talk about current AMS current AMS monitoring and tracking in the hospital?</td>
<td>• Adherence to a documentation policy (dose, duration, and indication)</td>
</tr>
<tr>
<td></td>
<td>• How do we monitor and track antimicrobial use?</td>
<td>• Adherence to facility-specific treatment recommendations</td>
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<td></td>
<td>• How do we monitor and track antimicrobial resistance?</td>
<td>• <em>C. difficile</em> infection rate</td>
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<td></td>
<td>• Do nurses have a role in those activities?</td>
<td>• Antibiotic use by counts of antibiotic(s) administered to patients per day (Days of Therapy; DOT)</td>
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<td></td>
<td>• Can you tell me, what are the barriers to monitoring and tracking antibiotic use?</td>
<td>• Antibiotic use by number of grams of antibiotics used (Defined Daily Dose; DDD)</td>
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<td>• Direct expenditure for antibiotics (purchasing costs)</td>
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| **2E: Reporting information to staff on improving antimicrobial use and resistance** | • Let’s talk about how information about AMS is communicated to staff in the hospital?  
• Do we report the outcomes of the AMS program to staff?  
• What kind of data are reported?  
• Do prescribers receive reports or feedback of their antimicrobial prescribing?  
• What are some of the challenges related to reporting AMS to staff? | • AMR rate, antimicrobial consumption |
| **2F: Education** | • Let’s talk about staff education and AMS in the hospital?  
• Do you think our healthcare staff have enough knowledge in relation to AMS?  
• Does our stewardship program provide education to healthcare staff?  
• Can you tell me who should be educated/trained regarding AMS?  
• What educational topics do you think are important for healthcare staff to receive in order to improve antimicrobial use? | • Doctors, nurses, pharmacists, epidemiologists  
• Basic knowledge of infection management, administration and monitoring of antimicrobial therapy |
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<tr>
<td>• 2F: Education (cont.)</td>
<td>• Can you tell me what barriers there are in providing AMS education and training?</td>
<td>• Lack of financial support, clinical leadership, resources</td>
</tr>
<tr>
<td>3: Current role of nurses in AMS in the hospital</td>
<td>• Let’s talk about current role of nurses in AMS in the hospital</td>
<td>• Education, challenging prescribing decisions, therapeutic drug monitoring, clinical review and direct prescriber feedback, collaboration, antimicrobial prescribing surveillance and audit, AMS hospital service, clinical review and direct prescriber feedback</td>
</tr>
<tr>
<td>4: Potential role of nurses in AMS</td>
<td>• What do you think may be potential roles for nurses in AMS?</td>
<td>• Educator, challenging prescribing decision, therapeutic drug monitoring, clinical review and direct prescriber feedback, collaboration, antimicrobial prescribing surveillance and audit, AMS hospital service, clinical review and direct prescriber feedback</td>
</tr>
<tr>
<td>5: Barriers/challenges to nurses’ engaging in AMS</td>
<td>• What do you think are some of the barriers to nurses’ engaging in AMS?</td>
<td>• Knowledge/training/ leadership support/time/prescribing authority, challenging medical staff /Time constraints/workload/staff communication/</td>
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### Appendix B: Interview Guides/Focus Groups

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<tr>
<th>Topic heading</th>
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<td>Section 1 and 2 are the same as interview guides of organisational leader interviews</td>
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<tr>
<td><strong>3: Current role of nurses in AMS in this hospital</strong></td>
<td>• What activities are you currently doing that would be considered AMS?</td>
<td>• Adjustment of timing and preparation of medicines</td>
</tr>
<tr>
<td>• 3A: Ward nurses</td>
<td></td>
<td>• Monitoring for side effects of antimicrobial</td>
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<td>• Initiating reviews of treatment</td>
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<td></td>
<td></td>
<td>• Obtaining cultures and sensitivities before beginning antimicrobial therapy</td>
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<td></td>
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<td>• Providing ongoing for treatment safety and effectiveness</td>
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<td>• Involvement in decision to change the route of antimicrobial medicines from IV to oral</td>
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<td>• Monitoring the duration of surgical prophylaxis in consultation with doctors and pharmacists</td>
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<td></td>
<td>• Educating patients about appropriate antimicrobial use</td>
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<td></td>
<td></td>
<td>• Informing patient about recognizing and reporting adverse effects and complication</td>
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<td></td>
<td></td>
<td>• Infection prevention and control practices, strict environmental cleanliness</td>
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| 3B: Infection control nurses  | What elements of your everyday work is related to AMS?                    | - Pre-authorization of restricted antimicrobials  
- Review of patients on intravenous antimicrobials, for potential switch to oral therapy  
- Review of patients receiving antimicrobials with duplicate spectra, or other potentially inappropriate drug combinations  
- Review of patients on selected broad spectrum antimicrobials  
- Review of patients with documented sterile site infections to ensure appropriate antimicrobial therapy is in place  
- Review of patients receiving antimicrobials for a duration that exceeds recommendations in the hospital antimicrobial guidelines  
- Participation in the infection prevention and control program  
- Provision of education on prudent antimicrobial use to consultant, non-consultant and nurse prescribers |
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<tr>
<td>4: Nurses’ interactions with patients regarding AMS on admission, during</td>
<td>4A: What AMS activities do you do for patients on admission to the ward?</td>
<td>Interview patients about past history of antibiotic taking including adverse effects and complication</td>
</tr>
<tr>
<td>their hospitalization and preparation for discharge from hospital</td>
<td>4B: What AMS activities do you do for patients during their hospitalization?</td>
<td>Look at antibiotics that patients bring in with them</td>
</tr>
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<td></td>
<td></td>
<td>Inform patient when they are prescribed antibiotics along with the reason why they need to be treated by that, dose, duration, possible side effects, possible adverse effects and complication</td>
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<tr>
<td></td>
<td></td>
<td>Monitoring allergy status</td>
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<td>Clinical specimen and drug resistance</td>
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<td>Ensuring administration and continuation of the drug</td>
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<td>Review antibiotic within 48 hours after order initiating</td>
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<td>Educating patients and their carers on how to take antibiotics and hygienic practices</td>
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<td></td>
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<td>Advising patients on how to take their course when they are at home</td>
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<td>Provide guidance about possible medication side effects</td>
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</table>
| 5: Potential roles for nurses/infection control nurses in AMS | What do you think are potential roles for nurses/infection control nurses in AMS? | Prescribing  
Collaboration; participate in prevention and infection control program, review of hospital wide infection practices of clinicians  
AMS hospital service (with AMS team, MD team)  
Clinical review and direct prescriber feedback  
Antimicrobial prescribing surveillance and audit  
Therapeutic monitoring  
Stop antibiotics  
Tracking therapeutic disease  
Provision of education on prudent antimicrobial use |
| 6: Barriers/challenges to nurses’/infection control/ nurses’ engagement in AMS | What are the challenges to nurses’/infection control nurses’ engagement in AMS? | Education  
A lack of confidence in the area of AMS  
Time constraints/ workload  
Changing practice/habits/ attitudes  
Lack of knowledge/keeping knowledge up to date  
Patient/family expectations and attitudes  
Challenging medical staff/prescribing decision  
Staff education/training  
Staff communication  
Leadership support |
### Appendix C: Clinician Survey

#### Demographic information

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<tr>
<th>Profession</th>
<th>☐ Physician</th>
<th>☐ Nurse</th>
<th>☐ Pharmacist</th>
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<th>☐</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>☐ Male</th>
<th>☐ Female</th>
<th>☐ Other</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>☐ &lt;1 year</th>
<th>☐ 1 to 5 years</th>
<th>☐ 6 to 10 years</th>
<th>☐ 11 to 20 year</th>
<th>☐ &gt;20 year</th>
</tr>
</thead>
</table>

#### Please indicate how serious a problem you believe antimicrobial resistance is in the following places (scale of 1 to 7)

1. Antimicrobial resistance is a worldwide problem.
   - ☐ 1 Not a problem
   - ☐ 2
   - ☐ 3
   - ☐ 4
   - ☐ 5
   - ☐ 6
   - ☐ 7 Very serious problem

2. Antimicrobial resistance is a problem in Thai Community.
   - ☐ 1 Not a problem
   - ☐ 2
   - ☐ 3
   - ☐ 4
   - ☐ 5
   - ☐ 6
   - ☐ 7 Very serious problem

3. Antimicrobial resistance is a problem in Thai Hospitals.
   - ☐ 1 Not a problem
   - ☐ 2
   - ☐ 3
   - ☐ 4
   - ☐ 5
   - ☐ 6
   - ☐ 7 Very serious problem

4. Antimicrobial resistance is a problem in the study hospital.
   - ☐ 1 Not a problem
   - ☐ 2
   - ☐ 3
   - ☐ 4
   - ☐ 5
   - ☐ 6
   - ☐ 7 Very serious problem

#### Please indicate how strongly you believe the following contribute to antimicrobial resistance at the study hospital

5. Use of antimicrobials in Thai animal/agricultural sectors
   - ☐ 1 Does not contribute
   - ☐ 2
   - ☐ 3
   - ☐ 4
   - ☐ 5
   - ☐ 6
   - ☐ 7 Strongly contributes

6. Use of antimicrobials in the Thai community
   - ☐ 1 Does not contribute
   - ☐ 2
   - ☐ 3
   - ☐ 4
   - ☐ 5
   - ☐ 6
   - ☐ 7 Strongly contributes

7. Use of antimicrobials in Thai Hospitals
   - ☐ 1 Does not contribute
   - ☐ 2
   - ☐ 3
   - ☐ 4
   - ☐ 5
   - ☐ 6
   - ☐ 7 Strongly contributes

8. Use of antimicrobials at the study hospital
   - ☐ 1 Does not contribute
   - ☐ 2
   - ☐ 3
   - ☐ 4
   - ☐ 5
   - ☐ 6
   - ☐ 7 Strongly contributes
Please indicate how strongly you believe the following contribute to antimicrobial resistance at study hospital

<table>
<thead>
<tr>
<th>Question</th>
<th>Rating Options</th>
</tr>
</thead>
</table>

Please indicate how strongly you agree or disagree with the following statements

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rating Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. I previously involved in care of patients with an antibiotic resistant infection</td>
<td>Yes [ ] No [ ] Unsure [ ]</td>
</tr>
<tr>
<td>12. I have noticed increasing number of antimicrobial resistance infections over past 5 years</td>
<td>Yes [ ] No [ ] Unsure [ ]</td>
</tr>
<tr>
<td>13. I would estimate that the percentage of inpatient antimicrobial orders that are inappropriate at the study hospital is:</td>
<td>&lt;10% year [ ] 10 to 25% [ ] 26 to 50% [ ] &gt;50% [ ]</td>
</tr>
<tr>
<td>14. In which patient groups do you believe that antimicrobial orders are inappropriate at study hospital in order of frequency (Please number the following in order of importance where 1 is most importance and 5 is least)</td>
<td>Patients with community acquired infection [ ] Patients with immune suppressive condition [ ] Surgical patients (exclude surgical prophylaxis) [ ] Patients being treatment in critical care [ ] Patients being treatment in general wards [ ] Patients being treatment in VIP wards [ ]</td>
</tr>
<tr>
<td>15. I would estimate that the percentage of surgical prophylaxis orders that are inappropriate at the study hospital is:</td>
<td>&lt;10% year [ ] 10 to 25% [ ] 26 to 50% [ ] &gt;50% [ ]</td>
</tr>
<tr>
<td>16. What do you consider is the most frequent problem associated with surgical prophylaxis at the study hospital (Please tick one only)</td>
<td>Timing of first dose of prophylaxis [ ] Inappropriate antibiotic chosen [ ] Prophylaxis is not stopped at the appropriate time [ ] Other (please explain) [ ]</td>
</tr>
</tbody>
</table>

Please indicate how strongly you believe the following contribute to antimicrobial resistance at study hospital.
### Please indicate how strongly you agree or disagree with the following statements

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. Improving antimicrobial prescribing at the study hospital will help decrease antimicrobial resistance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ 1 Strongly disagree                                                                                                           □ 2             □ 3             □ 4             □ 5             □ 6             □ 7 Strongly agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Improving antimicrobial prescribing should be an organisational priority.                                                                                       □ 1 Strongly disagree   □ 2             □ 3             □ 4             □ 5             □ 6             □ 7 Strongly agree</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>19. A formal policy for the use of antimicrobials should be introduced at study hospital.                                                                                                           □ 1 Strongly disagree   □ 2             □ 3             □ 4             □ 5             □ 6             □ 7 Strongly agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>20. A policy that limits the prescribing of selected antimicrobials to certain clinical indications via an approval process should be introduced at the study hospital.                     □ 1 Strongly disagree   □ 2             □ 3             □ 4             □ 5             □ 6             □ 7 Strongly agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>21. Local antimicrobial guidelines and protocols should be introduced at the study hospital.                                                                                                           □ 1 Strongly disagree   □ 2             □ 3             □ 4             □ 5             □ 6             □ 7 Strongly agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. A computer application which gives advice on selection and duration of antimicrobial therapy for specific clinical conditions would be clinically useful                                    □ 1 Strongly disagree   □ 2             □ 3             □ 4             □ 5             □ 6             □ 7 Strongly agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. A team consisting of an ID specialist physician and Pharmacist providing individualized antimicrobial prescribing advice and feedback would assist with antimicrobial selection.                          □ 1 Strongly disagree   □ 2             □ 3             □ 4             □ 5             □ 6             □ 7 Strongly agree</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. I have heard of the term “Antimicrobial stewardship”.                                                                             □ Yes             □ No             □ Unsure</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. I worked in healthcare facilities with AMS programs                                                                                                                                                     □ Yes             □ No             □ Unsure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. I would rate the level of my knowledge about appropriate antibiotic is:                                                                                                                  □ 1 Strongly disagree   □ 2             □ 3             □ 4             □ 5             □ 6             □ 7 Strongly agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. I would be interested in participating in education session about AMS                                                                                                           □ Minimal       □ Limited       □ Average       □ Good       □ Very good</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Options:**

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree
Please indicate how strongly you agree or disagree with the following statements

<table>
<thead>
<tr>
<th>28. I would be willing to participate in any activities to improve the quality of antimicrobial use at the study hospital.</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 1 Strongly disagree □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 Strongly agree</td>
</tr>
</tbody>
</table>


### Appendix D: Patient Survey

#### Part 1: Demographic Information
- **Gender**
  - ☐ Male
  - ☐ Female
  - ☐ Other
- **Age**
- **Education**
  - ☐ None
  - ☐ Primary school
  - ☐ High school
  - ☐ Bachelor degree
  - ☐ Post graduate
- **Long term health problem**
  - ☐ None
  - ☐ Having chronic disease (please specify) ..........................................

#### Part 2: Attitudes and behaviors regarding antibiotic use
Please write in the space provided or indicate your agreement level or how true it is about you with the following statements by putting a tick in the box.

1. **How many times did you take antibiotics in the past year?** .......................................................... 
2. **Why did you take antibiotics?**
   - ☐ Cold
   - ☐ Respiratory tract infections
   - ☐ Wound infections
   - ☐ Gastroenteritis
   - ☐ Mouth ulcer
   - ☐ Other (please specify) .......... 
3. **I buy antibiotics from a drugstore when I get a cold.**
   - ☐ Never
   - ☐ Sometimes
   - ☐ Frequently
   - ☐ Every time
4. **I go to see a doctor when I get a cold.**
   - ☐ Never
   - ☐ Sometimes
   - ☐ Frequently
   - ☐ Every time
5. **I stop taking antibiotics when I feel better.**
   - ☐ Never
   - ☐ Sometimes
   - ☐ Frequently
   - ☐ Every time
6. **I share antibiotics with others.**
   - ☐ Never
   - ☐ Sometimes
   - ☐ Frequently
   - ☐ Every time
7. I keep antibiotics at home for next time.
   - Never
   - Sometimes
   - Frequently
   - Every time

8. If I complete antibiotics but I am still not feeling well, I will buy extra antibiotics from a drug store.
   - Never
   - Sometimes
   - Frequently
   - Every time

### Attitudes towards antibiotic use

9. I believe that patients should be able to buy antibiotics
   - 1 Strongly disagree
   - 2 Disagree
   - 3 Unsure
   - 4 Agree
   - 5 Strongly agree

10. I believe that antibiotics can reduce symptoms of a cold.
    - 1 Strongly disagree
    - 2 Disagree
    - 3 Unsure
    - 4 Agree
    - 5 Strongly agree

11. I believe that antibiotics can prevent complications of a cold.
    - 1 Strongly disagree
    - 2 Disagree
    - 3 Unsure
    - 4 Agree
    - 5 Strongly agree

12. I expect to be prescribed antibiotics by a doctor when I get a cold.
    - 1 Strongly disagree
    - 2 Disagree
    - 3 Unsure
    - 4 Agree
    - 5 Strongly agree
### Attitudes towards antibiotic use

13. I expect to receive antibiotics from a drug store when I get a cold.

- [ ] 1 Strongly disagree
- [ ] 2 Disagree
- [ ] 3 Unsure
- [ ] 4 Agree
- [ ] 5 Strongly agree

### Patient’s knowledge

14. Where do you get information regarding antibiotic use in the community?

- [ ] Doctor
- [ ] Pharmacist
- [ ] Nurses
- [ ] Drug stores
- [ ] Friends/Neighbors
- [ ] Internet/Google search
- [ ] Hospital
- [ ] Other (please specify) 

15. I believe that an incomplete course of antibiotics can reduce its effectiveness.

- [ ] 1 Strongly disagree
- [ ] 2 Disagree
- [ ] 3 Unsure
- [ ] 4 Agree
- [ ] 5 Strongly agree

16. I believe that an incomplete course of antibiotics can contribute to antibiotic resistance.

- [ ] 1 Strongly disagree
- [ ] 2 Disagree
- [ ] 3 Unsure
- [ ] 4 Agree
- [ ] 5 Strongly agree

17. I believe that antibiotics may cause drug allergy.

- [ ] 1 Strongly disagree
- [ ] 2 Disagree
- [ ] 3 Unsure
- [ ] 4 Agree
- [ ] 5 Strongly agree

18. I want to have more information regarding the best way to use antibiotics.

- [ ] 1 Strongly disagree
- [ ] 2 Disagree
- [ ] 3 Neither expected or unexpected
- [ ] 4 Agree
- [ ] 5 Strongly agree
<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>19. I expect to take antibiotics.</td>
<td>☐ 1 Strongly disagree ☐ 2 Disagree ☐ 3 Unsure ☐ 4 Agree ☐ 5 Strongly agree</td>
</tr>
<tr>
<td>20. I expect to receive intravenous antibiotics.</td>
<td>☐ 1 Strongly disagree ☐ 2 Disagree ☐ 3 Unsure ☐ 4 Agree ☐ 5 Strongly agree</td>
</tr>
<tr>
<td>21. I believe that intravenous antibiotics are stronger than tablets.</td>
<td>☐ 1 Strongly disagree ☐ 2 Disagree ☐ 3 Unsure ☐ 4 Agree ☐ 5 Strongly agree</td>
</tr>
<tr>
<td>22. I would ask my relatives to buy an antibiotic from outside if doctor does not prescribe it for me.</td>
<td>☐ 1 Strongly disagree ☐ 2 Disagree ☐ 3 Unsure ☐ 4 Agree ☐ 5 Strongly agree</td>
</tr>
<tr>
<td>23. I expect to be asked by doctors and/or nurses about antibiotics that I've taken in the past year.</td>
<td>☐ 1 Strongly disagree ☐ 2 Disagree ☐ 3 Unsure ☐ 4 Agree ☐ 5 Strongly agree</td>
</tr>
<tr>
<td>24. I would tell the doctor/nurse if my relatives bring antibiotics from outside to me.</td>
<td>☐ 1 Strongly disagree ☐ 2 Disagree ☐ 3 Unsure ☐ 4 Agree ☐ 5 Strongly agree</td>
</tr>
<tr>
<td>Question</td>
<td>Options</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 25. I want to tell the doctor/nurse about antibiotics that I have taken recently. | □ 1 Strongly disagree  
 □ 2 Disagree  
 □ 3 Unsure  
 □ 4 Agree  
 □ 5 Strongly agree |
| 26. I want to know whether I’m receiving antibiotics.                     | □ 1 Strongly disagree  
 □ 2 Disagree  
 □ 3 Neither expected or unexpected  
 □ 4 Agree  
 □ 5 Strongly agree |
| 27. I want to know the reason why I have to take antibiotics.             | □ 1 Strongly disagree  
 □ 2 Disagree  
 □ 3 Neither expected or unexpected  
 □ 4 Agree  
 □ 5 Strongly agree |
| 28. I want to know how long I have to take antibiotics.                   | □ 1 Strongly disagree  
 □ 2 Disagree  
 □ 3 Neither expected or unexpected  
 □ 4 Agree  
 □ 5 Strongly agree |
| 29. I am afraid of getting multi-drug resistant infections that may be difficult to treat. | □ 1 Strongly disagree  
 □ 2 Disagree  
 □ 3 Neither expected or unexpected  
 □ 4 Agree  
 □ 5 Strongly agree |
TO: Healthcare administrators

Plain Language Statement

Date: 8 July, 2015
Version 2

Full Project Title: The Role of Nurses in Antimicrobial Stewardship: A Thai Case Study
Principal Researcher: Professor Mari Botti
Student Researcher: Miss Nantanit Sutthiruk
Associate Researchers: Professor Julie Considine
Associate Professor Andrea Driscoll
Assistant Professor Kumthorn Malatham

You are invited to participate in this research project because we would like to obtain your views in relation to clinical governance for antimicrobial stewardship (AMS) within the Thai context.

1. Your Consent
   This Plain Language Statement contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project so that you can make a fully informed decision whether you wish to participate.
   Once you understand what the project is about and if you agree to take part in it, you will be asked to sign the Consent Form. By signing the Consent Form, you indicate that you understand the information and that you give your consent to participate in the research project. You will be given a copy of the Plain Language Statement and Consent Form to keep as a record.

2. Purpose and Background
   The overall aim of this project is to explore the current and potential role of nurses in AMS in acute healthcare in Thailand. The specific aim of this phase is to describe the current clinical governance structures in your hospital that relate to AMS and how nurses are involved in these structures. Detailed analysis of health service clinical governance for AMS is important to identify alignment with international best practice, gaps in best practice and where nurses could best contribute to AMS clinical governance.
3. Procedures
You are invited to take part in a face-to-face interview. If you agree, the interview will be audiotaped and will take approximately 20-30 minutes using an interview guide. The interview will take place at a time and location that best suits you. The sorts of questions that will be asked include:

- What is the current structure of antimicrobial stewardship governance at Ramathibodi hospital?
- What is the main purpose of antimicrobial stewardship governance?
- What are nurses’ current roles in antimicrobial stewardship governance at Ramathibodi hospital?
- Are there roles that nurses could play in antimicrobial stewardship governance at Ramathibodi hospital but currently do not? Why not?

4. Possible Benefits
There may not be immediate benefits to you. However, your views will make a valuable contribution to the understanding of AMS governance in the Thai healthcare context.

5. Possible Risks
We do not anticipate there will be any risk to you in participating in this project.

6. Privacy, Confidentiality and Disclosure of Information
The information obtained in connection with the research project will be kept confidential and will only be used for the purpose of the research project. It will only be disclosed with your consent. In any publication, information will be provided in such a way that you cannot be identified. The data will be held in secure storage for five years after publication of the findings of the research project, after which it will be destroyed.

7. Results of Project
The results of this project will be reported as summary findings in publications and in a doctoral thesis. In addition, a report of the findings will be submitted to the hospital executive. Should you wish to access this report, you can request it by contacting the research team or the Director of Ramathibodi hospital.

8. Participation is Voluntary
Participation in this study is voluntary. If you do not wish to take part in this study or change your mind after signing the consent form, you will be free to withdraw from the study without affecting your relationship with Ramathibodi Hospital or Deakin University. However, you will only be able to withdraw data within four weeks after the interview. After this time, your responses will have been integrated with those of others and it will not be possible to withdraw your data.

9. Reimbursement for your costs
You will not be paid for your participation in this study.

10. Ethical Guidelines
This project will be carried out according to the *National Statement on Ethical Conduct in Human Research (2007)* produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies. The ethical aspects of this research project have been approved by the Human Research Ethics Committees of Deakin University and Ramathibodi Hospital.

### 11. Complaints

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact:

**The Manager, Ethics and Biosafety, Deakin University**, 221 Burwood Highway, Burwood Victoria 3125, Telephone: +61 03 9251 7129, or email - research-ethics@deakin.edu.au

Please quote project number 2015-131.

**Or, The Chair of the Ethics Committee, Ramathibodi Hospital**, 270, Rama VI Rd. Payathai, Rachathewi, Bangkok, 10400, Telephone: +66 2201 1544

### 12. Further information, Queries or Any Problems

If you require further information, wish to withdraw your participation or if you have any questions concerning this project, please contact:

**Nantanit Sutthiruk (Student Researcher)** International phone: +61 3 9244 6319, Thailand phone: +66 2441 4234, Email: nsutthir@deakin.edu.au or

**Professor Mari Botti (Principal Investigator)** International phone: +61 3 9426 6565 Email: mari.botti@deakin.edu.au
TO: Healthcare administrators

Consent Form

Date: 8 July, 2015
Version 2

Full Project Title: The Role of Nurses in Antimicrobial Stewardship: A Thai Case Study

Reference Number:

I have read and understand the attached Plain Language Statement. I freely agree to participate in this project according to the conditions in the Plain Language Statement. I have been given a copy of the Plain Language Statement and Consent Form to keep.

I understand that the interview will be audio-taped and transcribed.

The researcher has agreed not to reveal my identity and personal details, including when information about this project is published, or presented in any public forum.

Participant’s Name (printed) ………………………………………………………………………
Signature ………………………………………………..Date …………………………………

Researcher’s Name (printed) ………………………………………………………………………
Signature ………………………………………………..Date …………………………………
TO: Healthcare administrators

Withdrawal of Consent Form

(To be used for participants who wish to withdraw from the project)

Date: 8 July, 2015
Version: 2
Full Project Title: The Role of Nurses in Antimicrobial Stewardship: A Thai Case Study
Reference Number: 

I hereby wish to WITHDRAW my consent to participate in the above research project and understand that such withdrawal WILL NOT affect my work or rights.

Participant’s Name (printed)........................................................................................................

Signature .................................................................Date .................................

Please mail this form to:

Nantanit Sutthiruk
Ramathibodi School of Nursing, 999, Salaya, Puthamontol, Nakhonpathom, 73170, Thailand
Phone: +66 2441 4234
Email: nsutthir@deakin.edu.au
Appendix F: Plain Language Statement- Clinicians

TO: Doctors, nurses and pharmacists

Plain Language Statement

Date: 8 July, 2015
Version 2

Full Project Title: The Role of Nurses in Antimicrobial Stewardship: A Thai Case Study
Principal Researcher: Professor Mari Botti
Student Researcher: Miss Nantanit Sutthiruk
Associate Researchers: Professor Julie Considine
Associate Professor Andrea Driscoll
Assistant Professor Kumthorn Malathum

You are invited to participate in this research project because we would like to obtain your perceptions and attitudes towards antimicrobial resistance, antimicrobial use and antimicrobial stewardship (AMS) interventions within the Thai context.

1. Your Consent

This Plain Language Statement contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project so that you can make a fully informed decision whether you wish to participate. Once you understand what the project is about and if you agree to take part in it, you will be asked to complete a survey. By completing and returning the survey, you indicate that you understand the information and that you give your consent to participate in the research project. You may keep this copy of the Plain Language Statement as a record of your participation.

2. Purpose and Background

The overall aim of this project is to explore the current and potential role of nurses in AMS in acute healthcare in Thailand. The specific aim of this phase is to determine the perceptions and attitudes towards AMS among Thai clinicians. It is useful to understand the differences and similarities between professions along with barriers and facilitators to effective AMS in order to inform feasible and clinically useful AMS policy.
3. Procedures
If you consent to participate, you are invited to take part in a survey by filling out a questionnaire. The questionnaire contains questions about you generally (profession, department, gender, age, for example) and perceptions and attitudes towards antimicrobial resistance, antimicrobial use and AMS interventions. The expected time to complete the survey is approximately 10-15 minutes.

4. Possible Benefits
There may not be immediate benefits to you. However, your views will make a valuable contribution to the understanding of AMS governance in the Thai healthcare context.

5. Possible Risks
We do not anticipate there will be any risk to you in participating in this project.

6. Privacy, Confidentiality and Disclosure of Information
The information obtained from you in connection with the research project will be kept confidential and will only be used for the purpose of the research project. In any publication, information will be provided in such a way that individual responses cannot be identified. The data will be held in secure storage for five years after publication of the research project, after which it will be destroyed.

7. Result of Project
The results of this project will be reported as summary findings in publications and in a doctoral thesis. In addition a report of the findings will be submitted to the hospital executive. Should you wish to access this report, you can request it by contacting the research team or the Director of Ramathibodi hospital.

8. Participation is Voluntary
Participation in this study is voluntary. If you do not wish to take part in this study you do not have to do so without affecting your relationship with Ramathibodi Hospital or Deakin University.

9. Reimbursement for your costs
You will not be paid for your participation in this study.

10. Ethical Guidelines
This project will be carried out according to the National Statement on Ethical Conduct in Human Research (2007) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies. The ethical aspects of this research project have been approved by the Human Research Ethics Committees of Deakin University and Ramathibodi Hospital.
11. Complaints

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact:

**The Manager, Ethics and Biosafety, Deakin University**, 221 Burwood Highway, Burwood Victoria 3125, Telephone: +61 03 9251 7129, research-ethics@deakin.edu.au. Please quote project number 2015-131.

Or, **The Chair of the Ethics Committee, Ramathibodi Hospital**, 270, Rama VI Rd. Payathai, Rachathewi, Bangkok, 10400, Telephone: +66 2201 1544

12. Further information, Queries or Any Problems

If you require further information, wish to withdraw your participation or if you have any questions concerning this project, please contact:

**Nantanit Sutthiruk (Student Researcher)** International phone: +61 3 9244 6319, Thailand phone: +66 2441 4234, Email: nsutthir@deakin.edu.au or

**Professor Mari Botti (Principal Investigator)** International phone: +61 3 9426 6565 Email: mari.botti@deakin.edu.au
Appendix G: Plain Language Statement- Nurses

TO: Nurses

**Plain Language Statement**

**Date:** 8 July, 2015  
**Version 2**

**Full Project Title:** The Role of Nurses in Antimicrobial Stewardship: A Thai Case Study

**Principal Researcher:** Professor Mari Botti  
**Student Researcher:** Miss Nantanit Sutthiruk  
**Associate Researchers:** Professor Julie Considine  
Associate Professor Andrea Driscoll  
Assistant Professor Kumthorn Malathum

You are invited to participate in this research project because we would like to obtain your views in relation to nurses’ role in AMS within the Thai context.

**1. Your Consent**

This Plain Language Statement contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project so that you can make a fully informed decision whether you wish to participate. Once you understand what the project is about and if you agree to take part in it, you will be asked to sign the Consent Form. By signing the Consent Form, you indicate that you understand the information and that you give your consent to participate in the research project. You will be given a copy of the Plain Language Statement and Consent Form to keep as a record.

**2. Purpose and Background**

The aim of this project is to explore the current and potential role of nurses in antimicrobial stewardship (AMS) from patient admission, during hospitalization, and after discharge in acute healthcare in Thailand. Understanding the current and potential role of nurses in AMS is important because it will inform nursing education and professional development in relation to AMS, health service AMS governance, and strategies to engage patients both within the hospital and the community.

**3. Procedures**
You are invited to take part in a focus group. If you agree, you will be asked to complete this written consent form before starting the focus group. The researcher will conduct the focus groups while an observer documents interactions and non-verbal behaviors during the focus group. You will be provided with an opportunity to debrief and provide feedback. Two types of recording methods will be used including written notes and audio recording. The focus groups will be conducted over approximately 40-60 minutes using a question guide. The sorts of questions that will be asked include:

- What do your understanding of antimicrobial stewardship?
- What are the current roles for nurses/infection control nurses in antimicrobial stewardship?
- What do you think potential roles for nurses/infection control nurses in antimicrobial stewardship may be in the future?
- How do nurses interact with patients regarding to antimicrobial stewardship, from admission, during their hospitalized and in preparation for discharge?
- What roles could nurses play to reduce antimicrobial resistance in relation to patient’s used of antibiotics?
- What do you think are the barriers to nurses’ engagement in antimicrobial stewardship?

4. Possible Benefits
There may not be immediate benefits to you. However, your views will make a valuable contribution to nursing education and professional development in relation to AMS, health service AMS governance, and strategies to engage patients both within the hospital and the community.

5. Possible Risks
We do not anticipate there will be any risk to you in participating in this project.

6. Privacy, Confidentiality and Disclosure of Information
The information obtained in connection with the research project will be kept confidential and will only be used for the purpose of the research project. It will only be disclosed with your consent. In any publication, information will be provided in such a way that you cannot be identified. The data will be held in secure storage for five years after publication of the research project, after which it will be destroyed.

7. Result of Project
The results of this project will be reported as summary findings in publications and in a doctoral thesis. In addition a report of the findings will be submitted to the hospital executive. Should you wish to access this report, you can request it by contacting the research team or the Director of Ramathibodi hospital.

8. Participation is Voluntary
Participation in this study is voluntary. If you do not wish to take part, you do not have to. If you decided to take part and later change your mind, you are free to withdraw from this project at any stage before or during the focus group by informing the researcher. After the focus group, it will not be possible to remove information that you provided because your responses will have been integrated with those of others.

9. Reimbursement for your costs
You will not be paid for your participation in this study.

10. Ethical Guidelines
This project will be carried out according to the National Statement on Ethical Conduct in Human Research (2007) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies. The ethical aspects of this research project have been approved by the Human Research Ethics Committees of Deakin University and Ramathibodi Hospital.

11. Complaints
If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact:

The Manager, Ethics and Biosafety, Deakin University, 221 Burwood Highway, Burwood Victoria 3125, Telephone: +61 03 9251 7129, research-ethics@deakin.edu.au. Please quote project number 2015-131.

Or, The Chair of the Ethics Committee, Ramathibodi Hospital, 270, Rama VI Rd. Payathai, Rachathewi, Bangkok, 10400, Telephone: +66 2201 1544

12. Further information, Queries or Any Problems
If you require further information, wish to withdraw your participation or if you have any questions concerning this project, please contact:

Nantanit Sutthiruk (Student Researcher) International phone: +61 3 9244 6319, Thailand phone: +66 2441 4234, Email: nsutthir@deakin.edu.au or

Professor Mari Botti (Principal Investigator) International phone: +61 3 9426 6565 Email: mari.botti@deakin.edu.au
TO: Nurses

Consent Form

Date: 8 July, 2015
Version 2

Full Project Title: The Role of Nurses in Antimicrobial Stewardship: A Thai Case Study
Reference Number:

I have read and understand the attached Plain Language Statement. I freely agree to participate in this project according to the conditions in the Plain Language Statement. I have been given a copy of the Plain Language Statement and Consent Form to keep.

I understand that the focus group will be audio-taped and transcribed.

The researcher has agreed not to reveal my identity and personal details, including when information about this project is published, or presented in any public forum.

Participant’s Name (printed) ………………………………………………………………………
Signature ………………………………………………………Date ……………………..

Researcher’s Name (printed) ………………………………………………………………….
Signature ………………………………………………………Date ……………………..

Page 4 of 5
TO: Nurses

Withdrawal of Consent Form

(To be used for participants who wish to withdraw from the project)

Date: 8 July, 2015
Version: 2

Full Project Title: The Role of Nurses in Antimicrobial Stewardship: A Thai Case Study
Reference Number:

I hereby wish to WITHDRAW my consent to participate in the above research project and understand that such withdrawal WILL NOT affect my work or rights.

Participant’s Name (printed)………………………………………………………………………………

Signature ………………………………………………………………..Date …………

Please mail this form to:

Nantanit Sutthiruk
Ramathibodi School of Nursing, 999, Salaya, Puthamontol, Nakhonpathom, 73170, Thailand
Phone: +66 2441 4234
Email: nsutthir@deakin.edu.au
Appendix H: Plain Language Statement- Patients

TO: Patients

Plain Language Statement

Date: 8 July, 2015
Version 2

Full Project Title: The Role of Nurses in Antimicrobial Stewardship: A Thai Case Study
Principal Researcher: Professor Mari Botti
Student Researcher: Miss Nantanit Sutthiruk
Associate Researchers: Professor Julie Considine
Associate Professor Andrea Driscoll
Assistant Professor Kumthorn Malathum

You are invited to participate in a research project that is being conducted by a research team from the School of Nursing and Midwifery, Deakin University, Australia and Ramathibodi Hospital.

1. Your Consent

This Plain Language Statement contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project so that you can make a fully informed decision whether you wish to participate.

Once you understand what the project is about you will be asked to complete a questionnaire. By completing and returning the questionnaire, you indicate that you understand the information and that you give your consent to participate in the research project. You may keep this Plain Language Statement as a record.

2. Purpose and Background

The overall aim of this project is to explore ways that nurses can participate in the safe use of antimicrobial medicines in acute healthcare in Thailand. Antimicrobial medicines are medicines used to treat or prevent infection. One of the ways that nurses can play a part in the safe use of antimicrobial medicines is through patient education. We wish to explore your attitudes and behaviors regarding your use of antimicrobial medicines (such as antibiotics) so that we can plan such education programs for patients and families including the development of information materials.
3. Procedures
If you consent to participate, you will be invited to take part in a survey by filling out a questionnaire. The survey contains questions about you generally (gender, age, education background, for example) and your thoughts and behaviors related to antimicrobial use. You will complete the survey by yourself; the expected time to complete the survey is approximately 15 minutes.

4. Possible Benefits
There may not be immediate benefits to you. However, your views will make a valuable contribution to the way doctors and nurses provide information to patients and families.

5. Possible Risks
We do not anticipate there will be any risk to you in participating in this project.

6. Privacy, Confidentiality and Disclosure of Information
The information obtained in connection with the research project will be kept confidential and will only be used for the purpose of the research project. In any publication, group information will be reported so that individual responses cannot be identified. The data will be held in secure storage for five years after publication of the research project, after which it will be destroyed.

7. Result of Project
The results of this project will be reported as summary findings in publications and in a doctoral thesis. In addition a report of the findings will be submitted to the hospital executive. Should you wish to access this report, you can request it by contacting the research team or the Director of Ramathibodi Hospital.

8. Participation is Voluntary
Participation in this study is voluntary. If you do not wish to take part in this study, you do not have to do so and this will not affect your treatment or your relationship with Ramathibodi hospital.

9. Reimbursement for your costs
You will not be paid for your participation in this study.

10. Ethical Guidelines
This project will be carried out according to the National Statement on Ethical Conduct in Human Research (2007) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies. The ethics aspects of this research project have been approved by the Human Research Ethics Committees of Deakin University and Ramathibodi Hospital.
11. Complaints

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact:

The Manager, Ethics and Biosafety, Deakin University, 221 Burwood Highway, Burwood Victoria 3125, Telephone: +61 03 9251 7129, research-ethics@deakin.edu.au. Please quote project number 2015-131.

Or, The Chair of the Ethics Committee, Ramathibodi Hospital, 270, Rama VI Rd. Payathai, Rachathewi, Bangkok, 10400, Telephone: +66 2201 1544

12. Further information, Queries or Any Problems

If you require further information, wish to withdraw your participation or if you have any questions concerning this project, please contact:

Nantanit Sutthiruk (Student Researcher) International phone: +61 3 9244 6319, Thailand phone: +66 2441 4234, Email: nsutthir@deakin.edu.au or

Professor Mari Botti (Principal Investigator) International phone: +61 3 9426 6565, Email: mari.botti@deakin.edu.au
Appendix I: University Ethics Approval

Memorandum
To: Prof Mari Botti
School of Nursing & Midwifery

From: Deakin University Human Research Ethics Committee (DUHREC)

Date: 30 July, 2015

Subject: The Role of Nurses in Antimicrobial Stewardship: A Thai Case Study

Please quote this project number in all future communications

The application for this project was considered at the DU-HREC meeting held on 22/6/2015.

Approval has been given for Ms Nantanit Sutthiruk, under the supervision of Prof Mari Botti, School of Nursing & Midwifery, to undertake this project from 30/07/2015 to 30/07/2019.

The approval given by the Deakin University Human Research Ethics Committee is given only for the project and for the period as stated in the approval. It is your responsibility to contact the Human Research Ethics Unit immediately should any of the following occur:

- Serious or unexpected adverse effects on the participants
- Any proposed changes in the protocol, including extensions of time.
- Any events which might affect the continuing ethical acceptability of the project.
- The project is discontinued before the expected date of completion.
- Modifications are requested by other HRECs.

In addition you will be required to report on the progress of your project at least once every year and at the conclusion of the project. Failure to report as required will result in suspension of your approval to proceed with the project.

DUHREC may need to audit this project as part of the requirements for monitoring set out in the National Statement on Ethical Conduct in Human Research (2007).

Human Research Ethics Unit
research-ethics@deakin.edu.au
Telephone: 03 9251 7123
Appendix J: Hospital Ethics Approval

Documentary Proof of Ethical Clearance
Committee on Human Rights Related to Research Involving Human Subjects

No MURA2015/576

<table>
<thead>
<tr>
<th>Title of Project</th>
<th>The Role of Nurses in Antimicrobial Stewardship: A Thai Case Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol Number</td>
<td>ID 09-58-59</td>
</tr>
<tr>
<td>Principal Investigator</td>
<td>Miss Nantanit Suthiruk</td>
</tr>
<tr>
<td>Official Address</td>
<td>Ramathibodi School of Nursing</td>
</tr>
<tr>
<td></td>
<td>Faculty of Medicine Ramathibodi Hospital</td>
</tr>
<tr>
<td></td>
<td>Mahidol University</td>
</tr>
</tbody>
</table>

The aforementioned project has been reviewed and approved by the Committee on Human Rights Related to Research Involving Human Subjects, based on the Declaration of Helsinki.

| Signature of Chairman Committee on Human Rights Related to Research Involving Human Subjects | ................................................................. |
|                                                                                           | Prof.                                           |

Date of Approval: October 9, 2015
Duration of Study: 6 Months
Appendix K: Publications Arising from This Thesis

ARTICLE IN PRESS

American Journal of Infection Control ■ (2017) ■ ■

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Thai clinicians’ attitudes toward antimicrobial stewardship programs

Nantanit Sutthiruk RN, MNS a,*, Julie Considine RN, PhD a,b, Ana Hutchinson RN, PhD a,c, Andrea Driscoll RN, PhD a,d, Kumthon Malathum MD e, Mari Botti RN, PhD a,c

a School of Nursing and Midwifery, Deakin University, Geelong, VIC, Australia
b Centre for Quality and Patient Safety Research - Eastern Health Partnership, Box Hill, VIC, Australia
c Centre for Quality and Patient Safety Research - Epworth Healthcare Partnership, Richmond, VIC, Australia
d Austin Health, Heidelberg, VIC, Australia
e Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Background: Effective hospital-wide antimicrobial stewardship (AMS) programs need multidisciplinary engagement; however, clinicians’ attitudes have not been investigated in Thailand where AMS is in early development. The aim of this study was to explore Thai clinicians’ (doctors, nurses, and pharmacists) perceptions and attitudes toward AMS.

Methods: A paper-based survey was distributed in a 1,000-bed university hospital in Bangkok, Thailand, between November 9, 2015, and December 21, 2015. A total of 1,087 clinicians participated: 392 doctors, 613 nurses, and 82 pharmacists.

Results: Most participants agreed that improving antimicrobial prescribing would decrease antimicrobial resistance (AMR) and should be a priority of hospital policy. Doctors were less likely to agree with policies that limit antimicrobial prescribing (P<.001) than nurses or pharmacists, and were less likely to be interested in participating in AMS education than other clinicians (P<.001). Pharmacists indicated higher agreement with the statement, recommending that a specialist team provide individualized antimicrobial prescribing advice (P<.01) and that feedback improves antimicrobial selection (P<.001). Nurses were less likely to agree that community antibiotic use (P<.001) or patient pressure for antibiotics contribute to AMR (P<.001).

Conclusions: AMS programs are vital to improving antimicrobial use by clinicians. Understanding clinicians’ attitudes and perceptions related to AMS is important to ensure that AMS programs developed address areas relevant to local clinical needs.

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BACKGROUND

Antimicrobial resistance (AMR) is a major health care problem worldwide with significant consequences.1 Patients with antimicrobial-resistant infections are at greater risk of worse clinical outcomes, recurrent infection, and death than infected patients without AMR.2 As many as 25,000 people in Europe die every year because of antibiotic-resistant microorganisms,3 and it is estimated that >2 million people are infected by antibiotic-resistant pathogens resulting in 23,000 deaths annually in the United States.4 It has been estimated that >500,000 people worldwide die every year as a result of AMR.5 In Thailand, as many as 90,000 patients are affected by AMR annually and the cost of the therapeutic use of antibiotic medications is >$200 million per year. The increase in AMR has resulted in approximately 3.24 million extra days of hospital stay and accounted for 38,481 deaths annually in Thailand.6 It is estimated that an additional 19,000 deaths are caused by multidrug-resistant (MDR) bacteria in Thailand each year. Mortality attributed to MDR Acinetobacter ba- teremia (41%).7

Inappropriate use of antimicrobial medications is a major cause of AMR. In U.S. hospitals, as many as 50% of antibiotics prescribed are unnecessary or inappropriate,8 and 47% of antibiotic use in Australian hospitals was found to be inconsistent with antimicrobial guidelines or patients’ microbiologic results.9 Antimicrobial
stewardship (AMS) programs have been initiated to respond to the growing problem of AMR. AMS is a process that aims to ensure optimal antimicrobial medicine use and minimize AMR. For AMS to be effective, hospital-wide AMS programs need the engagement of multidisciplinary professionals who are involved in antimicrobial prescribing and use. Clinicians need to be aware of the causes and consequences of AMR and current evidence for appropriate antimicrobial use. Differences and similarities between professions will affect the implementation of AMS programs. Clinician support for AMS programs has been identified in surveys conducted in Europe, Australia, and the United States. However, little is known about the attitudes and perceptions of clinicians toward AMS in Thailand. The aim of this study was to explore the perceptions and attitudes of clinicians. For the purpose of this study, clinician refers to doctors, nurses, and pharmacists.

METHODS

This study was a cross-sectional survey of health professionals at a 1,000-bed university hospital in Bangkok, Thailand. Data were collected between November 9, 2015, and December 21, 2015. A paper-based survey was distributed to 1,753 doctors, nurses, and pharmacists in the following departments: surgery, pediatrics, medicine, operating room, pharmacy, obstetrics and gynecology, orthopedics, ophthalmology, emergency medicine, community health nurses, family medicine, and anesthesiology. The overall response rate was 62.0% (1,087/1,753). The specific response rates per professional group were 41.4% (392/948) for doctors, 86.3% for nurses (613/710), and 86.3% for pharmacists (82/95).

Survey instrument

The survey for this study was based on a survey used in an Australian study. There were 26 items in the Australian survey of which 24 were retained: the 2 items deleted were related to Australian guidelines and not relevant to the Thai context. Because antibiotics can be purchased without prescription in Thailand and therefore are widely used, 2 additional questions related to patient influences on antibiotic prescribing decisions and patients’ ability to buy over-the-counter antibiotics were added by the researchers, because these are important contextual issues for Thai health care.

To ensure content and face validity, the survey was reviewed by the research team to determine that survey items were clear and that survey content examined the correct concepts. The English version was translated into Thai by 1 researcher. A nurse educator from a Thai University who holds a PhD in Nursing (written in English) performed a back translation from Thai to English. The consistency of meaning between the Thai and the back-translated English versions was determined by 1 researcher (N.S.). This comparison identified only minor differences that were corrected. The content and face validity relevant to the Thai context and language were established by a Thai panel consisting of specialists in infection prevention and control. These specialists were infectious disease physicians, an AMS specialist pharmacist, and a prevention and control specialist nurse who evaluated the items for consistency and experience with AMR and AMS are presented in Table 3. Differences and similarities between professionals will affect the implementation of AMS programs. Clinician support for AMS programs has been identified in surveys conducted in Europe, Australia, and the United States. However, little is known about the attitudes and perceptions of clinicians toward AMS in Thailand. The aim of this study was to explore the perceptions and attitudes of clinicians. For the purpose of this study, clinician refers to doctors, nurses, and pharmacists.

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Data analysis

Data were analyzed using SPSS version 23.0 for Windows (IBM, Chicago, IL). Descriptive statistics (frequencies, percentages, means, and SDs) were used to summarize the study data. Because the data did not conform to the normal distribution, medians and first and interquartile range are presented. For survey items that were categorical in nature, clinicians’ responses are presented as frequencies, and comparisons were made using the χ² test. For continuous data, the Kruskal-Wallis test was used to compare the responses of different professional groups (doctors, nurses, and pharmacists).

RESULTS

A total of 1,087 clinicians completed the survey: 392 (36.1%) were doctors, 613 (56.4%) were nurses, and 82 (7.5%) were pharmacists. Overall, 80.9% (n = 879) of clinicians were women: 52.6% of doctors (n = 206), 97.7% of nurses (n = 599), and 90.2% of pharmacists (n = 74).

Table 1 shows that clinicians were most commonly working in the areas of surgery (20.8%), pediatrics (18%), and medicine (17.6%). The median age was 29 years (interquartile range, 26-35), and ages ranged from 22-70 years. Almost half the clinicians (42.3%) had 1-5 years of clinical experience (n = 460).

Clinician perceptions of AMS

Clinician perceptions in relation to AMR are presented in Table 2. Compared with nurses, more doctors and pharmacists perceived that patients’ ability to buy antibiotics over-the-counter was a significant influence on AMR (P < .001). Clinicians, particularly doctors, believed that AMR was a serious problem worldwide, in Thai hospitals, and at the surveyed hospital (P < .001). AMR in the Thai community was considered less important, particularly by nurses (P < .001). Clinicians, particularly doctors, believed that antimicrobial use in Thai hospitals contributed to AMR.

Clinicians’ responses toward AMS programs

Clinicians’ attitudes toward AMS programs are presented in Table 3. Most clinicians from all professions agreed AMR would be reduced by improving antimicrobial prescribing and it should be a priority of the hospital and supported by a hospital-endorsed policy. Clinicians perceived that local antimicrobial policies and protocols, and a computer application to guide selection and duration of antimicrobial therapy, would be clinically useful. However, doctors were less likely than nurses and pharmacists to agree with a policy that limits antimicrobial prescribing (P < .001). Doctors were also less likely to be interested in participating in AMS education and training than nurses and pharmacists (P < .001). Pharmacists were more likely than doctors and nurses to agree that a team consisting of an infectious disease specialist physician and pharmacist to provide individualized antimicrobial prescribing advice and feedback would assist with antimicrobial selection (P < .001).

Previous involvement and experience with AMS

Clinicians’ responses to questions related to previous involvement and experience with AMS are presented in Table 4. Most clinicians had previously been involved in the care of patients with an antibiotic-resistant infection (88.1%). However, there were less pharmacists involved in the care of patients with resistant infections than doctors or nurses (59.8% vs 93.1% vs 88.7%, respectively; P < .001). Most clinicians perceived increasing numbers of antimicrobial-resistant infections over the last 5 years. Again, fewer pharmacists perceived this change over time than doctors or nurses.
Responses by profession to survey items related to antimicrobial resistance

Table 2

<table>
<thead>
<tr>
<th>Questions</th>
<th>All clinicians (N = 1,087)</th>
<th>Doctors (n = 392)</th>
<th>Nurses (n = 613)</th>
<th>Pharmacists (n = 82)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicate how serious a problem you believe antimicrobial resistance is in the following places:&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worksite</td>
<td>70 (60-70)</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
</tr>
<tr>
<td>Thai community</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
<td>50 (40-60)</td>
<td>60 (50-70)</td>
</tr>
<tr>
<td>Thai hospitals</td>
<td>70 (60-70)</td>
<td>70 (60-70)</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
</tr>
<tr>
<td>Surveyed hospital</td>
<td>70 (60-70)</td>
<td>70 (60-70)</td>
<td>60 (50-60)</td>
<td>60 (50-70)</td>
</tr>
<tr>
<td>Indicate how strongly you believe the following contribute to antimicrobial resistance at the surveyed hospital:&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antimicrobial use in Thai animal and agricultural sectors</td>
<td>50 (40-60)</td>
<td>50 (40-60)</td>
<td>50 (40-60)</td>
<td>50 (40-60)</td>
</tr>
<tr>
<td>Antimicrobial use in Thai community</td>
<td>50 (40-60)</td>
<td>60 (50-70)</td>
<td>50 (40-60)</td>
<td>60 (50-70)</td>
</tr>
<tr>
<td>Antimicrobial use in Thai hospitals</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
</tr>
<tr>
<td>Antimicrobial use at the surveyed hospital</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
</tr>
<tr>
<td>Patient pressure for antibiotics as part of treatment</td>
<td>50 (40-60)</td>
<td>60 (50-70)</td>
<td>50 (40-60)</td>
<td>60 (50-70)</td>
</tr>
<tr>
<td>Patients are able to buy antibiotics over-the-counter</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
<td>60 (50-70)</td>
</tr>
</tbody>
</table>

NOTE. Values are median (interquartile range) or as otherwise indicated.

*Kruskal-Wallis test.

<sup>3</sup>Rated on a Likert scale from 1 (not a problem) to 7 (very serious problem).

<sup>4</sup>Rated on a Likert scale from 1 (does not contribute) to 7 (strongly contributes).

(P < .001). Overall, <1 in 5 clinicians (17.2%) had heard of AMS terminology in English. Less than half the clinicians (37.6%) reported that they had worked in health care facilities with AMS programs. Further, AMR is one of the biggest public health threats that requires cooperation across government and public sectors globally to prevent and control the spread of resistant infections. Other studies have proposed that when infectious disease specialists are available for consultation, treating doctors may perceive less risk of AMR because they are deferring decision-making to expert clinicians and expert judgments about antibiotic use should limit the development of AMR. One possible explanation may be the variation in availability of infectious disease specialists in different hospitals. It may be proposed that when infectious disease specialists are available for consultation, treating doctors may perceive less risk of AMR because they are deferring decision-making to expert clinicians. The perception that AMR is a major problem globally is reported in many other studies. A few studies, including a study from Thailand, have found that although clinicians may think AMR is a major problem, they do not necessarily perceive AMR as a problem that affects practice in their hospital. These findings are concerning because AMR is an increasing and serious quality and safety issue.
people can buy antibiotics without a prescription also showed that most clinicians agreed AMR is a serious problem worldwide but less so in their own practice. These studies from countries where prescriptions are not required to buy antibiotics may explain clinicians’ perceptions that AMR is a problem originating from outside their hospital and from the broader community.

In Thailand, antibiotics are easily bought over-the-counter at grocery stores or drug stores. Thai people commonly seek basic advice from the pharmacist at a drug store if they are feeling unwell. In many countries, systems for improved antibiotic prescribing were important to reduce the occurrence of AMR and should be a hospital priority. Many other studies have also demonstrated that many countries across the world have responded to the emergence of AMR as a major issue. AMS guideline to be published in August 2015. All these strategies demonstrate that many countries across the world have responded to the emergence of AMR as a major issue. AMS is recognized as a key strategy to improve the appropriateness of antimicrobial use. Therefore, the strategies and systems that promote appropriate antibiotic use or AMS programs have been set as a worldwide agenda. In 2011, the World Health Organization launched the WHO Global Strategy on Containment of Antimicrobial Resistance campaign to empower every country in the world to respond to the AMR problem.

In many countries, systems for improved antibiotic prescribing have been initiated as a national agenda. For example, in Australia, a hospital AMS strategy is one of the compulsory criteria for hospital accreditation. In the United States, the Infectious Diseases Society of America published guidelines for improving the use of antimicrobial agents in the hospital as far back as 1988. Recently, in 2016, the U.S. National Action Plan for Combating Antibiotic-Resistant Bacteria has been approved. In England, the National Health Service has launched activities to support AMS since 1999 with regular updates of their national guidelines. Antimicrobial Stewardship Toolkit for English Hospitals was the most recent AMS guideline to be published in August 2015. All these strategies demonstrate that many countries across the world have responded to the emergence of AMR as a major issue. AMS is recognized as a key strategy to improve the appropriateness of antimicrobial use.

There were a number of differences between professions in perceptions of AMR. Nurses were less likely than doctors and pharmacists to agree that AMR was a serious problem in the Thai community, and that antibiotic use in the community contributed to AMR at the surveyed hospital. One possible explanation was that nurses surveyed in this study were hospital nurses and rarely worked in community settings. Therefore, their knowledge of AMR issues

<table>
<thead>
<tr>
<th>Questions</th>
<th>All clinicians (N = 1,087)</th>
<th>Doctors (n = 392)</th>
<th>Nurses (n = 613)</th>
<th>Pharmacists (n = 82)</th>
<th>χ²</th>
<th>df</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving antimicrobial prescribing at the surveyed hospital will help decrease antimicrobial resistance.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-6.0)</td>
<td>9.19</td>
<td>2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Improving antimicrobial prescribing should be an organizational priority.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-6.0)</td>
<td>1.17</td>
<td>2</td>
<td>.558</td>
</tr>
<tr>
<td>A formal policy for the use of antimicrobials should be introduced at the surveyed hospital.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>1.38</td>
<td>2</td>
<td>.501</td>
</tr>
<tr>
<td>A policy that limits the prescribing of selected antimicrobials to certain clinical indications via an approval process should be introduced at the surveyed hospital.</td>
<td>6.0 (5.0-7.0)</td>
<td>5.0 (4.0-6.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>33.73</td>
<td>2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Local antimicrobial guidelines and protocols should be introduced at the surveyed hospital.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>3.10</td>
<td>2</td>
<td>.212</td>
</tr>
<tr>
<td>A computer application which gives advice on selection and duration of antimicrobial therapy for specific clinical conditions would be clinically useful.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>13.38</td>
<td>2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>A team consisting of an infectious disease specialist physician and pharmacist providing individualized antimicrobial prescribing advice and feedback would assist with antimicrobial selection.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>18.05</td>
<td>2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>I would be interested in participating in education sessions about antimicrobial stewardship.</td>
<td>6.0 (5.0-7.0)</td>
<td>5.0 (4.0-6.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>22.45</td>
<td>2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>I would be willing to participate in any activities to improve the quality of antimicrobial use at the surveyed hospital.</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>6.0 (5.0-7.0)</td>
<td>16.68</td>
<td>2</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

NOTE. Values are median (interquartile range) or as otherwise indicated.

*Kruskal-Wallis test.
in the community may be poor. Although both nurses and doctors take a health history that includes antibiotic use in the communi-
ty, doctors have the major responsibility for prescribing so are more likely than nurses to consider antibiotic use in the community in their decision-making. Doctors also consult pharmacists for advice regarding antibiotic prescriptions; therefore, pharmacists may also have a deeper understanding than nurses of the consequences of antibiotic use in the community. The finding that nurses were less concerned than doctors and pharmacists about AMR in the community is similar to the results of an Australian study that showed nurses, doctors, and pharmacists believed that antibiotic use in the Australian community contributed to AMR at their hospital by 38%, 57%, and 77%, respectively. 15

Nurses were more likely than pharmacists to report being involved in the care of patients with antibiotic resistance and less likely to report that patient pressure to prescribe antibiotics contributes to AMR. AMR is an important consideration when providing edu-
cation to nurses about antibiotic use because nurses have a major role in antibiotic management during a patient’s hospitalization. Further, nurses have the most direct contact with patients and fami-
lies; therefore, it is vital that nurses provide patient and family education about antibiotics throughout their hospital stay and prior to discharge from hospital. 16

Despite doctors agreeing that guidelines and protocols to support antibiotic prescribing would be useful, doctors were significantly less likely than nurses and pharmacists to agree with any inter-
ventions that limit prescribing decisions. The finding that doctors do not favor interventions that limit prescribing has also been reflected in other studies. 17 Previous studies show that doctors are one of the most trusted professions and have high levels of decision-making about patient care. 18 Therefore, doctors may not see a need to change their practice or a need to be involved in AMS programs. AMR is a worldwide problem that will require multidisciplinary solutions. Involving doctors in the design of these programs and engaging them in critically examine their antibiotic prescribing may be needed along with audit and restrict-
tive activities.

Pharmacists seemed to have a higher focus on system improve-
ments than doctors and nurses. Other studies from Australia also show that pharmacists seemed to be more engaged with AMS systems than doctors and nurses. 19 One possible reason for this dif-
ference in perceptions of systems to improve AMS may be that pharmacists have more of an overview of the whole hospital, whereas doctors and nurses only know the patients and practices on their ward or wards. In the surveyed hospital, it is general prac-
tice for pharmacists to work across the whole hospital, whereas nurses typically only work in 1 ward and doctors may visit 2 or 3 wards. It is probable that these working circumstances of pharma-
cists, doctors, and nurses are similar in other countries.

There are a number of limitations that should be considered when interpreting the study findings. First, the study was conducted at a single site that was a well-resourced university hospital in Thai-
land. Therefore, the study results may not be generalizable to other Thai hospitals, particularly smaller rural hospitals. Second, particip-
ants were self-selecting and the characteristics of those who did not participate in the survey are unknown. Further, purposive sam-
ping was used to target doctors, nurses, and pharmacists from departments with high antibiotic use; therefore, there are depart-
ments such as psychiatry that are underrepresented. It is therefore possible that the sampling approach and recruitment limit the generalizability of the study results to other departments or hos-
pitals. Despite the sampling limitations, 1,087 clinicians participated in the survey and the overall response rate was 62%; therefore, there is confidence that the study results represent those groups tar-
getted for inclusion.

CONCLUSIONS

This study is the first large-scale survey of doctors, nurses, and pharmacists regarding AMR and AMS in Thailand. The staff survey was based on a survey used in an Australian study to understand clinicians’ perceptions and attitudes toward AMR and AMS in the Thai health care context. The major findings were that all partici-
ants surveyed perceived AMR as a major problem and that improved prescribing and use of antibiotics was important. Further, there were differences between professions regarding AMR and AMS. The results of this study highlight the potential barriers and facili-
tators to effective implementation of AMS programs in Thai hospitals.

References


