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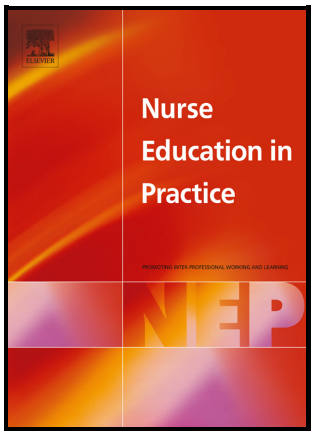

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Factors influencing self-reported adherence to standard precautions among thai nursing students: a cross sectional study

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NVG, SB, SA, JL and AH conceived and designed the study. NVG and SA conducted the data collection. NVG, SB, JL and AH analyzed the data. NVG, SB, JL and AH interpreted and drafted the manuscript. All authors contributed substantially to manuscript revision. NVG completed the final draft, submitted the manuscript and takes responsibility for the paper as a whole.

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Abstract

Aim: This study explored nursing students' compliance with standard precautions (SPs) and attitudes to SPs in Thailand, to identify factors that may increase adherence to SPs and infection prevention and control best practice.

Background: In the context of high rates of healthcare associated infections as in Thailand, effective strategies to promote high levels of clinician adherence to SPs is a priority. Nursing students are one group of healthcare workers who play a vital role in caring for patients and constitute the future nursing workforce.

Design: A cross-sectional survey design was used.

Methods: A self-reported survey comprising the Compliance with Standard Precautions Scale and the Factors Influencing Adherence to Standard Precautions Scale were distributed to nursing students as a Thai paper-based survey.

Results: A total of 533 second to fourth year nursing students from a tertiary nursing school in Bangkok, Thailand completed the survey. The average nursing student compliance to SPs was 68.5 %. Most (91.2%) reported only using water for handwashing and 57.2% reported reuse of surgical masks. The fourth-year students had higher compliance (M=3.90, SD=1.12) on the 'prevention of cross infection from person-to-person' dimension while second-year students reported higher compliance on the 'disposal of sharps' (M=2.67, SD=0.57) dimension. 'Contextual Cues' was identified as the factor (M=3.41, SD= .40) that had the greatest influence on adherence and 'Practice Culture' (M=1.84, SD=.66) and 'Justification' (M = 1.35, SD .68 had the lowest influence. Fourth year students identified 'Leadership' (M=2.90, SD=.49) as an important influence on adherence to SPs.

Conclusions: To increase nursing students' adherence there needs to be greater emphasis on the importance of SPs in theoretical sessions and regular monitoring and feedback on hand

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hygiene performance and personal protective equipment use while students are on placements. More visible organizational leadership and promotion of high levels of adherence to SPs may assist students to translate their theoretical knowledge into practice.

Keywords: infection prevention & control, nursing education, guideline compliance/adherence, standard precautions, personal protective equipment, Thailand

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INTRODUCTION

Healthcare associated infections (HAI) are a major global public health problem that threaten patient safety and results in economic loss (WHO, 2019a). The World Health Organization (WHO) identified that HAI is the most common adverse event associated with hospitalization and that no country has yet solved this problem (WHO, 2019a). Studies have shown that each year, hundreds of millions of patients worldwide suffer from HAI (ECDC, 2013; ODPHP, 2019; WHO, 2019a). The problem of HAI in low-and middle-income countries such as Thailand is more serious than high-income countries (WHO, 2019a). In 2017, a prevalence survey across hospitals in Thailand identified that of 688 patients, there were 791 occurrences of HAI. Another Thai study reported that the highest rates of HAI were found in university hospitals (7.3%) (Manosuthi et al., 2017). In addition, Thailand loses more than 2.6 billion dollars each year treating HAI caused by antimicrobial resistant infections (Phodha et al., 2018). In the context of high rates of HAIs, effective strategies to promote high levels of adherence to standard and transmission-based precautions by clinicians has been identified as a priority on the global health agenda (WHO, 2019c).

Standard precautions (SPs) are 'the minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infection status of the patient, in any setting where health care is delivered' (CDC, 2018). These precautions are the minimum standard that healthcare personnel have to apply to their work (CDC, 2018). Standard precautions include hand hygiene, use of personal protective equipment (PPE), sharps safety, safe injection practices, use and disposal of sterile instruments and devices and standards for cleaning and disinfection of environmental surfaces (CDC, 2018). The WHO encourages all healthcare workers to implement SPs when there is a risk of body fluids exposure to prevent unnecessary transmission of infections in hospitals (WHO, 2019a). Maintaining a high level of compliance with SPs is the key to promoting patient safety and minimizing the risks of

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cross-infection (WHO, 2007). Although healthcare facilities provide staff with equipment to support SP compliance, research has shown that healthcare staff implement SPs less than expected, particularly in relation to correct use of PPE, safe use and disposal of sharps and hand washing respectively (Tariku et al., 2017).

Nursing students are one group of healthcare workers who play a vital role in caring for patients under supervision of nurse educators (WHO, 2019b) and constitute the future nursing workforce. A previous study found that when nursing students are on clinical placement they perceived themselves to be at risk of exposure to potentially pathogenic microorganisms circulating in the clinical environment (Kim and Oh, 2015). International studies report that students' level of clinical experience and gender are associated with compliance with SPs. For example, a study of SP compliance amongst nursing students in Saudi Arabia found that students in higher years of study had a higher rate of compliance with SPs than students in lower years (Colet et al., 2017). Additionally, female students were significantly more compliant with SPs than male nursing students (Colet et al., 2017). While in Thailand, Kongsuwan et al. (2004) found that amongst third and fourth year nursing students hand hygiene' compliance rate was 45.8% and 57.7% respectively highlighting substantial gaps in practice (Kongsuwan et al., 2004). Another Thai study reported that 66.7% of fourth year nursing students at Boromarajonani College of Nursing, Phayao, reported a sharp or needle-stick injury during their clinical placement practice (Boonmee et al., 2012). These findings highlight the importance of encouraging high levels of compliance to SPs amongst nursing students and the healthcare staff who are mentoring them and acting as a role model in the clinical practice environment. The high rates of needle stick injuries amongst nursing students who have less clinical experience, demonstrates the critical role SPs have in maintaining workplace safety for health care students.

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In general, the monitoring and evaluation of SPs compliance is assessed by reporting incidents such as: the rate of sharp injuries, compliance with PPE use and, best practice in hand hygiene. However, these reports cannot identify the causes of non-compliance with SPs. Previous studies have identified some factors that influence healthcare workers' compliance with SPs. For example, Bouchoucha and Moore (2018) found that factors influencing adherence among nurses in Australia to SPs were leadership, justification, culture/practice, contextual cues and judgement. A Canadian study investigating 'determinants of nurse's adherence to facial protective equipment' identified that unit type, frequency of equipment use, equipment availability, training, organizational support and communication all influenced adherence to use of facial protection amongst nurses (Nichol et al., 2013). A study of factors affecting compliance with SPs among nursing students in South Korea found that the most important influencing factor was awareness of the importance of infection prevention and control (IPC) (Choi and Kim, 2018). In line with the findings of Bouchoucha and Moore (2021), nursing students' compliance was affected by observing gaps in SP compliance amongst the nursing staff at ward and the differences in SP practice students observed between the classroom simulation and real situation on the wards (Kim and Oh, 2015).

Several studies have suggested that pre-registration programs for all clinicians would be improved by expanding the content and emphasis on concepts such as infection prevention, standard and transmission-based precautions and appropriate use of PPE (Hinkin and Cutter, 2014; Kennedy and Burnett, 2011). Given the critical importance of ensuring that all new graduate nurses have the skills to protect themselves and their patients from unnecessary exposure to infection, this study explored nursing students' compliance with SPs and attitudes to SPs in Thailand, to identify factors that may increase adherence to SPs and IPC best practice amongst nursing students.

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METHODS

This study was a cross-sectional survey of nursing students at a school of nursing in Bangkok, Thailand. A Thai paper-based survey was distributed to second to fourth year nursing students who had completed the fundamentals of nursing subject and had experience of the practice environment on clinical placement. Data were collected between April and May 2019. The target population was a total of 657 students including 215 second year, 217 third year and 225 fourth year. The overall respond rate was 81.1% (533/657). The response rates per year were 72.1% (155/215) for second year, 99.1% (215/217) for third year and 72.4% (163/225) for fourth year.

Survey instrument

The survey instrument comprised three parts. The first part was participant characteristics items, the second part was a Thai translation of the Compliance with Standard Precautions Scale (CSPS) (Lam, 2011) and the third part was a Thai translation the Factors Influencing Adherence to Standard Precautions Scale- student version (FIASP-SV) scale (Bouchoucha et al., 2021).

The CSPS is a 20-item scale designed to evaluate compliance to SPs. It has good psychometric properties with responses rated using a 4-point Likert-scale, ranging from 0 (Never) to 3 (Always) (Lam, 2011). The 20-item CSPS were positively statement except for items 2, 4, 6 and 15 (Lam, 2014). As healthcare staff have to fully comply with standard precaution guidelines, a score of 1 is given for the ‘always’ option in positively items and the ‘never’ in negatively items (Lam, 2014). The total range scores are between 0 and 20 which the higher score identified a better compliance with standard precaution practices (Lam, 2014). The five-dimensions of CSPS are: use of protective device, disposal of sharps, disposal of waste, decontamination of spills and used article and prevention of cross infection

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from person-to-person. The CSPS item 'I take a shower in case of extensive splashing even after I have put on Personal Protective Equipment (PPE)' was excluded from this study as this practice is not available in the clinical setting where this study was conducted.

The Factors Influencing Adherence to Standard Precautions Scale- Student Version (FIASPS-SV) was designed to assess attitudinal and workplace factors which influence nursing student's adherence to SPs (Bouchoucha and Moore, 2018). The original FIASP-SV scale contains 23 items including the five factors of structure of leadership, justification, culture/practice, contextual cues and judgement with the acceptable internal consistency reliabilities ($\alpha = .61–.85$) (Bouchoucha et al., 2021). The Thai version of the scale has 25 items, with two additional items (Item 1; Item 2) to the original version to test for social desirability. The FIASP-SV has four factors solution (1) justification, (2) leadership, (3) contextual cues and (4) practice culture. The justification factor (7 items) conveys the participants; rationales for their non-adherence to SP and contains items such as: "I don't need to wear gloves when taking blood/cannulating as I am skilled at what I do". The leadership factor (6 items) contains items such as 'I have a responsibility to encourage people to protect themselves' or 'I feel comfortable challenging nurses or doctors when I see them not adhering to standard precautions' and has a focus on assessing respondents' perceptions of their own leadership and role modelling with regard to SP. The contextual cues factor (7 items) reflects respondents' perceptions of cues to action prompting adherence to SP, such as the proximity of PPEs. The organization culture and practice factor (3 items) relates to circumstances in the organization supporting or hindering the use of SP. Items such as: 'the culture of my organization allows for people not to follow standard precaution guidelines' are used. These four factors have good to strong internal consistency reliability with Cronbach's a ranging from .66 to .80. Items are rated on a 5-point Likert scale ranging from 0 (Not at all) to 4 (Very much). Total scores for each factor measured by the FIASPS-SV were

standardized on a scale (0-4) to adjust for differences in the number of survey items in each factor.

The translation of the two survey instruments (CSPS and FIASP-SV) from English to Thai was performed by one researcher (NVG). 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 two versions were then compared for consistency. The content and face validity relevant to the Thai context and language were established by three Thai panels consisting of specialists in infection and prevention control. The panels rated independently the relevance of each item to calculate a Content Validity Index (CVI). The CVI of this survey was 0.88 which is greater than the acceptable score of 0.80. To ensure internal consistency reliability, a pilot test of the Thai version was conducted with 30 nursing students at the survey nursing school before the study commenced. The coefficient alpha was calculated as 0.80.

Data collection and ethical aspects

To avoid participants being influenced into completing the survey, research assistants who were not academic staff members invited participants to complete the survey. The paper survey included a covering letter explaining how to complete survey while maintaining anonymity. The Participant Information Sheet was given to participants to keep, and they were informed that consent would be implied by completing the survey. The research assistants reminded participants to complete the survey within 4 weeks. The study was approved by the Human Ethic Committee of the survey university [registration number: MURA2019/238].

Data analysis

The study data were analyzed using SPSS version 23 for Windows® (IBM, Chicago, IL, USA). Descriptive statistics (Frequencies, percentages, means and SDs) were used to

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summarized the study data. Spearman's correlation coefficient was used to identify the relationship between sub-domain of the FIASPS and the CSPS. Analysis of variance (ANOVA) was used to compare year of study on the FIASPS and the CSPS.

RESULTS

Participant characteristics

A total of 533 nursing students completed the survey: 155 (29.1%) were second year students, 215 (40.3%) were third year students and 163 (30.6%) were fourth year students. Overall, 95.7% (n=510) of nursing students were female and over 99% (n=531) were between 20 and 24 years of age.

Nursing students' self-report of standard precautions compliance

Nursing students' self-reported compliance to SPs practice (Responses to the CSPS survey) is presented in Table 2. The overall average nursing student compliance was 68.5 %. The highest SPs compliance was the dimension of disposal of sharps (86.5%). The lowest self- report SPs compliance was the dimension of decontamination of spills and used articles (59.6%). The item with the highest self-reported compliance was 'I put used sharp articles into a sharps container' (95.7%). The lowest reported compliance was for items related to hand washing products, with 47% of participants responding that they 'sometimes' or 'always' 'only used water for hand washing' and 47% stating they sometimes or seldom used alcoholic hand rubs as an alternative to soap.

Nursing students' self-report of standard precautions compliance by domains

The mean scores for the CSPS by domain and comparisons by year of study are presented in Table 3. Fourth year nursing students scored highest for the dimension of 'prevention of cross infection from person to person' (M=3.90, SD=1.12) compared with second (M=3.65, SD=1.10) and third year students (M=3.56, SD=1.17). Analysis of variance

(ANOVA) was used to compare CSPS by domains by year of study. There was statistically significant difference in mean score (Mean Difference= .34, p = .01) on the 'Prevention of cross infection from person to person' domain between third year students (M=3.56, SD= 1.17) and fourth year students (M=3.90, SD= 1.12). Hedges g (unequal groups) effect size .30 – small to medium effect size.

Responses to the Influencing Adherence to Standard Precautions- Student Version Scale

Mean scores for the four factors Justification, Leadership, Contextual Cues and Practice Culture measured by the FIASP-SV scale are presented in Table 4. To enable comparison mean items were standardized (Table 4). Participants strongly endorsed the influence of contextual cues on their adherence to SP ('Contextual Cues' factor Mean Item = 3.41, SD = .40. In contrast, participants had lower levels of endorsement for the influence of culture on adherence ('Practice Culture' factor Mean Item = 1.84, SD = .66. All year levels presented the highest mean item scores on the 'Contextual Cues' factor, whereas they all presented the lowest on the 'Justification' factor.

There was a statistically significant multivariate difference for FIASPS factors by year level after controlling for social desirability (Pillai's Trace = .06, F[8, 1050] = 3.87, p < .001). Univariate comparisons revealed a difference within the doubtful range for 'Leadership' between second- and fourth-year students (p = .06 Hedges' G = .26). A significant difference in 'Contextual Cues' was identified between fourth and third year students (p = .001, Hedges' G = .40). Effect sizes were calculated when there was statistical significance and there was a small effect size for Leadership between 2nd and 4th year and medium for Contextual Cues between 3rd and 4th year.

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Correlation between FIASP-SV factors and CSPS domains

The Spearman's Correlation Coefficient was used to analysis the relationship among sub-domains of the FIASP-SV and the CSPS (Table 5). For eight pairs of sub-domains on the FIASP-SV and the CSPS there were significant correlations. The 'Leadership', sub-domain of the FIASP-SV correlated with the 'Prevention of cross infection from person-to-person', 'Decontamination of spills and used articles' and 'Use of protective device' (Spearman's rho (r)= .21, .14 and .14) sub-domains of the CSPS. The 'Justification', sub-domain of the FIASP-SV correlated with 'Prevention of cross infection from person-to-person' and 'Use of protective device' (Spearman's rho (r)= -.16 and -.17) sub-domains of the CSPS. The 'Contextual Cues', sub-domain of the FIASPS-SV correlated with 'Decontamination of spills and used articles' and 'Use of protective device' (Spearman's rho (r)= .10 and .17) sub-domains of the CSPS.

DISCUSSION

This study explored nursing students' compliance with SPs and factor influencing adherence to SPs in Thailand. The overall average compliance was 68.5 % in this study which reflects suboptimal compliance in a clinical practice setting (Lam, 2011, 2014). The study findings highlight six critical points. Most nursing students reported only using water for hand washing and more than half reported reuse of surgical masks. The fourth-year nursing students were more likely to comply on the dimension of 'prevention of cross infection from person-to-person' than second and third year students. Contextual Cues and Leadership were the two factors that had the highest level of endorsement by study participants as influencing adherence to SP. This is an important finding confirming the importance of incorporating visual and physical cues in the clinical environment to provide immediate reminders to clinicians of the importance of SPs and the significance of clinical leaders reinforcing the importance of vigilance in the correct use of SPs.

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Forty-seven percent of nursing students in this study reported that they sometimes or always only used water for hand washing and 47.1% stated that they sometimes or seldom used alcohol rub when their hands were not visibly soiled. In 2020, the WHO recommended that regular hand hygiene with an appropriate product is one of the best practices in an effective IPC strategy (WHO, 2020). The Centers for Disease Control and Prevention (CDC) also suggests that washing hands with water and soap is ideal to get rid of germs in general situations. An alcohol-based hand sanitizer should be used to clean hands when they are not visibly soiled and if soap and water are unavailable (CDC, 2019). Misunderstanding by nursing students to use only water to wash hands is concerning as this indicates that they may have insufficient training before clinical placements. A previous study which evaluated nursing students' hand hygiene compliance in Turkey identified the need to improve nursing students' hand hygiene compliance and practices (Öncü et al., 2018). Similarity, a Norwegian study suggested that improving student nurses' hand hygiene knowledge during clinical placement was crucial (Sundal et al., 2017). To encourage nursing students to comply with established hand hygiene guidelines, more intensive theoretical and practical training about the importance of hand hygiene and how it should be performed is needed prior to clinical placements. Also, regular monitoring and feedback about hand hygiene adherence would encourage and reinforce adherence to best practice recommendations while students are on clinical practice (WHO, 2020).

Nursing students in this study reported that their compliance with reuse of surgical mask or disposable Personal Protective Equipment (PPE) was only 42.8%, in contrast to a Hong Kong based study that reported an overall compliance rate 76.6% in nursing students and staff (Lam, 2014). In the current study these responses are likely to reflect the practice of reusing surgical masks during clinical placement shifts when students had very short encounters with patients. In the clinical setting, students' use a surgical mask when they have

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direct contact with or provide nursing care for patients with known or suspected droplet spread infections. In practice, students who are in contact with multiple patients for short interactions may find it is more practical to reuse disposable surgical masks when individual patient contacts are very short. This finding highlights that many clinicians find following best practice guidelines to the letter in the clinical practice setting challenging. However, in the current situation during the COVID-19 pandemic, studies demonstrate that mask wearing can reduce risk of acquiring infection and the spread of SARS-CoV-2 (Doung-ngern et al., 2020; Wang et al., 2020). Therefore, supplying students with sufficient surgical masks and encouraging students to comply more strictly to mask wearing protocols across the shift during clinical placement is needed.

The fourth-year nursing students were more likely to comply (mean=3.90) on the dimension of 'prevention of cross infection from person-to-person' than the second-year students (mean=3.65). One possible reason for these differences may be that fourth-year students have more experience providing care to a broad variety of patients and this may contribute to greater concerns about cross-infection and the need to adhere to SPs. While second year students have less clinical experience and may have more difficult applying what they have learnt from simulation training sessions into the reality of clinical practice.

In contrast, the second-year students were more compliant (mean=2.67) than the fourth-year students (mean=2.52) to the dimension of 'disposal of sharps', although this difference did not reach statistical significance this finding is clinically important and deserves further investigation. This may reflect greater concerns about blood-borne biological hazards that have the potential to cause both physical injury and mental stress amongst less experienced students. This result is supported by a study of predictive factors for needlestick and sharps injuries in nursing students during clinical placements in Italy that identified that second-year students perceived the importance of implementing preventive behaviors (Bagnasco et al.,

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2020). Whereas, the fourth-year students may think that they have developed sufficient refined psychomotor skills to avoid accidents with needles and associated sharp injuries. Low rates of compliance regarding disposal of sharps (48.4%) was also reported in a study of nursing staff and students' compliance with SPs in in Hongkong (Lam, 2014).

In the FIASP-SV there was a significant difference in leadership between fourth year students and second year students. This was also noted in a study of the compliance of Cypriot nurses with SPs, that showed that senior nurses were more likely to be proactive regarding adopting SPs if they observed one of their supervisors not complying the guidelines (Efstathiou et al., 2011). As the leadership factor related to staff confronting others they observed not adhering to SPs and staff role modelling on SPs compliance to promote their practice by others (Bouchoucha and Moore, 2018). One possible explanation for this finding is that as fourth-year students have more experience in clinical setting, they are more confident to confront others when gaps in adherence to best practice guidelines are observed. In the current study fourth-year students also reported being more confident about modelling the correct use of SPs than less experienced students. To promote a strong safety culture of the workplace regarding SP adherence (Lymer et al., 2004), the suggestion to promote the leadership dimension in simulation classroom by nurse educators as well as encouraging students to speak out when they have to deal with the challenging situations particularity for second year and third year students.

The average score for the FIASP-SV Culture and Practice factor was the lowest dimension (mean = 5.53, range 0-12) in this study. Previous studies have found that the organizational culture particularity infection prevention climate is a crucial dimension in influencing the students to comply with SPs (Cruz, 2019; Lymer et al., 2004). This finding is concerning as it may indicate that the current organization culture in the study setting might not be actively promoting adherence to SPs best practices. To encourage nursing student to

be being more concerned about high standards of adherence to SPs and other best practice guidelines and willing to challenge, previous studies in Saudi Arabia (Cruz, 2019) and China (Luo et al., 2010) have suggested that the organization should provide and maintain high quality training in standard and transmission-based precautions and ensure that patient safety standards are adhered to by all staff.

Contextual cues were identified as the highest average score for factors influencing adherence to SP in this Thai study (mean = 17.88, range 9-20). As the contextual cues reflect visual and environmental cues (such as placement of hand basins, sharps containers, hand sanitizer in the ward environment) that can be seen to act as cues to action. For example, using PPE when they are located near patients, also staff are more likely to comply SPs if dealing with needles or a blood-borne pathogen (Bouchoucha and Moore, 2018). It may be proposed that because nursing students have less experienced in clinical setting environments; also, trying to translate the concept of SPs into practice is challenging. These findings indicate that prominent visual and contextual cues are highly effective strategies to encourage students to be more adherent to SP. For example, face masks and hand sanitizer need to be easily accessible throughout the clinical area and, signage should be prominently displayed directing staff when transmission-based precautions and additional PPE are needed (Nilsen et al., 2012).

There was negative correlation between the ‘justification’ (sub-domain of the FIASP-SV) and sub-domains of the CSPS, ‘prevention of cross infection from person-to-person’ and ‘use of protective device’ (Spearman’s rho (r)= -.16 and -.17). As justification expresses participants’ confidence to assess patient and situational based clinical risks that influence their practice aside from adhering to guidelines (Bouchoucha and Moore, 2018), a negative correlation with the CSPS sub-domains is expected. The small negative correlation observed in this study implies that some nurses who have high levels of confidence in their own

clinical judgment may choose to ignore guidelines and were therefore less likely to adhere to transmission-based precautions. Nursing students in the current study had higher scores on the justification factor than nurses in a study reported by Bouchoucha and Moore (2018), suggesting that participants in the current study were more likely to justify or excuse non-adherence to guidelines. This is challenging issue for Thai nursing educators in encouraging student nurses to appreciate the risks to themselves and their patients if they fail to follow SPs guidelines.

Limitations

The study was conducted in a single institution which under the university curricular regulation. Most of the time on clinical placement, participants had experience in the selected university hospital where there is a good supply of resources to promote high levels of SPs compliance. The findings of this study may not be generalizable to other nursing schools and practice settings in Thailand.

CONCLUSIONS

This study reports the findings of a large-scale survey examining nursing students' self-report compliance with SPs and factors influencing adherence to PPE use in Thailand. The overall average compliance was suboptimal with poor compliance on suitable handwashing and use of PPE. Leadership and Contextual Cues were identified as the key factors influencing self-reported compliance. These findings highlight a need to provide nursing students with more intensive IPC theory and practical training, as well as opportunities for them to develop their leadership and interdisciplinary communication skills prior to clinical placement. In addition, greater support from the organization may help promote adherence to patient safety standards by all staff working in clinical practice settings.

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CONFLICTS OF INTEREST

None

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Table 1 Participants' characteristics

Demographic data	Number (n=533)	%
Age		
< 20	1	0.2
20 - 24	531	99.6
> 24	1	0.2
Gender		
Male	23	4.3
Female	510	95.7
Year of study		
Second year	155	29.1
Third year	215	40.3
Fourth year	163	30.6

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Table 2 Thai nursing students' compliance of standard precautions

Items	Compliance of SPs (N= 533)				
	Never	Seldom	Sometimes	Always	Overall % Compliance rate
Prevention of cross infection from person to person					
1. I wash my hands between patient contacts.	-	0.4%	16.1%	83.5%	83.5%
2. I only use water for hand washing.	8.8%	44.3%	43.2%	3.8%	8.8%
3. I use alcoholic hand rubs as an alternative to soap and water if my hands are not visibly soiled.	0.6%	6.2%	40.9%	52.3%	52.3%
9. I would cover my wound(s) or lesion(s) with waterproof dressing before patient contacts.	5.3%	6.2%	27.6%	61.0%	61.0%
11. I change gloves between patient contacts.		0.8%	10.7%	88.6%	88.6%
12. I decontaminate my hands immediately after removal of gloves.	0.4%	0.9%	24.0%	74.7%	74.7%
Average Overall Compliance					**61.5%**
Disposal of sharps					
4. I recap used needles after giving an	89.8%	0.6%	9.2%	0.4%	89.8%

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Items	Compliance of SPs (N= 533)				
	Never	Seldom	Sometimes	Always	Overall % Compliance rate
injection.					
5. I put used sharp articles into sharps container.	0.2%	0.2%	3.9%	95.7%	95.7%
6. The sharps container is disposed of when its contents reach the full line on the container.	73.9%	3.4%	19.5%	3.2%	73.9%
Average Overall Compliance					**86.5%**
Disposal of waste					
17. Waste contaminated with blood, body fluids, secretion and excretion is placed in red plastic bags irrespective of the patient's infection status.	10.5%	7.7%	18.2%	63.6%	63.6%
Average Overall Compliance					**63.6%**
Decontamination of spills and used articles					
18. I decontaminate surfaces and equipment after use.	0.6%	10.7%	45.2%	43.5%	43.5%
19. I wear gloves to decontaminate used equipment with visible soils.	2.1%	5.4%	19.9%	72.6%	72.6%

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Items	Compliance of SPs (N= 533)				
	Never	Seldom	Sometimes	Always	Overall % Compliance rate
20. I clean up spillage of blood or other body fluids immediately with disinfectants.	1.9%	4.7%	30.8%	62.7%	62.7%
Average Overall Compliance					**59.6%**
Use of protective device					
7. I remove Personal Protective Equipment (PPE) in a designated area.	0.6%	0.9%	23.6%	74.9%	74.9%
10. I wear gloves when I am exposed to body fluids, blood products and any excretion of patients.	0.2%	-	7.5%	92.3%	92.3%
13. I wear a surgical mask alone or in combination with goggles, face shield and apron whenever there is a possibility of a splash or splatter.	0.2%	1.7%	27.2%	70.9%	70.9%
14. My mouth and nose are covered when I wear a mask.	0.2%	0.6%	10.9%	88.4%	88.4%
15. I reuse a surgical mask or disposable Personal Protective Equipment (PPE).	42.8%	27.6%	18.9%	10.7%	42.8%
16. I wear a gown or apron when exposed to	2.8%	7.5%	28.7%	61.0%	61.0%

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Items	Compliance of SPs (N= 533)				
	Never	Seldom	Sometimes	Always	Overall % Compliance rate
blood, body fluids or any patient excretions.					
Average Overall Compliance					**71.7%**
Average overall compliance for the Total CSPS					**68.5%**

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Table 3 Mean scores on the Compliance with Standard Precautions Scale according to year of study

***** A post-hoc tests, difference between 3rd and 4th year means (.34)

Domains	**Mean (SD)**				
	2nd year (n=155)	**3rd year (n=215)**	**4th year (n=163)**	**P values**	**Hedges g**
Prevention of cross infection from person to person	3.65 (1.10)	3.56 (1.17)	3.90 (1.12)	.01*	.30
Disposal of sharps	2.67 (0.57)	2.60 (0.55)	2.52 (0.85)	.07	
Disposal of waste	0.56 (0.50)	0.67 (0.47)	0.66 (0.48)	.85	
Decontamination of spills and used articles	1.75 (1.00)	1.80 (0.99)	1.80 (1.08)	.98	
Use of protective device	4.31 (1.39)	4.29 (1.22)	4.31 (1.23)	.13	
Total Score				.42	

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Table 4 Factors influencing Adherence to Standard Precautions

FIASP-SV Factors Maximum Range (0-4)	**Mean Items (standardized) (SD) 2nd (n=155) M (SD)**	**3rd (n=215) M (SD)**	**4th (n=163) M (SD)**	***p***	**Total M (SD) Response Range**
Justification	1.26 (.61)	1.39 (.68)	1.39 (.75)	.13	1.35 (.68) Range 0-4
Leadership	2.78 (.44)	2.88(.39)	2.90 (.49)	.05[a]	2.86 (.44) Range 1-4
Contextual Cues	3.39 (.41)	3.50 (.40)	3.34 (.40)	.002[b]	3.41 (.40) Range 1.86-4
Practice Culture	1.93 (.72)	1.81 (.65)	1.79 (.62)	.12	1.84 (.66) Range 0-4

Note. [a]post-hoc tests, difference between 2nd and 4th (.11, Hedges' G = .26) - [b]post-hoc tests, difference between 3rd and 4th (.14, Hedges' G = .40)

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Table 5 Correlation between sub-domain of the Factors Influencing Adherence to Standard Precautions Scale- Student Version and the Compliance with Standard Precautions Scale

	Prevention of cross infection from person to person	Disposal of sharps	Disposal of waste	Decontamination of spills and used articles	Use of protective device
Leadership	.21**	-.05	.02	.14**	.14**
Justification	-.16**	-.02	-.00	-.07	-.17**
Practice Culture	-.05	.09*	.05	-.01	.07
Contextual Cues	.07	.06	.08	.10*	.17**

** $p < .01$, * $p < .05$

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7-8
		(b) Indicate number of participants with missing data for each variable of interest	7-11
Outcome data	15*	Report numbers of outcome events or summary measures	8-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11
		(*b*) Report category boundaries when continuous variables were categorized	9-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9-11

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Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	12-15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Author Statement

Nantanit van Gulik: Conceptualization, Methodology, Data Curation, Writing - Original Draft, Writing - Review & Editing, Funding acquisition. **Stéphane Bouchoucha**: Conceptualization, Methodology, Writing - Original Draft, Writing - Review & Editing. **Siriluk Apivanich**: Conceptualization, Methodology, Data Curation, Writing - Original Draft, Writing - Review & Editing. **James Lucas:** Conceptualization, Methodology, Writing - Original Draft, Writing - Review & Editing. **Anastasia Hutchinson:** Conceptualization, Methodology, Writing - Original Draft, Writing - Review & Editing.

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Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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