The Influence of Type D Personality on the Onset and Maintenance of Chronic Illness

Submitted by

Sharon Horwood

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School of Psychology,

Faculty of Health, Deakin University

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I am the author of the thesis entitled *The Influence of Type D Personality on the Onset and Maintenance of Chronic Illness* submitted for the degree of Doctor of Philosophy (Psychology).

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PUBLICATIONS ARISING FROM THIS THESIS


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ABSTRACT

This thesis adopted a dispositional personality perspective to investigate a relatively new construct in personality typology theory, Type D personality, which is defined as the synergistic effect of high levels of negative affectivity and social inhibition. A growing body of research suggests that Type D personality may be a risk factor for protracted morbidity and mortality in chronic illness patients, particularly those with cardiac-related disorders such as cardiovascular disease and hypertension. In Australia, chronic illnesses represent the majority of conditions responsible for the burden of illness borne by the Australian healthcare system. The cost of chronic illness can be counted in terms of physical, psychosocial, and economic burden. Hence, there is an urgent need to identify modifiable risk factors to reduce chronic illness incidence. Type D personality research within an Australian context is, presently, rare. However, if Type D personality is a risk factor for major chronic conditions, and is a construct that is relevant to the Australian population, it could be a target for future chronic illness prevention and intervention strategies. The thesis addressed four research questions. First, is Type D personality a new and valid construct in personality and health research, or simply a rebranding of known traits such as neuroticism and extraversion? Second, is Type D personality a typology that is present in the Australian general population, and, therefore, relevant to the Australian healthcare system? Third, what representation of Type D personality has the most valid and predictive utility for future health research? Finally, do the health-related behaviours and perceptions associated with Type D personality generalise to high-impact chronic conditions beyond the well-established cardiac population? Three studies collected online questionnaire data from Australian samples. The first study assessed the basic structure of Type D personality via a Big 5 factor and facet-level examination. The results from 268 participants indicated that although the Type D subscales of negative affectivity and social
inhibition correlated strongly with neuroticism and extraversion, each subscale could be further explained by unique personality facets not accounted for by the Big 5 factors. Evidence showed that Type D personality is a unique construct. The second study assessed the prevalence of Type D personality in the Australian population (n=955). The results indicated that the prevalence rate in the Australian population was approximately 40%, irrespective of age or gender, and was not statistically different from the rate reported in the United Kingdom and Ireland (38.5%). The final study examined the success of various representations of Type D (i.e. dichotomous/continuous/main effects) in predicting health-related variables. It also assessed Type D personality for its potential generality as a chronic illness risk factor. Data were derived from 208 chronic illness participants and 181 healthy controls. The results indicated that representing Type D as negative affectivity and social inhibition main effects produced superior prediction of health-related variables. Additionally, the rate of Type D was significantly higher in participants with a chronic illness compared to healthy controls. No differences in the rate of Type D were found between groups of participant with an illness of known etiology (i.e. type 2 diabetes, osteoarthritis, rheumatoid arthritis) and an illness of unknown etiology (i.e. chronic fatigue syndrome, fibromyalgia). Gender and the level of education of participants were not found to have any effect. Overall, the studies present certain challenges to the theory of Type D personality. Nevertheless, the studies also indicated that Type D personality research could be of benefit to public health in Australia given its apparent generality as a risk factor, and capacity to identify individuals who may be at higher risk of developing, and maintaining, a chronic illness. The strengths and limitations of the research were discussed, and suggestions made for further research.
CHAPTER 1- OVERVIEW

1.1 The Burden of Chronic Illness

Chronic illness (an illness that is likely to remain present for a duration of at least six months, DHAC, 2000), has become the leading cause of morbidity and mortality worldwide, and is now considered a global epidemic (WHO, 2016). In Australia, chronic illness accounts for 90% of all deaths (AIHW, 2011). The Australian healthcare system is currently supporting rising numbers of patients who are experiencing costly, yet preventable, chronic illnesses. The system is becoming increasingly overburdened and is in danger of becoming ineffective (AIHW, 2014). The economic cost of chronic illness is high. The most recent report from the Australian Institute of Health and Welfare (AIHW, 2014) indicated that, in 2011 - 2012, Australia’s national healthcare expenditure exceeded 140 billion dollars. In 2001, the National Public Health Partnership (NPHP) reported that chronic illness constituted approximately 70% of the total demand on the Australian healthcare system, and that the rate was expected to rise to 80% by 2020. Conversely, the Australian Department of Health (formerly the Department of Health and Aging, DHA) reported that by 2006, the current burden of chronic illness on the healthcare system had already reached 80% (DHA, 2006). By either estimation, the Australian healthcare system, the Australian economy, and the Australian people face a mounting challenge to manage the physical, psychosocial, and economic costs of chronic illness.

There are three clear factors that have contributed to the rise in the incidence and prevalence of chronic illness in Australia. First, Australians have one of the highest life expectancies in the world (79.9 years for males and 84.3 years for females; AIHW, 2014), which, when combined with a decreased fertility rate since the 1950s, means that Australia now has a large aging population that utilises an increasing proportion of healthcare services, including palliative care and nursing homes (Tabata, 2005). Second, the advances in treatment and prevention of infectious diseases and injuries has seen a significant reduction in acute care...
demand (AIHW, 2010a). Third, an increase in deleterious health-related lifestyle factors such as lack of exercise, poor diet, and excessive alcohol consumption, has contributed to an increased incidence of high-prevalence, high-impact chronic illnesses (AIHW, 2010a; Roberts, 2005).

In order to continue to manage, if not reduce, the burden of chronic illness, health research must attempt to find ways of both preventing new instances of chronic illness, and reducing the physical, psychosocial, and economic impact to existing sufferers. The present thesis aims to contribute to the broader sphere of health research by furthering our understanding of the potential mechanisms that may promote the onset and maintenance of chronic illness. Specifically, the thesis will focus on how Type D personality, the tendency to experience high levels of both negative affectivity and social inhibition, may impact on, or interact with, health-related behaviours, perceptions, and beliefs. Type D personality has been found to adversely affect morbidity and mortality in a variety of cardiac-related chronic conditions, and is considered to be a risk factor for further cardiac events (Bibbey, Carroll, Ginty, & Phillips, 2015; Denollet, Pedersen, Vrints, & Conraads, 2013). If it can be demonstrated that Type D personality is a risk factor for poor health outcomes in chronic illness generally, management of its associated health behaviours and beliefs could provide a potential avenue for the prevention of chronic illness onset in pre-morbid individuals, or for targeted intervention and treatment in individuals with existing illnesses.

To demonstrate the potential for intervention plans to be modified to account for the potential effects of Type D personality, consider a plan for a pre-diabetic individual. Typically, an intervention plan would focus heavily on the reduction of unhealthy lifestyle factors such as poor diet and insufficient exercise. If the same person also had a Type D personality profile, the intervention plan could include additional elements that are designed to mitigate the potential known effects of Type D personality, such as perceptions of poor social support (Williams et
A modified intervention plan could include referral to psychological counselling services to assist in reducing social inhibition, developing social skills, and challenging beliefs about lack of social supports. The plan could also include an increased frequency of general practitioner visits, or follow-up from general practitioners, to encourage adherence to planned treatment approaches. The modified intervention plan would not aim to change an individual’s personality per se, but to help the individual to develop their understanding, and subsequent management, of the likely behavioural and perceptual manifestations of one aspect of their personality.

1.2 Issues in Personality Research

Although personality research has seen a resurgence in recent decades, a number of problematic factors somewhat limit the applicability and reliability of the findings. Arguably, the biggest concern with personality research is the inability to clearly conceptualise personality itself, with differing perspectives continuing to compromise the cross-validation of findings. The debate surrounding the consistency of traits over time, and across situations, is a major consideration in undertaking longitudinal or prospective research. Despite modest estimates of the consistency (coefficients of .4 to .6; Funder, 1991), the heterogeneity of pathological disorders suggests that it is unlikely that one set of personality variables will consistently predict a particular biopsychological syndrome (Maher & Maher, 1994).

The varying methods and instruments used to assess personality may also restrict comparability of findings. The goal in personality research has often been to establish the contribution of a particular personality trait or subtype to measureable health outcomes, however the seemingly inconsistent approach to construct validity, reliability, and choice of assessment procedure, necessarily limits comparisons across studies (Weibe & Smith, 1997). A number of instruments are used in personality testing, from the substantial 567 item Minnesota Multiphasic Personality Inventory 2 (MMPI-2) to the 16 item Personality Questionnaire (16PF;
Cattell, Cattell, Cattell, Russell, & Karol, 1994). Many studies use subscales of larger inventories (e.g. the extraversion subscale from the Eysenck Personality Questionnaire) while new scales continue to emerge, seemingly to meet the demands of a particular line of enquiry (Weibe & Smith, 1997). Utilising a broad range of assessment devices lends itself to issues such as failure to detect subtleties when using short inventories, or over-inflation of subtleties when using broad-ranging inventories. When new inventories emerge there is a risk that the instrument is simply measuring a known trait but calling it something new.

A further issue that seems to constrain personality and health research (though is not limited to it) is the ‘what versus why’ problem. In many instances, personality research can demonstrate relationships or associations between various aspects of personality and health outcomes, however it can rarely offer more than a description of what was observed, leaving unanswered the questions of why, or how, the relationship occurred.

A relatively recent contribution to the field of personality research is the Type D, or ‘distressed’, personality construct. Type D is represented as a dichotomous construct, where an individual either has, or does not have, a Type D personality profile. Proponents of the theory claim that Type D personality is a risk factor for further adverse cardiac events in patients with existing conditions such as cardiovascular disease (Hausteiner, Klupsch, Emeny, Baumert, & Ladwig, 2010), coronary heart disease (CHD; Denollet et al., 1996), or myocardial infarction (Williams, O'Connor, Grubb, & O'Carroll, 2011b). Type D personality is represented by common personality traits that are assumed to be normally distributed, and, as such, is a typology that exists in the general population. Prevalence studies have indicated that Type D is present in a range of geographically disparate locations, such as Europe (Condén, Rosenblad, Ekselius, & Aslund, 2014), Asia (Chen et al., 2014), and the Middle East (Zohar, Denollet, Lev Ari, & Cloninger, 2011). As yet, however, no published study has examined the prevalence of Type D personality in the Australian population.
As interest and research in this relatively new personality typology increase, so do debates and criticisms of the construct. There are three main criticisms that have dominated the Type D literature, and, if not adequately resolved, may hinder future attempts to understand its role in relation to health outcomes. The criticisms of Type D personality that are addressed in the present thesis are that: 1) Type D is not a new construct but is either neuroticism and extraversion by another name, or an artefact of problematic research methodology, 2) representing personality traits as dichotomous rather than continuous is inconsistent with current statistical and personality trait theory, and 3) the majority of research that underpins the predictive capacity of the Type D construct comes from underpowered studies by the same collective of researchers, the Denollet Group.

1.2.1 Criticism 1: Old Wine in New Bottles – Is Type D Just Neuroticism in Disguise?

Numerous authors have commented on the possibility that Type D personality is no more than a re-badged representation of depression or neuroticism, and that methodological issues concerning sample sizes and overly-complicated analyses in early Type D research may have generated spurious results (Coyne & de Voogd, 2012a; Grande, Romppel, & Barth, 2012; Lespérance & Frasure-Smith, 1996; Smith, 2011). Shortly after the seminal Type D paper by Denollet et al (1996) appeared in the Lancet, a response from Lespérance and Frasure-Smith (1996) followed, in which they outlined concerns regarding the introduction of a new concept in an already crowded arena of cardiac risk factors. They argued that Type D personality may be nothing more than a flash-in-the-pan construct that ultimately does not further personality or health research, in much the same way that Types A, B, and C had failed to do so. In addition, they argued that Type D personality is no more than a disguised measure of neuroticism and depression. They stated that focussing research efforts on Type D personality may be a misuse of resources, given that, at that stage, the authors of Type D research were not able to articulate any realistic treatment protocols for the patients for whom it claimed to predict outcomes.
Instead, Lesperance and Frasure-Smith (1996) advocated for continued research into the impact of depression and depressive traits in cardiac research, particularly given the familiarity that clinicians have with depression as a construct.

Numerous studies have found that the effects of negative affectivity in models of Type D on health outcomes were reduced when depression and neuroticism were included in the regression analyses, with depression being a better predictor than either negative affectivity or, in some studies, overall Type D (Dulfer et al., 2015; Ossola, De Panfilis, Tona, Ardissino, & Marchesi, 2015). This may be a result of the standard measure of Type D personality, the DS14, measuring depression rather than personality disposition (Ossola et al., 2015). Although the effects of Type D have been reported to remain while controlling for depression and/or neuroticism, there is evidence that the negative affectivity component of Type D has a significant overlap, or strong association, with both depression and neuroticism (Christodoulou et al., 2013; Condén et al., 2014; Starrenburg et al., 2013).

Correlations between negative affectivity (as measured by the DS14) and neuroticism have been reported in numerous Type D studies, with values ranging from .58 (Grande, Glaesmer, & Roth, 2010) to .82 (Svansdottir, van den Broek, et al., 2013). These moderate to strong correlations indicate a considerable alignment between the constructs. Similarly, social inhibition has been found to have a moderate negative correlation with extraversion (e.g. -.69 Đurka & Ruch, 2014; -.67 Svansdottir, van den Broek, et al., 2013), adding further to concerns about the uniqueness and novelty of the Type D construct (Perbandt, Hodapp, Wendt, & Jordan, 2006).

Much of the criticism of the claim that Type D is different from depression and/or neuroticism is founded in methodological issues in a small, but heavily cited, set of Type D studies. Early Type D studies have suffered from a lack of power in many cases, but perhaps more concerning is the criticism that multivariate regression analyses in Type D research
commonly violated rules-of-thumb ratios for a minimum number of covariates per event (10:1; e.g. see Denollet, Holmes, Vrints, & Conraads, 2007; Pedersen et al., 2007). Other statistical concerns surrounding multiple regression techniques have been raised by commentators who criticised the inclusion of multiple measures of negative emotions as an unnecessary over-complication of highly-related variables, many of which are very difficult to single out as effectual, or even to demonstrate that they are not simply statistical artefacts (Ketterer et al., 2002; Ormel, Rosmalen, & Farmer, 2004).

So, the task for Type D research now is to establish a consistent and methodologically sound means by which to establish the degree of the relationship between negative affectivity and social inhibition with other more well-known and understood traits such as neuroticism and extroversion, and to determine if there is any meaningful difference between them.

1.2.2 Criticism 2: Dichotomising Personality

A further criticism of Type D personality is the representation of two continuous subscales as a single dichotomous type. Type D personality is not immune to the statistical issues inherent in splitting a trait at its median for categorisation purposes. Ferguson et al (2009) noted that, although Type D is explicitly stated to be a personality taxonomy, the oft used terminology in Type D research (e.g. ‘tendency’) is more appropriate for a continuous construct. These authors raised several concerns with regards to the dichotomisation of continuous negative affectivity and social inhibition, such as: 1) whether the seemingly arbitrary cut-off point on each subscale is, in fact, the most optimal cut-off point, 2) whether the statistical method employed to determine Type D versus non-Type D groups was appropriate, and 3) the lack of compelling theory or evidence to indicate that Type D is, by its nature, dichotomous. Given that most related constructs, such as depression and anxiety, are widely considered to be continuous in nature, conceptualising Type D as dichotomous seems somewhat counter-intuitive (Ruscio, Haslam, & Ruscio, 2006). While most contributors argue
that a continuous construct is a better representation than a dichotomous one (e.g. Howard & Hughes, 2012; Kelly-Hughes, Wetherell, & Smith, 2014; Stevenson & Williams, 2014), some researchers have published findings that indicate the dichotomous representation has better long-term predictive power (e.g. Dulfer et al., 2015).

More recently, a broader range of debates surrounding the representation of Type D has emerged within the literature. The basis for the presumed interaction of negative affectivity and social inhibition is somewhat unclear, as is whether each trait is equally weighted in the interaction (Dulfer et al., 2015). Recently, the debate has extended to whether there is an interactive effect at all (Kelly-Hughes et al., 2014). The suggestion that a statistical interaction can adequately represent a biological interaction may be problematic for the theory of Type D, as could be the assumption that personality traits can interact to produce an effect that is different to, or greater than, the unique contribution of each trait.

Other authors have raised concerns not only about the dichotomisation of continuous variables, but also of the statistical method employed in the construction of the Type D typology. The theoretical basis for grouping ‘high-highs’ (that is, high negative affectivity and high social inhibition) as a type that is distinct from the three other possible combinations may be somewhat problematic, given that the individual differences literature indicates that both negative affectivity and social inhibition are normally distributed traits (Suls, 2014). The strategy adopted by the Denollet group to combine continuous variables to form a type has long been rejected in the statistical literature due to the likelihood of it leading to spurious results (Coyne & de Voogd, 2012b). The cross-tabulation of two dichotomised variables has been found to encourage the inflation of statistical significance (Maxwell & Delaney, 1993), and the process has been referred to as ‘an abuse of data’ (p. 310, Cohen, Cohen, West, & Aiken, 2013).
Conceptualising Type D as a dichotomous typology no doubt has very effective clinical utility that can make diagnosis a relatively straight-forward process, however theoretical and statistical evidence warn against treating continuous variables in this way. As the debate surrounding the representation of Type D continues to grow, the force of the arguments against its original structure may see a need to re-think how Type D is both represented and measured.

1.2.3 Criticism 3: Publication Bias – An Issue with Same-Team Replication?

Type D research is still relatively new in the health and personality literature, and, as such, a potential limitation for the credibility of Type D research is the concentrated body of work emanating from a single research group, led by Denollet (often referred to as either the Denollet Group or the Tilburg Group). It is certainly not unreasonable, nor unprecedented, for early research in an emerging area to be dominated by the group responsible for the initial claims, as they are further along the research path than interested parties that are not connected to the group. A central issue raised in the Type D literature is that there seems to be an over-reliance on relatively old, underpowered Type D studies with positive results, as the basis or rationale for more recent research (Ioannidis, 2012). This is particularly concerning when larger, more recent studies have since been published that demonstrate a lack of prognostic value for Type D (e.g. Coyne et al., 2011; Grande et al., 2012; Pelle, Pedersen, et al., 2010).

The tendency for an area of research to become flooded with same-team replication has been referred to as ‘scientific inbreeding’, a term used to indicate the inherent problems that can emerge from a lack of researcher diversity, typically leading to obedient and obliged replication (Ioannidis, 2012, p. 408). The psychological sciences may be particularly prone to bias of this nature, given the complex, convoluted, and often ambiguous nature of the subject matter under investigation, however the solution is relatively straight-forward - wider publication of research from individuals or research groups unaffiliated with the primary
researchers. Though the solution may be obvious, detecting publication bias can be difficult to begin with, and even harder to prove.

1.3 Research Questions

The preceding section presented a number theoretical and methodological issues in personality research generally, and Type D personality theory and research specifically. These issues have informed the present research programme, and form the basis for the present research aims. This thesis has four primary research questions. First, is Type D personality a new and valid construct in personality and health research, or simply a rebranding of known traits such as neuroticism and extraversion? Second, is Type D personality a typology that is present in the Australian general population, and, therefore, relevant to the Australian healthcare system? Third, what representation of Type D personality has the most valid and predictive utility for future health research? Finally, does Type D personality, and its reported health-related impacts, generalise to other high-impact chronic conditions beyond the well-established cardiac population?

1.4 Overview of the Thesis

Chapter 2 begins with a review of the personality perspective that is most relevant to personality typology research - the dispositional perspective. In addition, a brief discussion of the major assumption upon which the thesis is based is presented. The assumption is that a person’s behaviour is a product of their personality and the situational context at any given moment (Lewin, 1935). Theoretical models of temperament and traits are discussed and evaluated. Also considered in Chapter 2 are the issues associated with the measurement of stability and change in personality, as well as potential problems in attempting to classify personality into distinct types.

The thesis then introduces the central construct under examination, Type D personality. Chapter 3 reviews the emergence of the construct, its theoretical basis and relationship to other
models of personality and typologies, the methodological development of the construct, and its
standard measurement instrument, the DS14.

The applications of Type D personality in health research are reviewed in Chapter 4. The
review shows that the majority of Type D literature has been, to date, largely confined to
cardiac-related chronic conditions and healthy controls, however recent studies have begun to
indicate that the effects of Type D personality may be able to be generalised to more chronic
conditions than have historically been investigated. Chapter 4 also presents a rationale for the
extension of Type D personality research beyond cardiac-related conditions, and introduces the
basis for including five chronic illnesses in the study to investigate the potential generality of
the effect of Type D personality within diverse chronic illness populations.

Chapter 5 details the first of three empirical studies designed to address the aforementioned
research questions. In Study 1, the Type D construct is subjected to a NEO Personality
Inventory Revised (NEO-PI-R) facet-level analysis in order to identify aspects of the construct
that may provide unique contributions over and above the contribution accounted for by the
Big 5 traits (referred to hereafter as factors), particularly neuroticism and extraversion.
Members of the general public (n=273) completed the standard measure of Type D personality,
the DS14, as well as the full-scale NEO-PI-R. Zero-order and semi-partial correlations were
used to identify incremental prediction of facets over factors for both of the Type D constituent
traits, negative affectivity and social inhibition. As the traditional representation of Type D is
dichotomous, and therefore unsuitable for a correlational analysis, a continuous representation
of Type D was calculated by summing the subscale scores for each of negative affectivity and
social inhibition. The findings indicated that, as expected, the Big 5 factor of neuroticism
correlated highly (+) with negative affectivity, and the Big 5 factor of extraversion correlated
highly (-) with social inhibition. The facets, however, demonstrated a moderate amount of
incremental prediction in each of the Type D constituent traits, which may indicate that there
are unique aspects of Type D personality that cannot be fully accounted for by the Big 5 factors. Interestingly however, when overall Type D was represented as a continuous measure, the facet-level incremental prediction disappeared and the Big 5 factors explained more of the variance for the continuous representation than for negative affectivity and social inhibition individually.

Having determined that the Type D construct may be sufficiently different from the Big 5 factors of extraversion and neuroticism to be considered a valid construct, the question of whether Type D was a relevant construct within an Australian context could be addressed. Chapter 6 presents the second empirical study, an estimation of the prevalence of Type D personality in the Australian population. Members of the Australian general population (n=955) completed a series of health-related questionnaires assessing the presence of Type D personality, perceptions of social support, frequency of positive health behaviours, and neuroticism. As Type D prevalence had not previously been examined in an Australian sample, and given the socio-cultural similarities between Australia and the UK and Ireland, it was predicted that the rate of Type D in Australia would be similar to, if not the same as, that found in the UK and Ireland (Williams et al., 2008).

A chi square goodness of fit analysis indicated that the prediction was correct, with the rate of Type D in the Australian population (39.7%) found to be no different to that in the UK and Ireland (38.5%). Furthermore, Type D personality was found to have the same effects on perceptions of social support and health-related behaviour in the Australian sample as was noted in the sample from the UK and Ireland. Finally, a further test of the uniqueness of the Type D construct was undertaken by way of a mediational analysis to determine if Type D continued to predict levels of social support and health behaviour while controlling for neuroticism. The results indicated that Type D continued to significantly predict social support
and health behaviours while controlling for neuroticism, which adds support to the contention put forward in Study 1, that Type D personality is more than simply trait neuroticism.

The third and final study is presented in Chapter 7. Study 3 aimed to determine whether Type D personality could be considered a more generalised predictor of health outcomes, rather than a predictor of health outcomes in cardiac-related chronic conditions specifically. In order to contribute to the debate in the literature pertaining to the continuous versus dichotomous representation of Type D, Study 3 also aimed to test various representations of Type D, including dichotomous, continuous, main effects of the constituent traits, and main effects plus their interaction, to determine which representation best predicted health outcomes. The representation that demonstrated the greatest prediction was incorporated into a regression analysis to predict social support, health behaviours, and symptom reporting from Type D status and illness group membership.

The illness groups consisted of individuals with one of five chronic illnesses: 1) chronic fatigue syndrome (CFS), 2) fibromyalgia, 3) type 2 diabetes, 4) osteoarthritis, or 5) rheumatoid arthritis. Due to limitations in sample size, the chronic illness participants were aggregated into two groups based on their diagnostic characteristics and DSM-V categorisation (APA, 2013), where applicable. CFS and fibromyalgia were combined into a superordinate group of functional somatic syndromes, while type 2 diabetes, osteoarthritis, and rheumatoid arthritis were combined into a superordinate group of illnesses of known etiology.

The five illnesses are all characterised by a degree of symptom overlap (e.g. fatigue, functional impairment). Importantly, there is a distinct point of difference between the functional somatic syndromes and the illnesses of known etiology. Type 2 diabetes, osteoarthritis, and rheumatoid arthritis are illnesses that are well understood, have a clear diagnostic criteria, and an effective standard treatment protocol that typically facilitates a sense of personal control over illness symptoms and progression. Conversely, CFS and fibromyalgia
have poorly understood etiologies, indirect diagnostic criteria (i.e. criteria that require physicians to rule out any other possible cause of symptoms rather than look for a set of symptoms indicative of CFS or fibromyalgia), and neither have agreed-upon or standardised treatment protocols, leaving sufferers with very few aspects of their illness experience over which they may be able to develop a sense of personal control.

The differences between the etiologies, diagnostic processes, and approaches to treatment of the two superordinate groups provides an opportunity to investigate whether the effects of Type D personality are amplified or mitigated by the type of chronic illness a person is experiencing – well understood and highly controllable or poorly understood and poorly controllable. The psychological distress that frequently accompanies the experience of uncertainty and perceived lack of control may be similar to the generalised psychological distress associated with Type D personality. Hence, in Study 3, a central aim of the study was to determine if chronic conditions that are characterised by diagnostic uncertainty and lack of personal control are differentially affected by the presence of Type D personality compared to conditions characterised by clear diagnostic understanding and personal control.

Participants who identified as having one of the five chronic illnesses under consideration (n=208), and healthy controls (n=181), completed a series of health-related questionnaires assessing presence of Type D personality, perceptions of social support, frequency of positive health behaviours, and perceptions of symptom severity (both physical and psychological).

The results of a series of seven regression models that were used to identify which representation of Type D best predicted each of the health-related outcomes (social support, health behaviours, physical symptoms, psychological symptoms) indicated that Type D was represented most effectively by continuous negative affectivity and social inhibition main effects, followed by the continuous main effects and the interaction of negative affectivity and
social inhibition. The least effective representation of Type D was the traditional dichotomous representation.

Based on these initial results, both the continuous main effects, and continuous main effects and interaction representations of Type D were entered into a series of linear regression analyses designed to model the effect of Type D and illness group (functional somatic syndrome or illness of known etiology) on health behaviours, perceived social support, and reported symptom severity. The descriptive analyses indicated that the rate of Type D was higher in the chronic illness group (collectively, 53.6%) than in the healthy controls (39.2%), however there was no difference in the rate of Type D personality between the functional somatic syndrome group (54%) and the illnesses of known etiology group (52.3%). The regression analysis results provided preliminary evidence that there may be an interaction effect between Type D and illness type. The findings suggesting that the effect of negative affectivity on social support was amplified in the functional somatic syndrome group, and that the effect of social inhibition on health behaviours was reduced in the chronic illness group compared to healthy controls. Overall, however, the evidence suggested that Type D personality was a more general predictor of health outcomes than a predictor of outcomes for specific illnesses.

Chapter 8 reviews two possible methodological limitations common to the three studies, gender bias and education bias. Neither gender nor level of education was found to have an effect on the results of the three studies.

The final chapter, Chapter 9, summarises the findings from each of the empirical chapters and discusses their limitations and implications. Recommendations for further research in the area of Type D personality and health are also suggested.
CHAPTER 2 - THE DISPOSITIONAL PERSPECTIVE, TEMPERAMENT AND TRAITS

2.1 The Dispositional Perspective

Proponents of the dispositional perspective of personality posit that innate temperamental dispositions begin to emerge within the first few days of life and continue to develop over the course of childhood and adolescence (e.g. see McAdams & Olson, 2010; Thomas, Chess, & Birch, 1970). In adulthood, trait theory forms the basis of the dispositional perspective. Trait theory is the view that personality characteristics exist along a series of bi-polar spectra. Their combination are thought to broadly account for the majority of variations in personality (e.g. see Allport, 1931; Cattell, 1943; Costa & McCrae, 1991). Temperament is the dominant model of personality in childhood, while trait theory is currently accepted as the principal perspective for understanding and explaining individual differences in adult personality (McAdams & Olson, 2010).

The term ‘temperament’ is commonly used to describe a broad, heritable disposition present in infancy and childhood. Temperaments are considered observable and measureable, but are not as distinct and specific as traits (van den Akker, Deković, Prinzie, & Asscher, 2010). For example, in adulthood, the trait of ‘agreeableness’ may be marked by friendliness and compliance, as well as a tendency towards social adaptability. In infancy and childhood however, aspects of individual characteristics thought to be temperamental in nature are often used to describe behaviours that are akin to agreeableness in adults.

Dispositional traits are measurable expressions of inter-individual variation in personality, and are thought to represent broad, internal factors that facilitate comparison (McAdams & Olson, 2010). The term ‘trait’, typically refers to a behavioural or emotional characteristic of adult personality. For example, an adult may be described as having a trait of ‘openness’ if they...
are willing to try new things, or possess the trait of ‘neuroticism’ if they are overly worried, frustrated, or anxious without just cause.

While there is agreement in the dispositional perspective literature that both temperament and traits underpin personality over the lifespan, there is not yet a single, clear, and parsimonious explanation of the relationship between the two. The following discussion will review the most influential attempts to account for the roles of temperament and traits in personality development.

2.2 Lewin’s Equation

Before an examination of temperament and trait theory is presented, a rationale for the basis of the present thesis is warranted. The dispositional perspective, as will be demonstrated, relies on the understanding that both temperament and traits are inherently biological in nature. Hence, personality, according to dispositional theory, is an innate, biological construct. From the perspective of applied psychological research, it could be argued that studying strictly biological constructs that, by nature, may be considered highly resistant to change, is a largely academic pursuit. For example, if a person has a biological or genetic underpinning for extraversion, could the person be reasonably expected to be able to control or change the expression of the trait of extraversion? In order to pursue an applied approach to personality research, this thesis must adopt a fundamental assumption that personality-related health issues can be therapeutically addressed in some way.

One long-standing theory of behaviour, proposed by Lewin (1936), states that an individual’s behaviour (B) is the product of both the person (P) and the environment (E) that they are in at the time of the behaviour, or $B=f(PE)$. The formula, commonly referred to as Lewin’s equation, was originally theorised as a means of understanding the behaviour of children. More recent adaptations of Lewin’s equation have refined the statement to include
personality and personal dispositions in place of the more general term ‘person’ (e.g. Bond, 2013; Snyder, 2013).

The formula provides a solid basis for applied personality research. That is, although personality itself may be difficult to modify, an individual’s behaviour and the environment are both modifiable variables. For example, if tobacco smoking behaviour is the result of an individual’s personality and their social environment (e.g. they share accommodation with another smoker), altering the environment (e.g. sharing accommodation with a non-smoker) may lead the personality by environment interaction to result in a modified behaviour (e.g. less desire to continue smoking). Hence, a basic assumption of the present thesis is that a person’s behaviour is a product of their personality and the situational context at any given moment. This assumption lends itself to an applied approach to personality research insofar as both behaviour and the environment are demonstrably modifiable, even if personality is not.

2.3 Temperament

Like personality, the concept of temperament is not new and has been referred to in texts as early as the fifth century B.C. (Hippocrates, c. 460 – c. 370 BC). In very early writings (e.g. Avicenna, 980–1037 AD; Galen, AD 129 – c. 200; Hippocrates, c. 460 – c. 370 BC) temperament was conceptualised as the outward manifestation of the combined effect of the four humors. The four elements of the material world (earth, air, fire and water) were represented by four corresponding fluids in the body (humors). The fluids of blood (sanguis), phlegm, bile (choler), and black bile (melancholer) combined to form a balance that was manifestly observable in the form of an individual’s temperament (Clark & Watson, 2008).

When the humors were in balance the individual was thought to be in good health, whereas ill health was considered to be the result of humoral imbalance. For example, an overabundance of black bile was believed to manifest as a depressive or outwardly sad temperament (Dumont, 2010). Extending the work of Hippocrates, Avicenna (980 -1037 AD)
proposed the inclusion of mental capacity, self-awareness, and moral development in the attempt to understand and explain temperament (Lutz, 2002). While ancient conceptualisations of temperament may now seem simplistic, and maybe even fanciful, the earliest theories, in essence, did identify two aspects of temperament that are included in current conceptualisations: 1) that temperament has a fundamental biological basis, and 2) at the core of temperament is emotion (Clark & Watson, 2008).

The first modern approach to defining temperament is often attributed to Allport (1937), who posited a definition that explains temperament as ‘the characteristic phenomena of an individual’s emotional nature, including his susceptibility to emotional stimulation, his customary strength and speed of response, the quality of his prevailing mood: these phenomena being regarded as dependent on constitutional makeup and therefore largely hereditary in origin’ (p. 54). Allport’s definition refers to emotional and behavioural expressions and reactions. The definition, notably, does not refer to any age range or period of the lifespan to which temperament is confined.

Later definitions, such as those proposed by Goldsmith et al (1987) or Saucier and Simonds (2006), typically referred to characteristics that are observable from infancy, and remain present throughout childhood. An element of Allport’s definition that has particular importance is the reference to the hereditary nature of temperament. Although definitions differ with regard to how temperament is explained, the notion that it is innate, predetermined, and expressed more or less from birth is fundamental to the concept, and may be one of the most salient differences between temperament and trait. Commonly, definitions of temperament refer to behaviours that form relatively consistent, observable patterns or manifestations over time (Shiner, 1998), with frequent references to emotionality, sociability, and activity (Cloninger, 2013). Five influential theories of temperament will now be reviewed, beginning with the seminal research of Thomas, Chess and Birch.
2.3.1 Thomas, Chess and Birch’s Nine Dimensions of Temperament

Although there are many theories of childhood temperament, the most widely adopted model is that proposed by Thomas, Chess, and Birch (1968; 1970), who proposed the idea that behaviour in infancy and childhood was not only structured and measurable, but related to trait development in adulthood. The authors described temperament as ‘the stylistic component of behaviour – that is, the how of behaviour as differentiated from motivation, the why of behaviour, and abilities, the what of behaviour’ (p.508).

Motivated by their own repeated observations of adaptive and maladaptive childhood personality development that seemingly was at odds with the prevailing environmental determinist view, Thomas, Chess, and Birch embarked on the now landmark New York Longitudinal Study to try to identify the markers in infancy and childhood that may lead to particular personality manifestations in later life (Thomas et al., 1970). Over a period of 14 years, 141 children from 85 families were observed and rated by their parents, and by research assistants, on nine pre-determined behavioural tendencies (see Table 2.1).

The parents of the children were interviewed six times by the researchers as their offspring advanced in age, and social integration (i.e. from home life to day care, to pre-school, to primary school). The ages of the children at each of the six interview points were 2 months, 6 months, 12 months, 2 years, 5 years, and 10 years of age. Remarkably, over the 14-year span of the study, attrition was minimal, with only four families (total of five children) leaving the study. The results of the study identified nine dimensions of temperament (see Table 2.1) that were thought to influence one of three child temperament types: easy, difficult, and slow-to-warm-up (Thomas et al., 1970).

‘Easy’ children were characterised as having an overall positive mood, low or moderate reactivity, regular bodily functions, positive approach to novel situations, and adaptability. Easy children quickly established regular sleeping and feeding schedules, and generally
adapted quickly to new routines, new foods and new people. As easy children began to participate in social situations outside of the home, they showed a tendency to learn the rules of, and participate in, new activities. They adapted easily to school and generally presented their parents with few problems.

In contrast, ‘difficult’ children were almost the polar opposite of easy children, insofar as they exhibited signs of withdrawal when confronted with novel stimuli, reacted to situations intensely, had irregular bodily functions, were generally negative in mood, and demonstrated poor adaptability. Difficult children were those that demonstrated irregular patterns in feeding and sleeping, and did not readily accept new foods or routines. They tended to cry a lot, with their crying and their laughter being characteristically loud.

The ‘slow to warm up’ children, accounting for only 15% of the sample, were noticeably tentative in their first experience to novel stimuli, generally had a low activity level and low intensity reactivity, were slow to adapt, and exhibited a ‘somewhat negative mood’ (Thomas et al., 1970, p. 105).

Table 2.1
*Thomas, Chess and Birch’s (1968) nine dimensions of temperament and associated rating scales*

<table>
<thead>
<tr>
<th>Temperamental Quality</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity Level</td>
<td>High/Low</td>
</tr>
<tr>
<td>Rhythmicity</td>
<td>Regular/Irregular</td>
</tr>
<tr>
<td>Distractibility</td>
<td>Distractible/Not Distractible</td>
</tr>
<tr>
<td>Approach/Withdrawal</td>
<td>Positive/Negative</td>
</tr>
<tr>
<td>Adaptability</td>
<td>Adaptive/Not Adaptive</td>
</tr>
<tr>
<td>Attention Span and Persistence</td>
<td>Long/Short</td>
</tr>
<tr>
<td>Intensity of Reaction</td>
<td>Intense/Mild</td>
</tr>
<tr>
<td>Threshold of Responsiveness</td>
<td>Low/High</td>
</tr>
<tr>
<td>Quality of Mood</td>
<td>Positive/Negative</td>
</tr>
</tbody>
</table>
The work of Thomas, Chess, and Birch (1970), and later Thomas and Chess (1987), was seminal in experimental and applied temperament studies, however their findings have since been revised on the basis that some of the nine dimensions proposed in the model contained redundancies, and, as such, most applied uses for the model now reflect seven basic temperaments (e.g. Buss & Plomin, 1987; Martin, Wisenbaker, & Huttunen, 1994). A primary shortcoming of the model, according to critics, was the inclusion of behaviours that are somewhat tenuously considered to influence personality, such as rhythmicity, which is the degree to which an infant or child eats and sleeps regularly (Buss & Plomin, 1984).

The criticism is that not all behavioural factors may act upon, or be directed by, temperament or personality factors. It may be that factors such as rhythmicity exert a secondary effect on an infant’s temperament, by way of a direct effect on the infant’s primary caregiver’s mood and parenting style. A child with irregular and unsettled sleeping and eating patterns may be a source of concern or frustration for their caregiver, which may, in turn, influence the amount of affection or attention directed toward the infant. The issue for temperament theory in this scenario is that the innate process, rhythmicity, is the basis for an environmental influence on personality development (caregiver affection), and not a direct and lasting biological influence of the infant’s own temperament.

A further issue faced by the temperament assessment scales developed by Thomas, Chess, and Birch (1968) is that they have proven difficult to replicate and appear to lack discriminant validity, presumably due to conceptually overlapping concepts (Martin et al., 1994; Sanson, Prior, Garino, Oberklaid, & Sewell, 1987). Nevertheless, this early foray into identifying and defining temperament has become influential in clinical applications, and remains a significant model for categorising infant temperament styles (Zentner & Bates, 2008).
2.3.2 Goldsmith and Campos’ Developing Emotion Systems

Goldsmith and Campos developed their theory of temperament from a biological basis, however confined their definition to individual differences in the expression and experience of primary emotions (Goldsmith et al., 1987; Goldsmith & Campos, 1982). Goldsmith and Campos refer to the work of emotional theorists such as Ekman (1982) and Izard (1977) when determining what constitutes a basic emotion. The experience of emotions such as anger, sadness, fear, joy and pleasure, disgust, interest, and surprise were thought to influence the development of temperament (Goldsmith et al., 1987). Although framing temperament in terms of emotions is not novel per se (e.g. Allport 1937), Goldsmith and Campos stipulate that the definition of temperament is contingent on the definition of emotions that is set by the theory (Goldsmith et al., 1987).

According to these authors, the definition of an emotion is contingent on four co-occurring criteria: 1) emotions regulate internal psychological processes, 2) emotions crucially regulate social and interpersonal behaviours, 3) basic emotions can be specified by unique patterns of facial, vocal or gestural expressions, and 4) basic emotions utilise a non-codified process that has an innate basis (Campos, Barrett, Lamb, Goldsmith, & Stenberg, 1983). A child’s temperament, then, would provide the emotional basis, or grounding, for later development of a personality trait. For example, temperamental anger may lead to the later development of adult trait aggression. An important aspect of Goldsmith and Campos’ theory of temperament is distinguishing it from motivation and ability. According to their theory, a single observable behaviour could be elicited by either motivational forces, level of ability, or an emotion, and it is the situational context that differentiates them (Goldsmith et al., 1987). The example that the authors use is that of a child who clings to their mother. The clinging behaviour could be explained as motivation if the child did not wish to be separated from its mother, ability if the
child lacked motor-function maturity, or emotion if the situation was novel and the child was fearful of exploring their surrounds (Goldsmith et al., 1987).

Plomin and Buss (1984) aired concerns about some of the nine behaviours that Thomas, Chess, and Birch had proposed as the basis of temperament. They also noted similar concerns with the Goldsmith and Campos’ (1982) model of temperament, which itself was based on Allport’s early definition of temperament. Plomin and Buss argued that two of the five dimensions of temperament proposed by Goldsmith and Campos, anger and fearfulness, may be difficult to differentiate in early infancy. They also stated that most problematic was the inclusion of motoric activity and interest/persistence in a temperament model that assumed there to be an emotional basis to behaviour (Buss & Plomin, 1984).

Goldsmith and Campos’ Developing Emotions System focused on not only the emotionality that they believed underpinned temperament, but also emotional regulation. Emotional regulation has been defined as ‘the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions’ (Thompson, 1994) and Goldsmith and Campos claimed that emotional regulation, in relation to goal-directed behaviour, was central to understanding temperament. Whether emotion and emotional regulation are mutually exclusive functions was later argued by Campos, Frankel, and Camras (2004), who posited that the two events happen together and may not be separable.

2.3.3 Plomin and Buss’ Criterial Approach to Temperament

Plomin and Buss (1987) approached the study and conceptualisation of temperament from the perspective of criterion matching (hence ‘criterial approach’) rather than the observational technique employed by Thomas, Chess, and Birch (1968). They suggested that temperament could only be identified as such if certain criteria were satisfied. The criteria that they proposed were largely derived from comparative earlier work by Diamond (1957). Plomin and Buss (1987) defined temperament as ‘a set of inherited personality traits that appear early in life’
(p508). The authors stated a belief that traits and temperament are enmeshed, and that one (trait) is the product of the other (temperament). The question of whether early temperament is a template for later trait formation, or that there is any direct relationship between them at all, is still under debate within the literature, and will be explored further in a subsequent section of the present thesis.

Buss and Plomin (1984) argued that the biological aspect of temperament was important, and, in particular, those characteristics that are heritable and unaffected by cultural or social forces. Expanding on Diamond’s (1957) argument that behaviours common among primates are the clearest culture-free indication of heritable temperament, Buss and Plomin stipulated that human temperament must be both genetic in origin and present from ontogenesis. Their model identified four traits that fulfilled their criteria: emotionality, activity, sociability, and impulsivity. These traits became known as the EASI model (Saucier & Simonds, 2006). The model was soon found to be problematic, however, when one of the traits, impulsivity, appeared to contradict the criterion by which it was selected. The authors dropped impulsivity from their model after noting that it typically did not manifest until school age (Buss & Plomin, 1984), and twin studies indicated that it was only evident as an inherited trait in boys (Buss & Plomin, 1975). The model, thereafter, became shortened to EAS. Although there appears to be evidence of stability in the EAS model (Rende, 1994), criticisms of the model include its apparent neglect of affect, in particular positive affect, and lack of support for the assertion that the EAS dimensions are more heritable than those included in competing models (Saucier & Simonds, 2006).

2.3.4 Rothbart’s Neurobiological Developmental Approach

Like the Goldsmith and Campos theory of Developing Emotion Systems, emotion and emotional regulation are also central to Rothbart’s theory of temperament. Rothbart defined temperament as relatively stable - primarily biologically based differences in reactivity and
self-regulation (Derryberry & Rothbart, 1984). The authors point to reactivity and self-regulation as the primary mechanisms responsible for the emergence of temperament. Reactivity refers to excitability of various systems including endocrine, autonomic, and central nervous system, as well as their associated behavioural responses. The concept of self-regulation refers specifically to processes that moderate reactivity, such as attention, approach, avoidance, and inhibition (Rothbart & Posner, 1985). The similarity with the Goldsmith and Campos, and Thomas, Chess, and Birch models of temperament is most apparent in the variables Rothbart included, such as fear, distress, soothability, smiling and laughter. The point of difference between the models was that Rothbart’s theory aimed to uncover the neurobiological substrate rather than focussing on the outward manifestation of each emotion.

The Neurobiological Developmental Approach included three broad dimensions of temperament: surgency-extraversion, negative affectivity, and effortful control (Posner & Rothbart, 2007). Surgency-extraversion is represented by positive anticipation, sensation-seeking and activity level, negative affectivity (fear), anger-frustration, and social discomfort. Effortful control is represented by attentional focus, inhibitory control, and perceptual sensitivity (Posner & Rothbart, 2007). The emergence of observable temperamental elements, according to these authors, is contingent on the development and efficiency of the neurobiological systems previously noted. For example, the development of persistence, which tends to emerge around one year of age, is dependent on the execution of effortful control of dominant responses over subdominant ones (Zentner & Bates, 2008). The authors believed that infants were the ‘model system’ for the study of temperament, as they had not yet been considerably influenced by socialisation or developed the cognitive maturity required to develop higher-order structures such as self-concept, which may modulate reactivity (Posner & Rothbart, 1980). Rothbart’s theory of temperament was not confined to infancy and childhood, with much of his work focussing on self-reported adult autonomic reactivity, motor tension and
activation, cortical reactivity, fear, frustration, sadness, relief, and pleasure (Goldsmith et al., 1987). Like other theories of the time, Rothbart was also careful to note that outward behaviour may be an indication of temperament, however it may also be influenced by other processes such as motivation, expectations, and knowledge structures (Goldsmith et al., 1987). The conceptual nature of Rothbart’s Neurobiological Developmental Approach allowed for greater movement in temperament research. It encompassed neurophysiological structures and systems, the basic biological building blocks thought to underlie temperament, however it also acknowledged the interactions that must necessarily occur between temperament, the social environment, and an individual’s social development (Derryberry & Rothbart, 1984; Rothbart & Posner, 1985).

2.3.5 Kagan’s High-Low Reactivity Theory

A more recent investigation of the nature of temperament identified a different neurobiological element as the key to understanding interpersonal differences. Kagan and Snidman (2004) identified the amygdala as the primary brain structure responsible for understanding temperament, by way of high or low reactivity responses in an infant. An infant with a low threshold for amygdala stimulation would be considered high-reactive, which manifests as shy, introverted, reflective, and anxious. On the other hand, an infant with a high threshold for amygdala stimulation would be considered to be low-reactive, which would manifest as outgoing, relatively fearless, and exploratory (Kagan & Snidman, 2004). Data to support Kagan and Snidman’s theory were collected via an 11-year longitudinal study in which neurobiological data were obtained in the form of brain scans, heart rate recordings, and sympathetic nervous system activation. Additionally, qualitative data were also collected in the form of direct observation, and descriptive assessments of each child obtained from parents, and, on some occasions, teachers (Kagan & Snidman, 2004). Kagan (2004) proposed that the amygdala bypassing effortful cognitive processing is the key to understanding the innate
temperamental differences between individuals. At four months of age, high or low reactivity can be assessed by observing an infant’s emotional and motor responses to novel stimuli. A low-reactive infant would respond with minimal motor activity, and fearful or anxious emotional displays. A high-reactivity infant would display essentially the opposite pattern.

Testing of high or low reactivity was repeated at ages two, four, seven, and eleven years. Kagan and Snidman (2004) found 20% of infants that had been categorised as high-reactivity, and 30% of infants that had been categorised as low-reactivity, maintained their profiles at age 11. Interestingly, of the 80% of high reactivity and 70% of low-reactivity infants who did not demonstrate the same behavioural profiles at age 11, none appeared to present the opposite profile either, but instead exhibited a more moderate manifestation of reactivity (Blandin, 2013). Only 5% of children at age 11 demonstrated characteristics that were the opposite profile at age four months (Kagan & Snidman, 2004). As noted by Blandin (2013), the findings of the Kagan and Snidman longitudinal study show that it is easier to predict what a child will \textit{not} become by age 11, rather than predict what they will become. That is, a low-reactivity child at age four months, is very unlikely to become a high-reactive 11 year old. The most likely explanation for the tempering of reactivity are environmental influences. For example, as children grow they begin to develop coping strategies for novel confrontations.

\textbf{2.4 Summary of Temperament Research}

From the preceding review of influential theories in the study of temperament, the similarities and differences in theories of temperament were apparent. Of most interest to the present discussion are the similarities. A core tenet of the major theories outlined is that temperament has a strong biological basis. Although temperament theorists do not necessarily limit their theories exclusively to infancy and childhood (e.g. Rothbart), most study temperament in the earliest stages of life with the assumption that temperament is inherently biological in nature. The notion that temperament is either inherited or inherent has significant
implications for later development of personality traits, if indeed temperament in childhood foreshadows later personality traits in adulthood.

Allport (1931) signalled the probable biological nature of temperament in the early 1930s, and subsequent major attempts to identify the basis and nature of temperament have concurred with that assumption. Thomas, Chess, and Birch’s (1970) landmark study noted consistent and observable behavioural similarities in newborn or days old infants, who were assumed to be too young to exhibit any learned response, and inferred a biological element to temperament. Both Goldsmith and Campos (1982) and Rothbart (Derryberry & Rothbart, 1984) developed theories based on the explicit assumption that temperament was driven by biological and developmental agents, and Kagan’s (2004) High-Low reactivity theory was developed to assess the innate response to stimuli in infants as young as four months of age. It seems that despite ongoing debate about how to define temperament exactly (e.g. see Digman, 1994), major theorists tend to agree that temperament is an innate, biological human function.

The second important commonality between models of temperament is the inclusion of emotions in the core definition, or operationalisation, of the construct. Thomas, Chess, and Birch (1970) based their research on the behavioural characteristic of infants and children, and developed three temperament types. Some of the original temperament styles thought to be the basis of Thomas, Chess, and Birch’s (1970) three types may not be directly associated with a specific emotions, or emotional style (e.g. rhythmicity), however a number of the dimensions were, such as approach/withdrawal (associated with fear), quality of mood (associated with positive or negative affect), and activity level (associated with excitement). Basic human emotions were the central theme of Goldsmith and Campos’ (1982) temperament research. Similarly, Rothbart’s (1988) neurobiological approach focused on the neural component of basic emotion, the amygdala. Of particular interest is the finding that emotions such as negative affectivity (Derryberry & Rothbart, 1984), fear, and distress are fundamentally temperamental
in nature (Goldsmith & Campos, 1982), as these emotions are common personality traits in adulthood. Although there is no conclusive evidence that temperament in infancy and childhood represents a linear pathway to equivalent trait manifestation in adulthood, Kagan and Snidman (2004) presented evidence of a degree of temperament stability.

2.5 Traits

Traits are conceptualised as enduring patterns of thoughts, feelings, and behaviours that characterise and distinguish individuals from one another (Roberts, Wood, & Caspi, 2008). Like temperament, traits are not directly observable per se, but instead are descriptive schemas constructed by personality theorists (Dumont, 2010). Some of the most prolific contributions to trait theory included the early attempts by Allport (Allport, 1931) and Cattell (Cattell, 1943) to identify and define traits, as well as the well-known trait theories proposed by Eysenck (1967) and Costa and McCrae (1991).

2.5.1 Allport’s Lexical Approach

Allport (1937) defined traits as ‘a generalised and focalised neuropsychic system (peculiar to the individual), with the capacity to render many stimuli functionally equivalent, and to initiate and guide consistent (equivalent) forms of adaptive and expressive behaviour’ (p. 295). Allport was the first modern theorist to claim that traits were biological in nature, referring to them as neuropsychic structures, and stressing that they were not simply descriptive labels for a theoretical notion. He considered traits to be both enduring and an account of consistencies in behaviour. Allport believed that traits could be divided into common traits, those shared by the majority of people in a given population, and individual traits, those that are unique to the individual. According to Allport’s theory, individual traits distinguish personality, more so than common traits, and that to understand any one person fully would require an account of traits that are particular to that person. Allport (as well as his contemporary, Murray) adopted an
idiographic approach to personality, focusing on traits that were considered unique to an individual. He identified some 4,000 possible traits via a process called the lexical approach.

The lexical approach, or lexical hypothesis, is the assumption that any given aspect of human personality has been assigned a name and/or description over the course of human language evolution. Language, according to lexical approach theory, is subject to a ‘survival of the fittest’ process whereby only words that are necessary to communicate aspects of important human behaviour, or behaviour that affects others, have remained in use (Wiggins, 1996). The task that Allport undertook was to identify all of the terms in the English language that could be considered a description of a trait or behaviour. Starting with the dictionary, Allport and his colleagues initially identified a list of some 18,000 traits that had a linguistic representation. In a more modest application of the lexical approach, Allport and his research assistants undertook a thematic analysis of over 300 letters penned to Allport by a woman known to both he and his wife. The letters spanned more than a decade, and were written by the author while she was in her sixties. The combined findings of 36 independent raters led Allport to deduce that the author was characterised by eight traits: quarrelsome-suspicious, self-centred, independent-autonomous, dramatic-intense, aesthetic-artistic, aggressive, cynical-morbid, and sentimental. This approach to personality assessment was indeed as idiographic as may be possible, and hence not readily developed into a general means of assessing personality in the population. Allport’s approach to trait theory rested on two assumptions: 1) that language will naturally evolve in a way that facilitates accurate descriptions of subjective experiences, and 2) that the experiences of a human can be expressed via language (Dumont, 2010). Allport’s research contribution to trait theory was both seminal and extensive, however the qualitative approach he undertook was quite at odds with more statistical methods adopted by other significant contributors to trait theory.
2.5.2 Cattell’s Factor Analytic Approach

Cattell was also intent on identifying the traits that best encapsulated personality, however, unlike Allport, Cattell pursued trait theory via more rigorous and systematic research techniques. Starting with some 4,500 terms that Allport had collated from dictionaries, Cattell employed a factor analytic process to reduce the total to under 200 initially, then following further analyses established a list of 16 factors that he believed represented personality (see Table 2.2). The 16 traits, according to Cattell, were the structural elements of personality, and from them he derived the Sixteen Personality Factor Questionnaire (16PF). Cattell’s 16 source traits were conceptually akin to Allport’s notion of central traits, despite the quite divergent approaches taken to deriving them. According to Cattell’s model, source traits were those underlying factors of personality that can only be identified by the presence of associated, and observable, surface traits. For example, an individual that is overtly energetic, gregarious, and sociable could be described as having the surface traits that underpin the source trait of warmth. Cattell (1950) also proposed the idea of constitutional traits and environmental-mould traits, which he claimed were primarily hereditary and experiential in nature. These categories were more like fuzzy sets, as it is very unlikely that any behaviour is wholly inherited or wholly environmentally derived (Dumont, 2010).

Table 2.2
Cattell’s 16 personality factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Low score description</th>
<th>High score description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warmth</td>
<td>Reserved, impersonal, distant, cool, detached, formal, aloof</td>
<td>Warm, outgoing, attentive to others, kindly, easy going, participating, likes people</td>
</tr>
<tr>
<td>Reasoning</td>
<td>Concrete thinking, lower general mental capacity, less intelligent, unable to handle abstract problems</td>
<td>Abstract-thinking, more intelligent, bright, higher general mental capacity, fast learner</td>
</tr>
<tr>
<td>Emotional Stability</td>
<td>Reactive emotionally, changeable, affected by feelings, emotionally less stable, easily upset</td>
<td>Emotionally stable, adaptive, mature, faces reality calm</td>
</tr>
<tr>
<td>Dominance</td>
<td>Deferential, cooperative, avoids conflict, submissive, humble, obedient, easily led, docile, accommodating</td>
<td>Dominant, forceful, assertive, aggressive, competitive, stubborn, bossy</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Liveliness</td>
<td>Serious, restrained, prudent, taciturn, introspective, silent</td>
<td>Lively, animated, spontaneous, enthusiastic, happy go lucky, cheerful, expressive, impulsive</td>
</tr>
<tr>
<td>Rule-Consciousness</td>
<td>Expedient, nonconforming, disregards rules, self-indulgent</td>
<td>Rule-conscious, dutiful, conscientious, conforming, moralistic, staid, rule bound</td>
</tr>
<tr>
<td>Social Boldness</td>
<td>Shy, threat-sensitive, timid, hesitant, intimidated</td>
<td>Socially bold, venturesome, thick skinned, uninhibited</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Utilitarian, objective, unsentimental, tough minded, self-reliant, no-nonsense, rough</td>
<td>Sensitive, aesthetic, sentimental, tender minded, intuitive, refined</td>
</tr>
<tr>
<td>Vigilance</td>
<td>Trusting, unsuspecting, accepting, unconditional, easy</td>
<td>Vigilant, suspicious, sceptical, distrustful, oppositional</td>
</tr>
<tr>
<td>Abstractedness</td>
<td>Grounded, practical, prosaic, solution orientated, steady, conventional</td>
<td>Abstract, imaginative, absent minded, impractical, absorbed in ideas</td>
</tr>
<tr>
<td>Privateness</td>
<td>Forthright, genuine, artless, open, guileless, naive, unpretentious, involved</td>
<td>Private, discreet, non-disclosing, shrewd, polished, worldly, astute, diplomatic</td>
</tr>
<tr>
<td>Apprehension</td>
<td>Self-Assured, unworried, complacent, secure, free of guilt, confident, self-satisfied</td>
<td>Apprehensive, self-doubting, worried, guilt-prone, insecure, worrying, self-blaming</td>
</tr>
<tr>
<td>Openness to Change</td>
<td>Traditional, attached to familiar, conservative, respecting traditional ideas</td>
<td>Open to change, experimental, liberal, analytical, critical, free thinking, flexibility</td>
</tr>
<tr>
<td>Self-Reliance</td>
<td>Group-oriented, affiliative, a joiner and follower dependent</td>
<td>Self-reliant, solitary, resourceful, individualistic, self sufficient</td>
</tr>
<tr>
<td>Perfectionism</td>
<td>Tolerated disorder, unexacting, flexible, undisciplined, lax, self-conflict, impulsive, careless of social rules, uncontrolled</td>
<td>Perfectionistic, organised, compulsive, self-disciplined, socially precise, exacting will power, control, sentimental</td>
</tr>
<tr>
<td>Tension</td>
<td>Relaxed, placid, tranquil, torpid, patient, composed low drive</td>
<td>Tense, high energy, impatient, driven, frustrated, over wrought, time driven</td>
</tr>
</tbody>
</table>

*Source: Adapted from Conn & Rieke (1994)*

2.5.3 Eysenck’s Dimensions of Personality

Some decades after Cattell’s seminal factor analytic approach to trait theory, Eysenck proposed a model of trait theory that has had far-reaching implications for the depositional
perspective (Clark & Watson, 2008). Eysenck’s trait theory was also based in factor analysis, however, unlike Cattell, Eysenck supplemented his analyses with experimental data. Hans Eysenck, along with his spouse, Sybil, developed a theory of traits and factors based on three orthogonal dimensions which he referred to as ‘superfactors’ (Eysenck, 1990). After 20 factor analyses (in research that spanned more than a decade), Eysenck and Eysenck (1963) concluded that personality can be explained via the dimensions of extraversion versus introversion, neuroticism versus emotional stability, and psychoticism versus impulse control. Each dimension was typified by a number of factors on which an individual could be assessed (see Table 2.3).

**Table 2.3.**

<table>
<thead>
<tr>
<th>Eysenck’s personality dimensions and associated characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraversion (Introversion)</td>
</tr>
<tr>
<td>Sociable</td>
</tr>
<tr>
<td>Lively</td>
</tr>
<tr>
<td>Active</td>
</tr>
<tr>
<td>Assertive</td>
</tr>
<tr>
<td>Sensation seeking</td>
</tr>
<tr>
<td>Carefree</td>
</tr>
<tr>
<td>Dominant</td>
</tr>
<tr>
<td>Venturesome</td>
</tr>
</tbody>
</table>

*Source: Adapted from Schultz and Schultz (2012)*

Eysenck noted that the extraversion-introversion dimension had been recognised as a building block of personality by Greek philosophers (e.g. Galen, AD 129 – c. 200; Hippocrates, c. 460 – c. 370 BC), was consistent with the neoanalytic work of Jung, and was found in almost every personality assessment scale that had been developed thus far. To Eysenck, this indicated very strong evidence that extraversion and introversion were fundamental to explaining personality (Eysenck, 1997). The dimensions, or superfactors, in Eysenck’s model present a
highly reductionist view of personality. While a reductionist approach is not inherently bad, it does risk masking the complexities of personality, a limitation that Eysenck acknowledged.

Evidence to support Eysenck’s dimensional trait theory demonstrated impressive stability and reliability over the lifespan, despite the influence of social and environmental elements (Schultz & Schultz, 2012). The stability and reliability results led Eysenck to claim that personality traits were largely determined by genetic inheritance, however he did not go as far as to state that social and environmental factors were unimportant (Eysenck, 1990). Twin studies and cross-cultural research conducted by Eysenck and others (e.g. see Bouchard Jr, 1984; Martin & Jardine, 1986; Tellegen et al., 1988) has presented consistent evidence that higher correlations of the three superfactors is more common between monozygotic twins than fraternal twins, as well as evidence that they are present in a diverse range of cultures. The evidence amassed throughout Eysenck’s career certainly seemed to support his theory of a biological/genetic basis to personality.

2.5.4 Costa and McCrae’s Five-Factor Model

Until the emergence of the Five-Factor Model in the 1980s, proponents of the factor analytic/dimensional approach to personality had failed to agree on a finite number of factors or traits in any model of personality. Cattell had proposed 16 factors, while Eysenck considered three an adequate amount, and other theorists of the time proposed numbers in between (e.g. Fiske, 1949; Guilford & Guilford, 1936; Guilford & Guilford, 1939). Although it may appear as though Costa and McCrae’s five factors, which would come be known as the Big 5, seemingly emerged spontaneously, most of the theorists mentioned previously came incredibly close to developing a definitive Five-Factor Model in their own right (Wiggins, 1996).

The Five-Factor Model (Digman, 1990; McCrae & Costa, 1987) is presently considered the dominant model in trait theory specifically, and in contemporary personality theory more generally (John, Naumann, & Soto, 2008; Musek, 2007). Although Costa and McCrae are
typically credited with the development of the Five-Factor Model, its emergence was
influenced by a confluence of theories and ideas from several contributors, primarily Goldberg,
at the conclusion that there were three factors that appeared to encapsulate a large amount of
personality variation (neuroticism, extraversion, and openness), but collaboration with the
above-named theorists resulted in the adoption of agreeableness and conscientiousness, and the
Five-Factor Model was born.

An important distinction to note prior to any review of the Five-Factor Model and the Big
5 is that the terms are not interchangeable. The Big 5 were derived from lexical studies and, as
such, serve only as a descriptive mechanism for the traits of neuroticism, extraversion,
openness to experience, agreeableness, and conscientiousness (Goldberg & Saucier, 1998). A
common criticism of the lexical approach is that although its fundamental assumption may be
appealing, it is by no means compelling (Block, 1995). McCrae and Costa (1985) were openly
cautious about its employment, stating that the assumption of the lexical approach, when
applied to anatomy, should mean that every word needed to describe human structure and
function will have evolved naturally, and, as that has not been the case, why, then, should it be
assumed of personality? The nature of the lexical approach means that the language of
personality could be considered a reflection of personality phenotype, the outward and
observable characteristics. The inherent limitation in this conceptualisation however, is that
phenotype is not an explanation of genotype, it does not explain the true underlying basis for a
particular trait. Hence, the use of naturally evolved language in the lexical approach is a useful
starting point, however it can only ever serve as the ‘what’ of personality, and not the ‘how’ or
‘why’ (Wiggins, 1996). Nevertheless the lexical approach underlies a great deal of trait theory
and has, in part, contributed to the development of the Big 5.
Each of the Big 5 factors has six constituent facets that add granularity to personality descriptions (Table 2.4). The inclusion of the facets allows personality assessments to home in on particular aspects of the Big 5 that may be influencing personality more than others. For example, an individual may score highly on the factor of extraversion, but an examination of facet scores may reveal that the extraversion is largely driven by high warmth and gregariousness scores, even if the person is moderate or low in excitement seeking.

Table 2.4
The Five-Factor Model factors and associated facets

<table>
<thead>
<tr>
<th>Neuroticism</th>
<th>Extraversion</th>
<th>Openness</th>
<th>Agreeableness</th>
<th>Conscientiousness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>Warmth</td>
<td>Fantasy</td>
<td>Trust</td>
<td>Competence</td>
</tr>
<tr>
<td>Angry hostility</td>
<td>Gregariousness</td>
<td>Aesthetics</td>
<td>Straightforwardness</td>
<td>Order</td>
</tr>
<tr>
<td>Depression</td>
<td>Assertiveness</td>
<td>Feelings</td>
<td>Altruism</td>
<td>Dutifulness</td>
</tr>
<tr>
<td>Self-consciousness</td>
<td>Activity</td>
<td>Actions</td>
<td>Compliance</td>
<td>Achievement striving</td>
</tr>
<tr>
<td>Impulsiveness</td>
<td>Excitement seeking</td>
<td>Ideas</td>
<td>Modesty</td>
<td>Self-discipline</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>Positive emotions</td>
<td>Values</td>
<td>Tender-mindedness</td>
<td>Deliberation</td>
</tr>
</tbody>
</table>

Source: Costa & McCrae (2008)

The Five-Factor Model, however, is not a theory of personality in and of itself. The proposed explanation of what personality is, and how it develops over the lifespan, is contained within McCrae and Costa’s (1996) Five-Factor Theory. The Five-Factor Theory integrates the various research findings that pertain to the Five-Factor Model. That is, the Five-Factor Model has yielded research data in the forms of longitudinal studies, cross-cultural studies, quantitative studies, and qualitative case studies, all of which evidence some or another influence, or quality, of the Five-Factor Model (Engler, 2014). It is the job of the Five-Factor Theory to try to account for the various, and at times seemingly conflicting, findings.

The Five-Factor Theory rests on four explicit assumptions about human nature: knowability, rationality, proactivity, and variability (McCrae & Costa, 2008). Knowability is the assumption that personality is an appropriate and meaningful topic for scientific investigation. Rationality is the assumption that humans are capable of understanding
themselves and others, and is a necessary pre-requisite for the first assumption. Proactivity is the assumption that humans are deliberate and conscious in their actions and reactions. Finally, variability is the assumption that people differ from one another in meaningful ways, which is an interesting assumption considering Costa and McCrae were seeking a unifying theory. Cattell sought to understand the personality structures that are common to all, while Allport sought to investigate structures unique to the individual. There seems a dichotomy in this assumption, that a theory can explain one or the other, but not both. The Five-Factor Theory succeeds in explaining both perspectives simultaneously, insofar as the Big 5 captures higher-order traits that are considered universally human, as well as identifies the degree to which individuals vary (individual differences) on the Big 5 factors and facets (McCrae & Costa, 2008). Costa and McCrae acknowledged that a major limitation of the Big 5 was their linguistic descriptive origins, but they also noted that another limitation was that any biological or dispositional trait is unlikely to be the sole influence on personality development (McCrae & Costa, 1987). Hence, the Five-Factor Model contextualises the Big 5 in relation to other agents of personality development thought to influence innate disposition at one time or another over the lifespan. Costa and McCrae’s Five Factor Model is schematically represented in Figure 2.1. The Five-Factor Model consists of components of the personality system (rectangles in Fig. 2.1), components that interface with adjoining systems (ellipses in Fig. 2.1) and dynamic processes (solid lines in Fig. 2.1). Table 2.5 presents the general criteria covered by each component of the Five-Factor Model. According to the model, biological bases are the inherited and inherent contributions such as genetics, cognition, and physiology, and constitute the starting point for the development of personality.
The Five-Factor Model of personality. Solid lines represent dynamic processes that continually influence causal pathways in the ongoing development of personality. Source: Costa and McCrae (1994)

The model does not offer an explanation of the mechanisms by which biological bases influence the personality system, only that personality is unlikely to go unaffected by them (McCrae & Costa, 2008). Biological bases directly influence the next component of the Five-Factor Model, basic tendencies. The component of basic tendencies refers to the unobservable, and therefore inferred, ‘raw material’ of personality, the Big 5 factors (Wiggins, 1996; p 66). Each of the Big 5 factors, and their associated facets are assumed to exist universally, and to varying degrees, in every individual. Basic tendencies are assumed to directly influence the broad category of characteristic adaptations, and, within that component, also directly influence the subset of characteristic adaptations, self-concept (McCrae & Costa, 1996).

The elements encapsulated by characteristic adaptations (see Table 2.5) cover a broad spectrum of acquired skills, attitudes, relationships, and behaviours that are considered a consequence of the interaction between an individual and their environment, as well as a personal narrative that develops as a function of one’s self-concept over time (Wiggins, 1996).
In the model, characteristic adaptations are self-influencing, insofar as their acquisition can become cyclic, or self-perpetuating. For example, acquisition of a new skill (e.g. a new language) may directly influence self-concept (e.g. ‘I am a competent learner’) or other characteristic adaptations (e.g. broadened opportunity to socialise).

The Five-Factor Model distinguishes between basic tendencies and characteristic adaptations insofar as the former are considered abstract psychological potentials, while the latter are their concrete manifestations (McCrae & Costa, 2008). Following the pathway of the model, characteristic adaptations then influence objective biography, which, in turn, can directly affect self-concept without necessarily effecting characteristic adaptations in a bidirectional fashion. An objective biography, according to Murray and Kluckhohn (1953, p. 30; cited in Wiggins, 1996) refers to ‘every significant thing that a man [or woman] felt and thought and said and did from the start to the finish of his [or her] life’. Like characteristic adaptations, the component of objective biography is a broad, all-encompassing variable that allows the model to account for changes in personality over the lifespan. Finally, the model refers to the role of external influences, and indicates a bidirectional influence with objective biography, as well as a one-way influence on characteristic adaptations. External influences may include factors from infant and child relationships with caregivers, access to education, peer influences, right through to macro-environmental influences such as culture or even historical era (Wiggins, 1996).

The Five-Factor Model also includes dynamic processes, indicated in Figure 2.1 by solid lines. Dynamic processes indicate how the components of the model interface, but are more complex than a simple indication of directionality. Table 2.6 presents examples of dynamic processes that have been suggested as important in explaining the workings of a (general) model of personality, and indeed demonstrate how the components of the Five-Factor Model are vulnerable to change or equilibrium, depending on which dynamic process may be at work.
and to what degree (Wiggins, 1996). It is important to note, McCrae and Costa (1996) pluralised dynamic processes within the model in order to indicate that many processes may be exerting an effect on any two interfacing components at a given moment.

Table 2.5
The major components, and their basic elements, of the Five-Factor Model

<table>
<thead>
<tr>
<th>Biological Bases</th>
<th>Basic Tendencies</th>
<th>Characteristic Adaptations</th>
<th>Self-Concept</th>
<th>Objective Biography</th>
<th>External Influences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetics</td>
<td>Extraversion</td>
<td>Acquired competencies</td>
<td>Implicit/explicit views of self</td>
<td>Overt behaviour</td>
<td>Developmental influences</td>
</tr>
<tr>
<td>Physical characteristics</td>
<td>Neuroticism</td>
<td>Attitudes, Belief and Goals</td>
<td>Self-esteem</td>
<td>Stream of consciousness</td>
<td>Macro-environment</td>
</tr>
<tr>
<td>Cognitive capacities</td>
<td>Openness to experience</td>
<td>Learned Behaviours</td>
<td>Identity</td>
<td>Live course</td>
<td>Micro-environment</td>
</tr>
<tr>
<td>Physiological drives</td>
<td>Agreeableness</td>
<td>Interpersonal adaptations</td>
<td>Life story</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vulnerabilities</td>
<td>Conscientiousness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted from Wiggins (1996)

Each of the elements of the Five-Factor Theory (components and dynamic processes) operate under a set of postulates that specify how the system operates. The postulates, listed below, are empirically testable, derived from empirical literature, and generally uncontested (McCrae & Costa, 2008), however trait models that have emerged since the Five-Factor Model indicate that some of the postulates may need to be revised. For example, postulate 1d (Structure) states that the five factors are at the top of the trait hierarchy. Since the development of the Five-Factor Model, newer personality frameworks have proposed narrower sets of superordinate traits, such as the Big 2 (Pérez-González & Sanchez-Ruiz, 2014) and the Big 1 (Musek, 2007) – both of which unseat the Big 5 as the highest set of traits in a hierarchy.

The postulates of the Five-Factor Model are:

1. **Basic tendencies**
   1a. **Individuality.** All adults can be characterized by their differential standing on a series of personality traits that influence patterns of thoughts, feelings, and actions.
1b. **Origin.** Personality traits are endogenous basic tendencies that can be altered by exogenous interventions, processes, or events that affect their biological bases.

1c. **Development.** The development of personality traits occurs through intrinsic maturation, mostly in the first third of life but continuing across the lifespan; and through other biological processes that alter the basis of traits.

1d. **Structure.** Traits are organized hierarchically from narrow and specific to broad and general dispositions; Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness constitute the highest level of the hierarchy.

2. **Characteristic Adaptations**
   2a. **Adaptation.** Over time, individuals react to their environments by evolving patterns of thoughts, feelings, and behaviours that are consistent with their personality traits and earlier adaptations.

   2b. **Maladjustment.** At any one time, adaptations may not be optimal with respect to cultural values or personal goals.

   2c. **Plasticity.** Characteristic adaptations change over time in response to biological maturation, social roles and/or expectations, and changes in the environment or deliberate interventions.

3. **Objective biography**
   3a. **Multiple determination.** Action and experience at any given moment are complex functions of all those characteristic adaptations that are evoked by the situation.

   3b. **Life course.** Individuals have plans, schedules and goals that allow action to be organized over long time intervals in ways that are consistent with their personality traits.

4. **Self-concept**
   4a. **Self-Schema.** Individuals maintain a cognitive-affective view of themselves that is accessible to consciousness.
4b. Selective perception. Information is selectively represented in the self-concept in ways that (i) are consistent with personality traits, (ii) give a sense of coherence to the individual.

5. External influences
5a. Interaction. The social and physical environment interacts with personality dispositions to shape characteristic adaptations, and with characteristic adaptations to regulate the flow of behaviour.

5b. Apperception. Individuals attend to and construe the environment in ways that are consistent with their personality traits.

5c. Reciprocity. Individuals actively influence the environment to which they respond.

6. Dynamic processes
6a. Universal dynamics. The ongoing functioning of the individual in creating adaptations and expressing them through thoughts, feelings, and behaviours is regulated in part by universal cognitive, affective, and volitional mechanisms.

6b. Differential dynamics. Some dynamic processes are differentially affected by basic tendencies of the individual, including personality traits.

Note: Adapted from McCrae and Costa (1996, 2008)

The Five-Factor Model presents a personality system in which individual differences can be detected among a set of traits considered to be universal in humankind. In addition to capturing micro and macro aspects of personality, the model can also explain personality as a cross-sectional ‘snapshot’ perspective, or as a lifespan approach (McCrae & Costa, 2008).

From the perspective of explaining a snapshot of personality at any given moment, the external influences component represents the situation or context, and the objective biography would represent the output of the system, an instance of behaviour. Alternatively, from a longitudinal perspective, personality development can be explained by the continued interaction of basic
tendencies and characteristic adaptations, with objective biography becoming evidence of the individual’s evolution up to any given point (McCrae & Costa, 2008).

Table 2.6
Examples of dynamic processes that may exert effect in the Five-Factor Theory of personality

<table>
<thead>
<tr>
<th>Information Processing</th>
<th>Coping and Defence</th>
<th>Volition</th>
<th>Regulation of Emotions</th>
<th>Interpersonal Processes</th>
<th>Identity Formation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception</td>
<td>Repression</td>
<td>Delay of gratification</td>
<td>Emotional reactions</td>
<td>Attachment and bonding</td>
<td>Self-discovery</td>
</tr>
<tr>
<td>Operant conditioning</td>
<td>Displacement</td>
<td>Rational choice</td>
<td>expression/suppression of affect</td>
<td>Social manipulation</td>
<td>Search for meaning</td>
</tr>
<tr>
<td>Implicit learning</td>
<td>Positive thinking</td>
<td>Planning and scheduling</td>
<td>Hedonic adaptation</td>
<td>Role playing</td>
<td>Self-consistency</td>
</tr>
</tbody>
</table>

Source: Adapted from Wiggins (1996)

The Five-Factor Theory is a Grand Theory of personality, insofar as it attempts to account for the whole person across the whole lifespan (McCrae & Costa, 2008). It explains personality by way of a universal system made up of defined structures and interacting dynamic processes that may repeatedly adjust the course of personality development. The theory incorporates, and gives meaning to, the Five-Factor Model, and provides understanding of how psychological constructs operate. Like many other Grand Theories (e.g. Freud, Skinner) it lacks specific details about some aspects in order to unify the central constructs, however it is strongly linked to robust empirical findings that span time, race and culture (McCrae & Costa, 2008). It is for this reason that the Five-Factor Model generally, and the Big 5 factors specifically, were adopted as the central theoretical framework in the present thesis.

2.6 Evidence for a biological basis of temperament and traits

The dispositional perspective operates on the assumption that genetic underpinnings are the basis of personality traits, and that change in personality is accounted for by environmental influences (Krueger, Johnson, & Kling, 2006; McCrae et al., 2000). To date, no single
candidate gene has been identified as being wholly responsible for a dispositional trait, and
twin studies have repeatedly found genetic contribution to personality to account for
approximately 50% of the variance observed in traits, with most of the remainder accounted for
by the twins’ non-shared environment (the shared environment accounted for little to none of
the variance) (McAdams & Olson, 2010). It is likely that the development of dispositional traits
is due to a complex interaction of polygenic influences and gene-environment interactions.

A substantial body of research has shown that predictable characteristics of the Big 5
factors may have a biological basis. For example, traits that are assumed to be related to the Big
5 factors have been found throughout different cultures, are measurable via self-report (or in
the case of children or impaired adults, by knowledgeable others), appear to remain stable
throughout adulthood, and are particularly heritable (Costa & McCrae, 2011). Although
biologically based temperament and traits are central to dispositional theory, it does not suggest
that infants are born with an intact and fully developed personality ready to be deployed.

A simple but pleasing assumption of the relationship between temperament and traits is
that the maturation principle simply exerts a linear development from childhood temperament
to adulthood personality. Although there are temperaments that appear to correlate well with
the later emergence of similar personality traits, the relationship between the two is not direct,
nor ostensibly simple (McAdams & Olson, 2010). Caspi et al (2005) concluded from a review
of developmental personality literature that the temperament to trait process may be accounted
for by three avenues of development. The authors claim that positive affectivity and a positive
approach may later develop into extraversion and positive emotionality traits. A surgency
factor, that is, behaviour marked by high levels of positive affect, impulsivity and engagement
with the environment, is thought to influence the transition from positive affect in childhood to
extraversion in later life (McAdams & Olson, 2010). Caspi et al (2005) also claim that the
temperaments of anxious /fearful distress and irritable distress may develop into neuroticism
and negative emotionality traits (irritable distress may predict low agreeableness). They also postulated that focused attention, effortful control, and some aspects of behavioural inhibition may develop into conscientiousness, constraint, and some aspects of agreeableness.

Although temperament and trait theory do not provide a full account for the biological basis of personality, there is considerable evidence of genetic influences in personality development nevertheless. For example, a study by Kaufman et al (2004) identified that a short allele at 5-HTT (serotonin transporter) gene in a sample of 57 maltreated children moderated depressive traits in adulthood if, and only if, the child’s caregiver also reported being under high stress (and hence, unable to provide adequate social support to the child). The sample of maltreated children was compared to an age-matched health control group. The research indicated that children who were genetically ‘primed’ with the short 5-HTT allele were twice as likely to experience depression as those who carried the gene but did receive adequate social support from primary caregivers. Although the findings indicated a clear influence of biology on depression (a facet of neuroticism) the manifestation of the trait does not occur without the input from the child’s social environment. A later study by Haeffel et al (2008) found a similar diathesis-stress interaction. One hundred and seventy-six male adolescents with a particular polymorphism were found to be more likely to experience depression if, and only if, they also experienced severe maternal rejection (Haeffel et al., 2008).

2.7 Summary of Trait Research

In summary, the dispositional perspective provides some clues as to the nature of personality. The presence of clear and distinguishable temperament in newborns, and throughout early childhood, certainly indicates a level of biological predisposition, however there does not appear to be an innate and intact personality profile that can be genetically identified. What is less clear in dispositional theory however is how childhood temperament develops into fully-fledged adult personality, and whether the changes are biological,
environmental, or both. There does not appear to be a linear relationship between temperament and traits, however the exact relationship between them is also still unclear. With regards to the applied question of the value of therapeutic intervention where personality traits are concerned, there is no clear answer yet. In the absence of evidence that suggests personalities are fixed and unchanging in adulthood, there is merit in pursuing personality-directed research and interventions on the basis that over time and context, change is possible, if not inevitable.

### 2.8 Typologies and Type D Personality

#### 2.8.1 Conceptualising Personality as a ‘Type’

Single-trait research is typically referred to as a variable-centred approach, and a major influence and advancement of this approach to personality research has been the Five-Factor Model (Costa & McCrae, 1992a; John & Srivastava, 1999). Variable-centred research approaches typically involve identifying a trait dimension of interest, and then grouping individuals on that dimension (Atkins, Hart, & Donnelly, 2005). For example, individuals rated as high on neuroticism may be compared to those rated low on neuroticism, on some outcome variable such as social competence. An implicit assumption of the variable-centred approach is that traits are independent of one another, and, hence, do not present as an integrated pattern that could be considered characteristic of an individual (Atkins et al., 2005). Most studies have used a variable-centred approach where the relationship between an outcome measure is examined in relation to each trait separately. This is a limitation of the variable-centred approach, insofar as single trait analyses cannot, by their definition, examine the changes to an outcome measure from the influence of multiple traits within an individual (Vollrath & Torgersen, 2002). An alternative to the variable-centred approach is to identify clusters of traits that typify a group of individuals, and categorising the cluster as a *type*.

The categorisation of traits into specific types is referred to as a person-centred approach (Robins, John, Caspi, Moffitt, & Stouthamer-Loeber, 1996). The typological approach aims to
identify specific traits that, when expressed in combination to specific degrees, are able to represent personality commonalities that facilitate both categorisation and comparison of people who meet the type criteria (Specht, Luhmann, & Geiser, 2014). The ability of the type approach to yield more predictive or explanatory evidence than a dimensional approach became evident when researchers found that combinations of specific trait dimensions (e.g. high extraversion and high neuroticism) predicted outcome measures (e.g. risky alcohol consumption) far better than either trait alone (Kjærheim, Mykletun, & Haldorsen, 1996). Typology provides a system of categorisation of people, in much the same way that a taxonomy classifies features of animals, chemical elements, or celestial bodies (Robins, John, & Caspi, 1998).

Typology, as a research focus, has been relatively absent from the literature in recent decades (Robins et al., 1996), but it is by no means a novel way of conceptualising personality. Just as temperament and traits were alluded to by the ancient Greeks, so too was the notion of different people possessing different types of personality (Theophrastus, circa 400 BC; cited in Morrison, 1965). The relative lack of modern typology research may be due to a lack of agreed upon procedures for extracting typologies from data. Robins, John, and Caspi (1998) outlined four common approaches to developing personality types. First, univariate typologies can be created by identifying a cut-off point at the extremes of the distribution of a single dimension. For example, on a normal distribution of inhibition scores, the tails of the distribution could represent uninhibited and inhibited types within a sample or population.

A second univariate typology approach is to extract types from a bimodal distribution. An example of this approach may be Strube’s (1989; cited in Robins, John and Caspi, 1998) finding that most people fall into two specific typologies that had previously been identified in personality and cardiac research, Type A or Type B personality, with few that fall into neither or both. Third, a bivariate approach allows the creation of types by splitting two dimensions at
their medians and crossing them to form four types. This process was employed by Covington (1992) who established four types by crossing a motivation (failure – success) dimension with an approach-avoidance dimension. In this 2x2 classification, the possible outcomes were failure/avoidance, failure/approach, success/avoidance, and success/approach. Covington (1992) found that each type demonstrated unique behaviours, goals, attitudes, and self-worth strategies in relation to achievement.

The fourth method for developing personality typology is a multivariate approach that requires identification of groups of individuals that share similar personality profiles across a variety of dimensions (Robins et al., 1998). The multivariate approach is inherently more complex than a univariate or bivariate approach, and requires a method that can identify personality similarities in individuals, but also identify distinct groups of individuals. The most commonly used method is Q-sort factor analysis (or inverse factor analysis). The Q-sort approach is an analysis of intercorrelations between people, rather than between dimensions. It is an assessment of the similarity of whole personality profiles, and the resultant clusters from inverse factor analysis are interpreted as types (Robins et al., 1998).

Block and Block (1980) adopted the Q-sort approach and have been credited with developing one of the most recognised typologies in personality research, ego-resiliency and ego-control. Ego-resiliency is characterised by a tendency to be flexible in response to stressful situation demands, and Ego-control reflects a tendency to over or under control emotional or motivational impulses (Block & Block, 1980). According to the theory, very high and very low ego-control is related to low ego-resilience, creating three distinct types (low control/low resilience, high control/low resilience, moderate control/high resilience). Block and Block’s (1980) research formed the basis of much of the subsequent typology research, and their three theoretical types have been well supported in replications (Atkins et al., 2005; Hart, Hofmann, Edelstein, & Keller, 1997; Robins et al., 1996; Weir & Gjerde, 2002). Block and Block’s three
types became known as resilients, undercontrollers and overcontrollers, and have been found in adults and children (Asendorpf, Borkenau, Ostendorf, & van Aken, 2001; Robins et al., 1996).

As noted previously, the Five-Factor Model has become the most widely utilised model of trait theory in modern research, however, Vollrath and Torgersen (2000) noted that little research had explored the effects of the Big 5 factors when considered together, rather than in isolation. In order to investigate the potential for Big 5 factor combinations to predict coping with stressful events, the authors developed eight typologies by combining high and low levels of neuroticism, extraversion, and consciousness (see Table 2.7). The eight typologies demonstrated clear and unique patterns of experiencing and coping with stress. Other researchers have found that personality typologies can offer greater explanatory value to longitudinal research. For example, well-being has been found to vary over time as a function of type (Shmotkin, 2005), and type has also been found to predict both happiness and suffering among older individuals (Shmotkin, Berkovich, & Cohen, 2006).

Table 2.7
Vollrath and Torgersen’s eight personality types derived from combinations of trait extraversion, neuroticism and conscientiousness

<table>
<thead>
<tr>
<th>Type</th>
<th>Trait</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extraversion</td>
<td>Neuroticism</td>
<td>Conscientiousness</td>
</tr>
<tr>
<td>Spectator</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Insecure</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Sceptic</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Brooder</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Hedonist</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Impulsive</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Entrepreneur</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Complicated</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

Source: Adapted from Vollrath & Torgersen (2000)
The typology approach is not without its limitations however. An obvious issue that typological research must contend with is the dichotomisation of personality. A number of authors have noted that splitting a dimension at its median in order to classify people as one type or another will necessarily result in a loss of variance (Haslam, Holland, & Kuppens, 2012; Vollrath & Torgersen, 2002). The probability of misclassifying a substantial number of people who fall either side of the split must be weighed against the heuristic benefits, and relative ease of understanding, that type categorisation affords. Nevertheless, there are strong reasons to pursue typology in personality research.

Typology research has shown that types may represent the consistent influence of core traits, the aspects of personality thought to be highly stable across time and contexts. In contrast, dimensions may represent surface traits, those that are subject to transitory influences such as mood (Asendorpf & Denissen, 2006). In order to test this idea, Asendorpf and Denissen (2006) compared the long-term predictive validity of types and dimensions in a sample of 154 children first tested at age four to six years, then subsequently at ages 17 to 22 years. Three possible outcomes were predicted: 1) types may be more characteristic of core traits than are dimensions, 2) dimensions may be more characteristic of core traits than are types, or (3) both types and dimensions reflect core traits. The authors found that while both approaches were very stable over time, at age 22 types predicted a number of personality outcomes more accurately than what could be achieved via dimensions (Asendorpf & Denissen, 2006). This finding gives considerable weight to the idea that typology can be an effective long-term predictor of personality. Dimensions, by their nature, allow for a much more nuanced level of differentiation between individuals, whereas even though types suffer from the previously noted issue of statistical crudeness, they may allow for more generalised long-term prediction (Asendorpf & Denissen, 2006). Other research has also reported that types have remained
robust across gender and age groups, as well as in the face of changing environmental factors (e.g. Specht et al., 2014).

Although much personality research still adheres to a single-trait approach, there is a great deal to be gained from conceptualising personality research from a typological perspective. Categorising personality into types may give rise to complexities and statistical limitations not as common in single-trait research, however the benefit in typology lay in the ability to study the whole person (McAdams & Pals, 2006). It would be difficult for any personality researcher to claim that traits act independently in any given individual, at best an argument could be that some traits are more dominant than others. Studying traits as types, allows for the detection of interactions between traits at different points across the lifespan and in different contexts, allowing for greater understanding of the complexity and variability of human personality.

2.8.2 Personality Types A, B, and C

One of the most well-recognised typology theories of the twentieth century is that of Type A personality (originally referred to as Type A Behaviour Pattern). Two cardiologists, Friedman and Rosenman (1959), proposed the idea that a particular set of behaviours constituted a type that was at higher risk than average for cardiac events (Friedman & Rosenman, 1959). Their seminal research involved studying the physiological markers of coronary artery disease (e.g. clotting time, cholesterol levels) in three groups of men with particular behavioural habits. The first group consisted of 83 men who demonstrated an intense and sustained motivation to achieve success. The second group also consisted of 83 men, but who demonstrated a pattern of behaviour that was considered to be the opposite of the first group. The third group consisted of 46 unemployed blind men who were identified as demonstrating a heightened and chronic state of anxiety and insecurity.

The results of the study not only identified individuals that theoretically had a higher risk of cardiac events (referred to as Type A), but also a second set of individuals that possessed the
opposite behavioural tendencies and were considered to be at very low risk of cardiac events (Referred to as Type B). The Type A behaviour pattern was described as the tendency to exhibit high levels of intense drive, competitiveness, achievement orientation, optimum mental alertness, and participation in multiple time-critical tasks. Type B behaviour pattern was essentially the opposite profile, a relaxed and somewhat underachieving disposition. It should be noted that Friedman and Rosenman were not psychological or personality researchers per se, and although their original study did refer to personality on a number of occasions, they tested and reported observable behaviours and did not administer a formal personality inventory. Nevertheless, the ambiguous definitions of Type A and Type B allowed for a reasonable inference that psychological constructs such as hostility, anger, and stress were at the core of the construct.

Subsequent publications by Rosenman and Friedman (1974) referred to Type A as ‘an action-emotion complex’ (p.67). As emotion is thought to be a core concept in both temperament and trait theory, the name, Type A behaviour pattern, began to evolve into Type A personality. The early studies by Rosenman and Friedman spawned an enormous interest in personality research, resulting in thousands of uncoordinated studies attempting to refine and understand Type A, its components, and its mechanisms (Hampson & Friedman, 2008). The construct enjoyed considerable popularity among clinicians for several decades, and was even declared as a reliable coronary risk factor by the American Heart Association (Weibe & Smith, 1997). There did seem to be considerable evidence that the Type A behaviours posed a greater risk of CHD, however questions concerning the psychological aspect of Type A began to emerge in the 1980s (Matthews, 1982).

First, the physiologically-driven conceptualisation of the construct did not (and was never intended to) address the psychological factors associated with Type A. Second, issues with the psychometric properties and administration of Type A assessment instruments were found
The three most commonly used measures (Type A Structured Interview; Jenkins Activity Survey; Framingham Type A Scale) demonstrated limited inter-correlation, and all three appeared to yield results that correlated highly with measures of other personality traits (Weibe & Smith, 1997). Finally, the assumption that Type A and Type B exist at opposite ends of the same continuum was challenged after evidence emerged that Type B is manifestly distinct from Type A (rather than a milder version of it) (Matthews, 1982).

Adding further to the concern for the validity of the Type A construct was a study by Mahajan and Rastogi (2011) who found no differences between Type A and Type B categorised participants on a measure of psychological wellbeing, a finding that would be unexpected if the typologies were valid and distinct from one another. Despite failing to attain empirical support and consensus in the personality research community, the terms Type A and Type B entered popular culture and are still commonly cited by lay persons to describe highly strung or overly relaxed individuals respectively. Some research areas still utilise the Type A and Type B behaviour patterns, however they are often not areas of psychological research (e.g. business studies; Hanif & Sarwat, 2011; Sameen & Burhan, 2014). The lack of support for the constructs from recent studies indicates that referring to Type A and Type B behaviour patterns as personality types may be over-extending their reach somewhat (Matthews, 1982).

In a relatively small and somewhat limited segment of the personality typology research field is the Type C personality construct. Type C was proposed in the early 1980s, and, like Types A and B, described a cluster of traits that were believed to increase the risk and severity of illness, in this case cancer (Temoshok & Heller, 1981). According to a series of studies conducted by Temoshok and others (see Temoshok, 1985, 1987; Temoshok & Heller, 1981; Temoshok et al., 1985), Type C personality is marked by social conformity and emotional suppression. A Type C individual would likely be overly compliant, passive, patient, and unassertive. They would also suppress emotions, and accept without question the direction of
those perceived to be in a position of authority. Type C individuals can be plagued by feelings of hopelessness and uselessness, demonstrate high levels of defensiveness and use of defence mechanisms, and poorly regulate self-control when under stress (Kneier & Temoshok, 1984; Temoshok, 1985; Temoshok et al., 1985). Type C individuals may also have difficulty recognising their own emotions and effectively expressing them to others (Lală, Bobîrnac, & Tipa, 2010).

The originators of the Type C personality construct claimed that the traits were the polar opposite of Type A personality, and that Type A and Type C would sit at each end of a continuum, with Type B personality somewhere around the mid-point (Temoshok, 1985). Type C was thought to influence breast cancer predominantly, and a small body of research has persisted with somewhat unconvincing findings (e.g. Bozo, Tathan, & Yılmaz, 2014; Lală et al., 2010). As such, the Type C personality construct appears to have faded away as quickly as it emerged. Little empirical research investigating either the construct itself, or the role of the construct in healthcare or other personality-related research, can be found, possibly due to the construct falling out of favour after a lack of reliable replications and disputed findings came to overshadow the efficacy of the construct (Blatný & Adam, 2008).

2.9 Summary of Personality Typology Research

There are reasons for and against clustering personality traits into discreet types. While there is a risk of reduced variance and less nuanced investigation when traits are split at the median to create types, there is a substantial gain in explanatory power when a whole-of-person approach to personality is adopted. While the research around trait theories outlined above suggests that typology may be fraught with methodological inconsistencies and limited replicability, they have ignited an interest in studying personality types in relation to health and well-being. Much of the medical literature, until the emergence of the Type A behaviour pattern, failed to account for an individual’s personality as a factor in health and illness, along
with most other psychological constructs. This may be due, in part, to the disease-focused medical model on which health and illness have, until very recently, been assessed. There can be no question that an individual’s personality moderates behaviours, and that some of those behaviours will, at least, influence physical and mental health. Types A, B, and C were largely unsuccessful in identifying personality traits that impact on health and illness directly or indirectly, however since the mid-1990s a new typology has emerged in the medical and psychological literature, Type D personality. Type D research, which will be introduced in the next chapter, has begun the task of addressing some of the short-comings of its predecessors.
CHAPTER 3 - TYPE D PERSONALITY

Type D personality is a relatively recent development in the area of personality typology research and is defined as the interaction of negative affectivity and social inhibition (Denollet, 2005). Proposed by Denollet and colleagues in the mid-1990s, the Type D construct refers to a particular set of normally distributed personality traits that, when manifest in concert, produce a ‘distressed’ personality profile. According to Type D theory, the interaction of negative affectivity and social inhibition can result in chronic suppression of negative emotions, and represents a general tendency to experience psychological distress (Denollet et al., 1996). A growing body of literature supports the contention that Type D personality may play a key role not just in extending personality typology theory, but also in understanding the role of personality in physical and mental health.

3.1 The Emergence of Type D Personality

Type D personality evolved from psychological medicine research that was aimed at understanding the relationships that may exist between personality and cardiac health. The single-trait research aimed to identify trait combinations that reflected differences in an individual’s ability to cope with life stressors. Working from an a priori standpoint, Denollet and de Potter (1992) first measured 166 male CHD patients on three superordinate traits: negative affectivity, positive affectivity, and self-deception (a tendency to withhold unfavourable information about the self in order to present in a more positive light). The data included self-report measures of negative affectivity (NA), social inhibition, self-deception, subjective distress, perceived stress, Type A behaviour, anger-in, and physiological measures of cardiorespiratory fitness. A cluster analysis identified four distinct groups of CHD patients who differed in their coping style. The findings remained robust at three and 15 month follow-up intervals.
The four groups were referred to as: Low-NA, High-NA, defensive, and repressive. Individuals classified as Low-NA (i.e. low levels of negative affectivity, self-deception and social inhibition) were prone to moderate levels of perceived stress and coronary-prone behaviour. The Low-NA cluster also represented hardiness which manifested as an ability to cope with stress in an adaptive way (Denollet & de Potter, 1992).

The second cluster of traits, High-NA (i.e. high levels of negative affectivity and social inhibition, low self-deception), demonstrated high levels of free-floating distress, tension, anger, disability, and low levels of well-being. Individuals in the High-NA cluster rated highly on the Type A behaviour scale, and had a tendency to be hyper-vigilant with regards to perceived threats. High-NA represented a type that did not cope well with daily stressors.

The third cluster identified by Denollet and de Potter (1992) was referred to as defensive (i.e. high self-deception scores). Individuals in the defensive group actively deferred their own attention away from somatic or psychological reactions to stress, and, hence, reported a low level of perceived stress. This was often in spite of their physiological and behavioural measures of stress indicating high arousal.

The final cluster was referred to as the repressive group (i.e. low levels of negative affectivity and social inhibition, and high levels of self-deception). Individuals in the repressive cluster demonstrated low level stress/distress and somewhat average levels of Type A behaviours. The study demonstrated that the four personality types, extracted from a heterogeneous CHD population, could account for a very large amount of the variance in perceived stress, subjective distress, and coronary-prone behaviour. The authors noted that they were unable to extrapolate their findings beyond male CHD patients, and that many of the participants that scored highly on negative affectivity exited the program before their rehabilitation was complete, which may have introduced a selection bias into the findings.
Nevertheless, a behavioural and perceptual pattern had emerged in the data that seemed to be related to specific clusters of personality traits.

Building on this research, Denollet (1993a) investigated the possibility of distinct coping styles in CHD patients that may constitute types (or subtypes). A sample of 405 male CHD patients completed self-report measures of negative affectivity, social inhibition, self-deception, Type A and anger-in, chronic tension, trait anger, hostility, life stress, and depression. Cardiorespiratory fitness was measured objectively via a bicycle exercise test. The multivariate approach was again based on a cluster analysis, the reliability of which was tested by randomly dividing the sample into two groups and examining the clustering for consistency with the whole-of-sample model. The two clusters identified were split at their median in order to create discrete personality types. The type models were tested on their ability to predict CHD behaviour variables of Type A, anger-in, hostility, depression, and life stress (Denollet, 1993a). Consistent with the results of the preceding study (i.e. Denollet & de Potter, 1992), the results yielded a taxonomic model of four personality types. The types were referred to as hardy, inhibited, repressive, and distressed.

Hardy individuals were low in distress and defensiveness, were expected to cope well with adverse conditions, and tended to conceptualise problems as highly controllable, viewing them as a challenge rather than a barrier. Inhibited individuals were high in defensiveness and social inhibition, shy or tense in social situations, and tended to use maladaptive avoidant coping styles. The repressive type were high in defensiveness but low in social inhibition, and tended to cope by repressing negative emotions. Finally, distressed individuals were low in defensiveness but high in distress, and were likely to experience adjustment difficulties.

Of the four types identified, the distressed type emerged as the most likely profile to present a risk of cardiac-related health problems. Prior research has demonstrated that the core component of the distressed type, emotional distress, is associated with factitious and actual
health complaints (Costa & McCrae, 1987; Friedman & Booth-Kewley, 1987a), as well as the incidence of CHD in the general population (e.g. Rosengren, Tibblin, & Wilhelmsen, 1991). Although each of these studies was primarily investigating either neuroticism (i.e. Costa & McCrae, 1987 and Friedman & Booth-Kewley, 1987a) or psychological distress (Rosengren, Tibblin, & Wilhelmsen, 1991), each paper emphasised the role that emotional distress can play in the development of actual and perceived poor health.

Although the distressed type seemed to be the most useful in predicting cardiac-related health outcomes, it is worth noting that each of the remaining types also presented possible avenues for disease progression. For example, the core component of the inhibited type, passivity and deliberate avoidance of interpersonal conflict, has been associated with negative health outcomes that result from deliberate suppression of emotions (Friedman & Booth-Kewley, 1987b). The inhibited type closely resembled the Type C construct (Temoshok, 1987) as those individuals were inclined to inhibit their own emotional expression in order to maintain harmonious social relationships. The characteristics associated with the repressed type can also be attributed to poor health outcomes (e.g. see King, Taylor, Albright, & Haskell, 1990). Conversely, the traits that made up the hardy type appeared to be protective in nature. Individuals who were classified as hardy were best equipped to deal with ongoing stressors, possibly due to a tendency to view threats as somewhat controllable, and, hence, respond with coping strategies that were more active and optimistic (Denollet, 1993a).

The research established four clear and distinct coping types in CHD patients. Two major limitations somewhat restricted the efficacy of the findings. First, the absence of female CHD patients in the sample meant that the findings were only able to be extrapolated to male CHD populations. Second, the limited inclusion of biomedical risk-factors for CHD meant that there was a possibility that the results did not reflect the impact of potential confounding variables.
Despite the gender and biomedical risk-factor limitations, the results offered theoretical and empirical weight to the supposition that multivariate trait combinations can, and do, influence health outcomes. The distressed personality appeared to be the type most likely to predict future cardiac events as well as inhibit recovery from CHD in men, and offered a substantive re-introduction of personality typology into the health research literature.

3.1.1 The DIRE Model

As the development of the coping types progressed, the description of the types were revised to distressed (D), introverted (I), restrained (R), and excitable (E). The types became known as the DIRE model. Under the heading of the DIRE model, the distressed personality type was described as the tendency to experience emotions associated with negative affectivity, and to inhibit the expression of those emotions in social situations. The two key elements of the distressed type were identified and labelled as negative affectivity and social inhibition, and this formalised the definition of what is now referred to as Type D personality. The Type D personality construct had evolved into a promising personality typology that seemed to be able to predict CHD morbidity with far greater accuracy and success than its now defunct predecessor, the Type A behaviour profile.

The major limitations of the Type D research thus far were the absence of both female participants, and biomedical risk factors for CHD, in the analyses. In a 1996 study published in the Lancet, Denollet et al. addressed these limitations. The participants, 268 men and 35 women, were recruited through a cardiac rehabilitation program and qualified for entry to the study if they had experienced a coronary event within two months of the beginning of the study. The participants underwent a standard cardiac treatment program that consisted of 36 sessions (no timeframe for the program was stated). The rehabilitation program included aerobic exercise training, individual psychological counselling, and six psychological group counselling sessions. Cardiac health check-ups were carried out every six months. The
participants were contacted again several years after the study, with timeframes ranging from six to ten years post rehabilitation. The average length of time for follow-up was 7.9 years. At follow up there was no participant attrition.

Type D personality was assessed by administering the Trait-Anxiety subscale of the State-Trait Anxiety Inventory (van der Ploeg, Defares, & Spielberger, 1980) and the Social Inhibition subscale of the Heart Patients Psychological Questionnaire (Erdman, Duivenvoorden, Verhage, Kazemier, & Hugenholtz, 1986). The tallying of the upper half of median splits on both scales produced a dichotomous Type D taxonomy. The main outcome measure in the study was death from all causes. The researchers divided deaths into cardiac and non-cardiac. After six to 10 years, 38 patients had died (14%). Of the 38 deaths, 24 were classified as cardiac and 14 were classified as non-cardiac.

The results showed that Type D personality was associated with a four-fold increased risk of mortality, and the effect of personality on mortality was not attenuated by severity of cardiac condition. Of the deaths that occurred more than five years post initial coronary event (n=14), participants with Type D personality were found to have been at three times greater risk of mortality than non-Type D participants. The addition of depression, use of benzodiazepines, and social alienation to the model did not add significantly to the predictive power of Type D. The findings indicated that a personality typology could predict health outcomes in CHD patients, independently of biomedical risk factors and gender.

Recent Type D cardiac research has mostly continued to support the use of categorical representations of personality as risk factors and predictors of health outcomes. For example, in a sample of 158 pre-operative cardiac patients (i.e. patients with diagnosed cardiac conditions who were scheduled to undergo cardiac surgery), Tully et al (2011) found that personality traits (particularly the negative affectivity component of Type D), affective disorders and affective phenotypes were associated with post-operative morbidity outcomes, independent of known
cardiac surgery risk factors. Similarly, Type D personality was associated with a higher prevalence of hypertension and diabetes in a random sample of 4,753 participants in Iceland (Svansdottir, Denollet, et al., 2013). The study found that Type D personality was a risk factor for future coronary events, largely a result of poor health beliefs and behaviours that were commonly associated with Type D personality.

Not all recent research has supported the idea that Type D personality has unique predictive value in cardiac patients. Coyne et al (Coyne et al., 2011) found that Type D personality did not predict cardiovascular disease mortality in a sample of 706 cardiac patients. In both unadjusted and adjusted models of predictive cardiac risk factors, Type D personality was not found to contribute to cardiac mortality in either its traditional dichotomous representation, or as a continuous negative affectivity by social inhibition representation.

In a study of risk factors for chronic heart failure mortality (n=111), quality of life, and readmission, Type D personality was not associated with mortality or re-admission, however it should be noted that the study did not find that any of the psychological variables included added to any prediction models after controlling for the effects of disease severity (Volz et al., 2011). These results are surprising, as health research generally suggests that psychological variables are important predictors of morbidity and mortality in chronic illness.

Although there are conflicting findings in relatively recent Type D research, there does appear to be reasonable evidence to suggest that personality typologies, such as Type D, may be useful predictors of health behaviours, beliefs, and perceptions.

### 3.2 Constituent Elements of Type D

Type D personality is comprised of two common, normally-distributed traits, negative affectivity and social inhibition. Broadly, negative affectivity is the tendency to experience negative mood states, negative emotions, and emotional distress, across time and context (Bruck & Allen, 2003; Denollet, 2000, 2005). Social inhibition is the tendency to supress the
expression of emotions, and feel inhibited, tense, and insecure in social interactions (Denollet et al., 2006). Both negative affectivity and social inhibition have been found to independently influence health, but according to Type D theory, their combined influence has an interactive effect. A description of negative affectivity and social inhibition is now presented, along with examples of how past research has identified the ways in which each trait can influence health and well-being.

3.2.1 Negative Affectivity

Type D theory was originally developed using the variables of negative affectivity, positive affectivity, and self-deception. These variables were included for three specific reasons, they are: 1) well-defined dimensions, 2) generalisable to a range of situations and contexts, and 3) observable and/or measurable attributes (Denollet & de Potter, 1992). Positive affectivity was eventually excluded from the Type D construct after the authors found that it did not contribute significantly to any model predicting CHD morbidity or mortality.

It is important to note that positive affectivity and negative affectivity are not opposite ends to the same spectrum. Trait research has found that positive and negative affectivity are not inversely correlated as could be assumed, but are orthogonal dimensions that exist on their own spectra; that is, high and low positive affectivity versus high and low negative affectivity (Carver & Scheier, 1990; Diener, Larsen, Levine, & Emmons, 1985; Watson, Clark, & Tellegen, 1988). An individual who is prone to experiencing negative affectivity may also experience positive affectivity simultaneously. Positive affectivity can reflect the tendency to be enthusiastic, active and alert – traits that are quite separate from those associated with negative affectivity, such as anger, contempt, fear, and guilt (Watson et al., 1988). The features of negative affectivity are not necessarily influenced by the presence of positive emotions, and are also distinct from those typically associated with anxiety and depression (e.g. sadness, lethargy, tension) (Watson et al., 1988).
Negative affectivity is strongly related to neuroticism, and, in some cases, the terms are used interchangeably (e.g. Johnson, 2003; Smith & MacKenzie, 2006). Other terms, such as trait anxiety and general maladjustment, have also been used interchangeably with negative affectivity (Watson & Clark, 1984). Costa and McCrae (1980) defined negative affectivity as a general dissatisfaction in life, and stated that it consisted of traits that cluster under the heading of neuroticism. The aspects of neuroticism that Costa and McCrae (1980) identified as the basis of negative affectivity were anxiety, hostility, impulsivity, and psychosomatic complaints. Measures of those aspects were correlated highly with a measure of negative affectivity, so it may be reasonable to ask, is negative affectivity simply neuroticism by another name, or are they distinct but overlapping constructs?

The trait of negative affectivity represents emotional states such as anger, disgust, and fearfulness. The effects of negative affectivity on an individual’s overall personality have been found to be considerably more entrenched, compared to the effects of neuroticism (Watson & Pennebaker, 1989). For example, negative affectivity refers to a persistent and pervasive experience of negative moods and emotions, as well as a negative view of the self (Watson & Pennebaker, 1989). Compared to individuals who were considered high in neuroticism, individuals with high levels of negative affectivity have been found to experience greatly increased and unremitting distress and dissatisfaction across situations, even when no obvious signs of overt stress were present (Watson & Clark, 1984). Individuals high in negative affectivity are also more likely to dwell on their perceived inadequacies or failings, be inwardly focused, and unsatisfied with themselves, as well as unfavourably view others and the world generally, compared to individuals with low negative affectivity (Watson & Pennebaker, 1989).

From a total sample of 541 healthy adults, Watson and Pennebaker (1989) found no evidence of any correlation between the trait of negative affectivity and objective measures of health. They did, however, find that negative affectivity was associated with a broad range of
subjective health complaints and symptom reporting. Correlations between negative affectivity and physical complaint scores were moderate to strong, consistent across several independent samples, and were found using a variety of physical and somatic symptom reporting scales (Watson & Pennebaker, 1989). The authors assessed both trait and state negative affectivity in relation to physical symptoms, somatic complaints, and mood. They found that all dependent measures correlated highly with both state and trait measures of negative affectivity, indicating a common underlying dimension. Negative affectivity, it seemed, was not merely the experience of negative emotions, but rather a trait that also represented generalised somatic distress. The authors hypothesised three possible mechanisms for explaining the relationship between negative affectivity and somatic distress: a psychosomatic hypothesis, a disability hypothesis, and a symptom perception hypothesis.

3.2.1.1 The Psychosomatic Hypothesis

The psychosomatic hypothesis reflected past research findings that psychological constructs such as depression, anger, and anxiety, have been causally associated with a wide variety of minor (e.g. headache, nausea) and serious (e.g. CHD, diabetes) physical symptoms and disorders. The authors noted that psychosomatic models have had a ‘checkered history’ (p239), a prudent observation even now, as the use of the term ‘psychosomatic’ in relation to poorly understood conditions, such as functional somatic syndromes, has evoked consternation at times. Nevertheless, Watson and Pennebaker (1989) assessed both subjective and objective measures of health and illness in the healthy sample.

Across the measures of health assessed in the study, little support was found for the psychosomatic hypothesis. Negative affectivity was unrelated to a range of health markers and conditions, including lifestyle variables, fitness, dysfunction, pathology, GP visits, and objective measures of risk (Watson & Pennebaker, 1989). The results also indicated that although individuals with high levels of negative affectivity reported significantly more
physical complaints and symptoms than individuals with low levels of negative affectivity, their objective health behaviours did not reflect their subjective experiences. That is, they may have complained of more headaches but did not take more aspirin, or complained of angina but not shown objective evidence of greater coronary risk. Put simply, high negative affectivity individuals complained about their health but did not show any objective evidence of poorer health or increased mortality (Watson & Pennebaker, 1989).

3.2.1.2 The Disability Hypothesis

The disability hypothesis was based on the assumption that negative affectivity is a product of the disease process. The theory states that the onset of illness or general health problems causes distress to the individual, and the experience of negative emotionality stems from that distress. This makes intuitive sense, as it is very unlikely that the onset of illness is likely to evoke positive emotions, or even evoke no emotional reaction at all. In Watson and Pennebaker’s (1989) results, no relationship between negative affectivity and any major chronic health condition was found, however the authors did concede that minor ailments such as frequent headaches could conceivably cause high negative affectivity. The suggestion has since been supported by findings that negative affectivity was predictive of probable and actual migraine (Chan & Consedine, 2014). One likely reason why no support for the disability hypothesis was found is that most research has relied on self-report measures of illness or incapacity to assess its relationship with health. In order to effectively test the disability hypothesis, objective measures of health status would be required to satisfy the assumptions.

3.2.1.3 The Symptom Perception Hypothesis

The final explanation proposed by Watson and Pennebaker (1989) was the symptom perception hypothesis. Both the psychosomatic and disability hypotheses relied on the existence of real and correlated health problems. In contrast, the symptom perception hypothesis assumed that negative affectivity may be related to the way that individuals
perceived, responded to, and complained about their physical and psychological sensations. The data indicated that high negative affectivity individuals were more likely to perceive, exaggerate, and overreact to minor physical complaints, problems, or sensations. The symptom perception hypothesis results showed that negative affectivity may be a vulnerability factor for habitual symptom reporting.

3.2.1.4 Biological Variables

Recent studies have investigated the possibility that negative affectivity is related to hypothalamic-pituitary-adrenal (HPA) axis dysfunction and hypercortisolism (Adam, 2006; Morris, Rao, Wang, & Garber, 2014; Stawski, Cichy, Piazza, & Almeida, 2013). Doane and Zeiders (2014) found that increased negative affectivity corresponded with increased cortisol in a sample of 77 healthy adolescents. The study examined daily affect, perceptions of social support from family and friends, and cortisol levels via a combination of affect journaling and salivary samples five times per day over three days. The findings indicated that increased negative affectivity was associated with a 12% increase in cortisol, even after adjusting for normal cortisol fluctuations and daily behaviours.

In another examination of the relationship between negative affectivity and increased cortisol reactivity, the ability to engage in mindful thinking was found to mitigate the effects of both anxiety and negative affect on cortisol production (Daubenmier, Hayden, Chang, & Epel, 2014). The study engaged a sample of 43 overweight or obese women, who had no history of diabetes, cardiovascular disease, or endocrine disease, and who were not taking any medication. In addition to measuring salivary cortisol on awakening, the researchers obtained self-reported dispositional mindfulness ratings (i.e. how the participants related to their thoughts and feelings), self-reported perceptions of stress over the previous month, and, finally, self-ratings of positive and negative affect. The study found the expected relationship between increased negative affectivity and increased cortisol awakening response, however they found
that the degree of the relationship diminished as dispositional mindfulness (the tendency to
consciously recognise and accept thoughts and emotions as transient) increased. The authors
speculated that individuals with less dispositional mindfulness may be more likely to fail to
identify their negative emotions as passing states and instead apply a self-judgement such as
being ‘wrong’ or ‘bad’ for having them.

3.2.1.5 Summary and Limitations of Negative Affectivity Research

The studies presented provide an interesting perspective on the relationship between
negative affectivity, physiological responses to stress, and cognitive appraisals – either negative
self-appraisal or anticipated negative social appraisal. Whether negative affectivity is a risk
factor, vulnerability factor, or product of subjective health experience is unclear, but what does
seem to be clear is that negative affectivity is, in some way, associated with a variety of
negative health conditions.

Frequent inconsistencies in the definition and use of the term *negative affectivity*, along
with difficulties in disentangling it from highly related constructs such as depression and
anxiety, potentially limit findings that claim to elucidate the role that negative affectivity plays
in health and illness. For example, a number of studies investigating the effects of negative
affectivity on health use the term *negative affectivity* as a catch all for traits and behaviours that
are more commonly attributed to depression and anxiety (Martel, Dolman, Edwards, Jamison,
& Wasan, 2014; Sohl & Friedberg, 2008). Features of depression and anxiety range from (but
are not limited to) sadness, hopelessness, emptiness, excessive worry, and apprehension (DSM-
V, APA, 2013). In contrast, research concerning the nature of negative affectivity typically
does not reflect depressive and anxious traits, rather, it encapsulates traits such as hostility,
anger, guilt, fear, and nervousness (Koch, Forgas, & Matovic, 2013; Watson et al., 1988).

Furthermore, individuals who score highly on measures of depression and anxiety also
tend to score highly on negative affectivity (Smith & MacKenzie, 2006). Prospective studies
have found that anxiety and depression are associated with increased blood pressure, hypertension (Davidson, Jonas, Dixon, & Markovitz, 2000), and cardiovascular disease (Simonsick, Wallace, Blazer, & Berkman, 1995), conditions that have also been attributed to high negative affectivity.

3.2.2 Social Inhibition

The second trait that underpins Type D personality is social inhibition. From the perspective of Type D personality, social inhibition represents a deliberate suppression of emotional expression in social situations as a means of avoiding disapproval from others (Denollet, 2005), however various other conceptualisations are found throughout the literature (Marin & Miller, 2013). The notion of socially induced stress has been present in personality research literature in various forms for some time. Horney (1937) referred to it as ‘basic anxiety’ in the late 1930s and described it as a heightened sensitivity to even the slightest social rejection.

3.2.2.1 Defining Social Inhibition

Like negative affectivity, social inhibition has suffered from the same issue of inconsistent application and interchangeability with other terms, including ‘sensitivity to social rejection’ (Cole, Kemeny, & Taylor, 1997), ‘behavioural inhibition’ (Fox, Henderson, Marshall, Nichols, & Ghera, 2005), ‘reward dependence’ (Gray, 1991) and ‘social avoidance’ (Berry, Lloyd-Jones, Garside, Wang, & Greenland, 2007). Social inhibition is also often substituted for the Big 5 factor of introversion (i.e. low extraversion; e.g. Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997), and is commonly associated with aspects of social anxiety (e.g. see Kupper & Denollet, 2014).

Often in Big 5 factor literature, introversion is not explicitly defined. Extraversion is more often defined, leaving the definition of introversion to be assumed to be the opposite of extraversion (e.g. see Costa & McCrae, 1992a, 1995; McCrae & Costa, 1985). Extraversion is
characterised by sociability, high levels of physical activity, and a tendency to experience positive emotions (Costa & McCrae, 1992a). The implication then, is that an introverted person would be characterised by a preference for solitude and quietness, with a tendency to experience negative moods, or perhaps just less positive moods. Compared to the Type D theory that describes social inhibition, introversion and social inhibition may be related constructs, but are almost certainly not the same. Traits such as shyness, social avoidance, and social anxiety are mainly driven by fear of social transactions, particularly those involving strangers or where negative evaluation is anticipated. Hence, the social inhibition-related motivations to limit or withdraw from social situations are quite different from those supposedly underpinning introversion (Marin & Miller, 2013). For example, the emotional experience of social anxiety may lead to a cognitive evaluation of social situations as being fear inducing, which fosters a behavioural manifestation of social avoidance. The rewarding effect of social avoidance (i.e. reduced experience of social anxiety) may lead to a preference for being alone – but the preference for being alone is arrived at via different mechanisms from those attributed to an introvert’s preference for solitude.

3.2.2.2 Biological Variables

The basis for the development of social inhibition is thought to be biopsychosocial in origin. Support for a biological contribution to the development of social inhibition can be found in neurological and immunological studies, as well as in temperament research. Starting with the latter, developmental research suggests that social inhibition is a temperamental disposition, observable in infants and children (Dyson, Klein, Olino, Dougherty, & Durbin, 2011; Fox et al., 2005). For example, Kagan and colleagues reported behavioural inhibition in infancy, and estimated that approximately 15% of children demonstrated inhibited characteristics.
The results of genetic and family studies have also shown social inhibition to be temperamental in nature. Social phobia, for example, has been found to aggregate in families, with children of affected parents having a four-fold risk of developing the disorder (Lieb et al., 2000). Similarly, socially inhibited and fearful children have a high probability of having parents, or a parent, at risk of multiple anxiety disorders, including social phobia (Rosenbaum et al., 1991). Although these and other studies found strong effects, there are some mixed findings. A family study that compared anxiety ratings of 361 adopted children with the anxiety ratings of their biological and adopted parents found no direct relationship between social inhibition in children and anxiety in either set of parents (Brooker et al., 2011).

The influence of the family environment must also be considered as a potential avenue for the development of social inhibition in children. In a study that examined 51 parent-child dyads, parenting style was found to be a means by which anxiety-related disorders may be transmitted from parent to child (Woodruff-Borden, Morrow, Bourland, & Cambron, 2002). Highly anxious parents were found to be less responsive to their children’s cues, which put their children at increased risk of becoming fearful, worrisome, and insecurely attached. The influence on genetic and social/familial factors are, of course, likely to operate synergistically. Unravelling the exact contributions of genetic and environmental factors in social inhibition may not be completely feasible, but given that many offspring of anxious parents do not demonstrate social inhibition, genetic factors do not fully explain intergenerational transmission of social inhibition.

Proposed neurobiological underpinnings of social inhibition include compromised executive function (Wagstaff et al., 2008) and patterns of reduced amygdala-cingulate cortex connectivity (Blackford et al., 2014). In a study of 60 undergraduate university students, social inhibition was found to be related to over-burdened executive and frontal systems (Wagstaff et al., 2008). In this study, social inhibition was induced by participants carrying out a
performance-based language task (i.e. participants were required to carry out the task in view of social others). In line with well-established performance facilitation and impairment theory (e.g. see Bond Jr, Atoum, & VanLeeuwen, 1996), the authors found that the social presence of other people placed high loads on frontal and executive systems, leaving little capacity for other tasks that require those same systems. The authors concluded that as verbal fluency and processing of social situations both rely on central and frontal systems, engaging in both cognitive tasks simultaneously overly taxes both systems thereby reducing their capacity to optimally function.

A number of other studies have also implicated the frontal region of the brain in behavioural inhibition (Davidson, 1992; Fox, 1992; Fox, Calkins, & Bell, 1994). Asymmetrical activation of left and right frontal regions, assessed using electroencephalogram, has been thought to relate to approach and avoidance behaviours respectively (Fox et al., 2005). Fox and colleagues (1994) found that a pattern of stable right frontal asymmetry in 80 children over their first two years of life, were more inhibited at 14 and 24 months than children with a stable left frontal pattern. Furthermore, infants who were described as consistently inhibited at four years of age had demonstrated increased right frontal asymmetry at nine and 14 months, compared to children who did not develop ongoing inhibition (Fox, Henderson, Rubin, Calkins, & Schmidt, 2001). Calkins, Fox and Marshall (1996) found that negative affectivity in response to novel stimuli was associated with right frontal asymmetry at nine months of age, and behavioural inhibition at 14 months of age, and that the combination of temperamental negative affectivity and right frontal EEG was the best predictor of socially inhibited behaviour in four year old children.

The amygdala and the cingulate cortex have also been implicated in the development of social inhibition. Blackford and colleagues (2014) employed functional magnetic resonance imaging (fMRI) to investigate possible individual differences between 40 healthy adults with
varying levels of social inhibition. The authors predicted that social inhibition would be associated with the strength of intrinsic connectivity in amygdala networks. The results showed that the neural pathways between the amygdala and a distributed network of cortical and subcortical regions were diminished in individuals with higher levels of social inhibition. A possible interpretation of the findings, as offered by the authors, was that the diminished pathways affected modulation of amygdala reactivity in response to social stimuli. In this instance, the neurobiological explanation for social inhibition is not necessarily a heightened fear response due to over-activity of the amygdala, but rather, the inability to moderate normal reactivity to a level appropriate to the situational context.

Behavioural inhibition has also been found to influence heart rate and cortisol production in children. Over a number of studies, Kagan and colleagues (1984; 1988) concluded that, compared to non-inhibited children, inhibited children exhibited overly elevated heart rates in response to situations or tasks that were unfamiliar. Other studies have found mixed results, ranging from no association between inhibition and heart rate response (Marshall & Stevenson-Hinde, 1998) to an association only when extremes of a sample are used (i.e. very high versus very low behavioural inhibition; Calkins & Fox, 1992). Increased levels of cortisol have also been attributed to the development of behavioural or social inhibition (Tops & Boksem, 2011). Cortisol is often cited as a stress hormone involved in punishment sensitivity (van Honk, Schutter, Hermans, & Putman, 2003). As socially inhibited persons are often fearful of unfavourable judgements by others, which could be perceived as a form of punishment, the perceived social threat may have the double effect of raising heart rate and elevating cortisol levels.

Socially inhibited children may be motivated to avoid situations where they may experience the arousal associated with elevated cortisol, a behaviour that may aid in the development and maintenance of poor coping techniques (Gunnar, 1994). In adulthood, cortisol
levels, HPA axis activation, and delayed-type hypersensitivity were measured in 36 adults that were diagnosed with either fibromyalgia, irritable bowel syndrome, or both. The participants who had higher levels of social inhibition developed heightened HPA axis activation and greater delayed-type hypersensitivity when under conditions of sustained psychological stress, (Cole, Kemeny, Weitzman, Schoen, & Anton, 1999).

Psychological stress has been identified as a pathway by which the HPA axis can be activated (Stansbury & Gunnar, 1994). If sustained psychological stress was the main, or only, driver of delayed-type hyperactivity, it would be expected that all participants in the Cole et al study would have demonstrated the same response, but only the socially inhibited participants demonstrated a disordered immune response. The results remained significant even when disease severity, and depressive and anxious symptoms were controlled (Cole et al., 1999).

3.2.2.3 Social Inhibition and Health

A number of health-related outcomes are associated with persistent social inhibition. In a review of factors thought to encourage the development of physical and mental health problems in children, social behavioural inhibition was found to be associated with a greater difficulty when interacting with peers, developing peer relationships, academic performance, and school adjustment in the short-term. In the long-term, the effects consisted of a range of internalising problems such as loneliness, social anxiety, low self-esteem, and depression (Rubin, Coplan, & Bowker, 2009). At the opposite end of the life course, a study of 123 elderly individuals showed that social inhibition significantly predicted depression, along with other factors such as age, intellect, and neuroticism (Wongpakaran, Wongpakaran, & van Reekum, 2012). The same authors also found that social inhibition in a different sample of 126 elderly individuals was correlated with increased somatisation, and significantly predicted somatisation when depression was not factored into a predictive model (Wongpakaran & Wongpakaran, 2014). Observations regarding the possible effects of socially inhibited behaviour on health status
suggest that hypertension (Sommers-Flanagan & Greenberg, 1989), rheumatoid arthritis (Solomon & Moos, 1964), and some cancers (Cole, Kemeny, Taylor, & Visscher, 1996) are more common among individuals who exhibit social inhibition.

A meta-analysis of 76 long-term prospective studies suggested interpersonal sensitivity (rather than social inhibition) perpetuates chronic illness morbidity and mortality (Marin & Miller, 2013). Interpersonal sensitivity was described as a stable tendency to experience concern about negative social judgement, and to carry out behaviours to avoid expected judgement (Marin & Miller, 2013). The core components of interpersonal sensitivity are presented in Table 3.1.

<table>
<thead>
<tr>
<th>Interpersonal Sensitivity Features</th>
<th>Feature Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejection sensitivity</td>
<td>The tendency to anxiously expect, readily perceive, and overreact to social rejection (Downey et al., 1994; Feldman &amp; Downey, 1994).</td>
</tr>
<tr>
<td>Social anxiety and avoidance</td>
<td>A condition characterised by extreme discomfort upon exposure to possible scrutiny of unfamiliar people. This can lead to avoidance of anxiety-provoking situations.</td>
</tr>
<tr>
<td>Social and psychological inhibition</td>
<td>A failure to publicly express any subjectively significant private experience, including, but not limited to, emotional, social, and behavioural impulses (Cole, Kemeny, Taylor, &amp; Visscher, 1996).</td>
</tr>
<tr>
<td>Behavioural inhibition</td>
<td>A quiet, vigilant, and affectively subdued response to unfamiliar situations, especially unfamiliar people. The behaviourally inhibited temperament is usually described in young children (G. A. Kaplan et al., 1994).</td>
</tr>
<tr>
<td>Shyness</td>
<td>An emotional-behavioural syndrome characterised by social anxiety and interpersonal inhibition and avoidance (M. R. Leary, 1986).</td>
</tr>
<tr>
<td>Submissiveness</td>
<td>The tendency to stay in the background and to let others lead and dominate.</td>
</tr>
<tr>
<td>Introversion–extraversion</td>
<td>One of the “Big Five” characteristics thought to represent the basic structure of personality. Reflects a person’s preferences for social situations (McCrae &amp; Costa, 1997).</td>
</tr>
<tr>
<td>Type D</td>
<td>The interaction of negative affectivity and social inhibition (Denollet, 1998, 2005).</td>
</tr>
</tbody>
</table>

*Source: Adapted from Marin and Miller (2013)*
3.2.2.4 Summary of Negative Affectivity and Social Inhibition

From the preceding reviews there appear to be particular commonalities between negative affectivity and social inhibition in the way that they influence health and wellbeing. From a biological perspective, there appear to be relationships between quite specific neurological processes and both negative affectivity and social inhibition. HPA axis disturbance and elevated cortisol levels are common to both, and related structures such as the amygdala and right frontal region have also been implicated in poor health outcomes in people with high negative affectivity or high social inhibition. Both elements are related to somatisation and exaggerated, or over reported, physical symptoms and complaints. Both are also associated with poor or maladaptive coping strategies under stress. Furthermore, both traits have been observed in infants or children, and found to predict later life health and/or personality outcomes.

From research to date, it is reasonable to conclude that the presence of either negative affectivity or social inhibition may increase an individual’s likelihood of poor health outcomes, however of particular interest is whether the presence of both traits has a cumulative effect on the associated processes, behaviours, and outcomes. On the basis of the prior research presented, it seems a plausible assumption that a superordinate effect may result from the interaction of negative affectivity and social inhibition. The following review of the mechanisms by which Type D personality is thought to impact on health status certainly points to a probable cumulative influence of some description.

3.3 Mechanisms of Type D

A growing body of research shows that Type D personality can predict morbidity and mortality in certain chronic illnesses, and is associated with a wide range of negative health outcomes (e.g. see Bunевичius et al., 2013; Dannemann et al., 2010; Denollet, Vaes, & Brutsaert, 2000; Habra, 2003; Michal, Wiltink, Grande, Beutel, & Brähler, 2011; Nefs, Pouwer,
Type D research has been primarily undertaken in cardiac-related chronic illness groups and, as a result, much of the understanding of the mechanisms by which Type D influences health is based on that particular patient group. Although the following discussion focuses on biological and psychosocial mechanisms of Type D separately, it is very unlikely that they operate independently of one another. An interaction of biology and the environment offers the most likely explanation of Type D’s mechanisms of effect.

3.3.1 Biological Pathways: Stress, HPA Axis, Immune Response and Cortisol Production

The increased sensitivity to stress and distress that characterises Type D is central to the biological pathways thought to mediate, at least in part, the relationship between Type D and health status. Type D personality is characterised by sensitivity to psychosocial stressors (Michal, Wiltink, Grande, Beutel, & Brähler, 2011), higher levels of perceived stress (Michal, Wiltink, Grande, Beutel, & Brahler, 2011; Polman, Borkoles, & Nicholls, 2010), as well as a chronic susceptibility to psychological distress (Pedersen & Schiffer, 2011). Additionally, individuals with Type D personality have been found to be highly susceptible to oxidative stress (Kupper, Gidron, Winter, & Denollet, 2009).

Stress, in general terms, is an adaptive experience, and serves to engage behavioural and biochemical effectors to increase an organism’s chance of survival (Tsigos & Chrousos, 2002). Under conditions of perceived or actual threat (physical or psychological), the activation of a stress response provokes enhanced and focused attention, increased cardiac output and respiration, and increased blood flow to the brain, heart, and skeletal muscles to provide them with the necessary oxygen and fuel for optimal functioning in response to the threat. The HPA axis and the efferent sympathetic/adrenomedullary system are the primary effectors of the stress response, and influence all body organs during an exposure to threat (Gold, Goodwin, & Chrousos, 1988).
In normal HPA axis functioning, the hypothalamus releases corticotropin-releasing hormone (CRH), which stimulates the pituitary gland to release adrenocorticotropic hormone (ACTH) into the bloodstream. ACTH, in turn, triggers the release of glucocorticoids, one of which is cortisol, from the adrenal cortex and/or the adrenal glands (Tsigos & Chrousos, 2002). Glucocorticoids also stimulate the fear centres in the amygdala (Tsigos & Chrousos, 1994). These and other hormones/neurotransmitters (i.e. epinephrine/norepinephrine) facilitate the physiological responses noted above. A negative feedback mechanism allows the hypothalamus to detect increased levels of cortisol in the bloodstream and, as such, begin to shut down the stress response thereby reducing the amount of time that glucocorticoids can exert associated antireproductive, catabolic, and immunosuppressant effects (Tsigos & Chrousos, 2002).

Under optimal conditions, CRH is secreted in a circadian fashion, roughly two to three secretions per hour (Engler et al., 1989), with the greatest frequency and size of secretions occurring in the early morning (Horrocks et al., 1990). Under stress, the number and size of CRH secretions increases, resulting in higher levels of ACTH and circulating cortisol. Additionally, lipids that mediate inflammation are secreted and act to prolong HPA axis activation (Holmes, Antoni, Aguilera, & Catt, 1986). There is abundant evidence to suggest that frequent or prolonged stimulation of this system leads to increased cortisol release, which, in turn, has been associated with increased risk for disease (Habra, 2003).

Over-activation of the HPA axis will often lead to suppression of immune activation (Adler, Kinsley, Hurwitz, Mossey, & Goldenberg, 1999), a function that perturbs pro-inflammatory cytokine networks and is a known predictor of mortality in chronic heart failure patients (Conraads et al., 2006). There is evidence that major depressive disorder is associated with the production of pro-inflammatory cytokines and overall increased inflammation (Maes et al., 1991), with the most reliable indicators identified as interleukin-6, tumour necrosis factor-α, and c-reactive protein (Dowlati et al., 2010; Zorrilla et al., 2001). Increased levels of
tumour necrosis factor-α (Conraads et al., 2006) and lower levels of endothelial progenitor cells (EPC; Van Craenenbroeck et al., 2009) have been found in Type D chronic heart failure patients, the latter being responsible for the repair of damaged endometrium in blood vessels. Decreased EPC levels can result from excess oxidative stress, poor dietary control of sugar, and cholesterol (Kupper et al., 2009; Williams et al., 2008).

Social inhibition can also play a key role in the neurological response to stress, potentially altering neurobiology in a similar way to cortisol activity (Bosch et al., 2009; Kret, Denollet, Grèzes, & de Gelder, 2011). A feature of socially inhibited behaviour is frequent scanning for social threats. Once a social threat is perceived, a multisystem stress reaction can ensue, encompassing cardiovascular, immune, metabolic, and neuroendocrine systems (Denollet et al., 2006). Type D cardiac prevalence research has indicated that an individual’s level of social inhibition predicts cardiac events; that is, individuals with high negative affectivity and high social inhibition are more likely to experience a cardiac event compared to individuals with high negative affectivity and low social inhibition (Sher, 2005). The ability to cope with the life changes that often accompany chronic illness (e.g. reduced earning capacity, decreased social contact opportunities, depressed mood) is, to a large extent, strengthened by perceived or actual social support (Bloom, 1982; Lepore, 1995).

Psychoneuroimmunological research has demonstrated how learning, stress, and emotion can each adversely affect immune system functioning. In animal studies initially (Ader, Cohen, & Felten, 1995), and in human studies more recently (Zachariae et al., 2007), immune system functioning could, to some extent at least, be classically conditioned. Studies of cancer patients receiving treatment involving cytotoxic agents that resulted in side-effects of vomiting, nausea, fatigue, and immunosuppression, found that some patients experienced the same side-effects in an anticipatory/conditioned response to seeing, smelling or tasting anything that they associated with the treatment (Zachariae et al., 2007).
Similarly, stress and emotion have also been implicated in decreased immune functioning (Zachariae, 2009). Haroon, Raison and Miller (2012) postulated that a primary source of inflammation in depressed patients was likely to be the result of psychosocial stress. As noted, the human stress response operates optimally under conditions of acute stress, producing a short-lived reaction. Under conditions of repeated or long-term stress, the protective benefits they are intended to deliver diminish and the resultant allostatic load can increase the incidence of chronic inflammation (Zachariae, 2009).

Research investigating the effects of stress on the immune system and inflammatory processes has found evidence of a possible link in the development of conditions or diseases such as infection, autoimmune diseases, allergies, and cardiovascular diseases (Pedersen, Bovbjerg, Zachariae, & Piscitelli, 2009). In a systematic review of 25 studies conducted by Cuijper and Smit (2002), negative emotions were found to contribute to mortality in depressed patients, while other studies with experimentally induced negative affect found associated immunosuppression (Zachariae et al., 1991; Zachariae, Jørgensen, Egekvist, & Bjerring, 2001). In a less direct pathway, negative affect is also associated with poor sleep quality (Prather, Bogdan, & Ahmad R. Hariri, 2013). Poor sleep quality is also associated with suboptimal immune functioning (Ganz, 2012).

Together, these findings point toward Type D representing a physiological propensity to experience heightened and protracted stress responses via multiple inputs, which in turn can result in a compromised immune response. From a strictly biological standpoint, negative affectivity and social inhibition each contribute to the exhaustion of stress-response systems in the brain and body, thereby increasing immunosuppression which, in turn, can leave an organism vulnerable to infection, disease and higher than normal bodily ‘wear and tear’. These processes however, do not occur without input from the individual’s perceptions, beliefs, attitudes, and behaviours.
The following section will consider the psychosocial mechanisms that influence, or interact with, the biological mechanisms outlined above to further explain the processes by which Type D may effect health and illness.

3.3.2 Psychosocial Pathways

Type D personality has been found to influence health via psychological and behavioural mechanisms such as poor health behaviours (Williams et al., 2008), greater perception and reporting of symptoms (Jellesma, 2008), lower perception of social support (Ginting, van de Ven, Becker, & Närking, 2014), and the use of maladaptive coping mechanisms in response to stress when compared to non-Type D individuals (Martin et al., 2011). Each possible mechanism appears able to work independently and interdependently with the others, and each represents a mechanism by which Type D personality can influence health outcomes. Each psychosocial factor is now presented, along with research findings that demonstrate the potential relationship each factor has with Type D.

3.3.2.1 Health Behaviours

One psychosocial mechanism that has been prominent in psychological literature is health-related behaviour. Poor quality and modifiable health-related behaviours, such as smoking and physical inactivity, have been found to be possible mediators of the relationship between Type D personality and poor health outcomes (e.g. see Gilmour & Williams, 2012).

Prior research has established that there are significant differences between Type D and non-Type D individuals with regards to the health-related behaviours they undertake. For example, in a sample of 1,012 healthy adults, participants who had a Type D personality profile were significantly less likely to eat sensibly, spend time outdoors, and get regular medical check-ups when compared to non-Type D participants (Williams et al., 2008). A cross-sectional study of 1,592 participants, found that compared to non-Type D individuals, Type D
individuals were more likely to lead an unhealthy lifestyle, such as engaging in less physical activity and making poorer diet choices (Mommersteeg, Kupper, & Denollet, 2010).

### 3.3.2.2 Illness Perceptions and Symptom Reporting

Type D personality is characterised by a generally negative outlook on life and a tendency to be dissatisfied with the self, the world, and others (Denollet, 2005). Type D research has shown that individuals with a Type D personality profile have lower perceptions of their quality of life, and higher negative mood and anxiety, than non-Type D individuals. These results have been found in both cardiac (e.g. Denollet et al., 2000; Pedersen & Denollet, 2003) and non-cardiac (e.g. Kim et al., 2014; Klaassen, Nykliček, Traa, & de Nijs, 2012; Mols & Denollet, 2010a) illness populations.

In a systematic review of 12 published studies that investigated Type D-related health implications in non-cardiovascular illness groups, Mols and Denollet (2010a) found correlations between Type D and increased perceptions of illness severity in most of the studies incorporated in the review. The review highlighted the tendency for Type D individuals to perceive their situation and condition as more serious, more debilitating, and more worrying than non-Type D patients with the same conditions. Type D individuals tended to report physical and psychological symptoms in greater numbers and of higher perceived severity than those reported by non-Type D individuals and demonstrated much higher levels of somatisation.

In a sample of 100 cardiac rehabilitation patients, Type D patients reported increased rumination, dwelling on feelings, and self-blame with regards to illness than non-Type D patients (Shanmugasegaram et al., 2014). The authors stated that Type D individuals appeared
to have a tendency to demonstrate very strong emotional responses to their illness (Shanmugasegaram et al., 2014).

Interestingly, although Type D individuals tend to perceive their condition to be more serious, more disabling and more prolonged than non-Type D patients with the same condition, there is evidence to suggest that Type D individuals are less likely to seek appropriate medical support or adhere to treatment plans designed to manage their conditions (Pelle, Schiffer, Smith, Widdershoven, & Denollet, 2010; Williams et al., 2008; Wu & Moser, 2014). In some regards, this mechanism is closely related to health behaviours, as failure to attend physician appointments or self-manage treatment plans are behaviours that will almost certainly lead to poor health outcomes.

The evidence that Type D individuals have different and more negative perceptions about their illnesses than non-Type D individuals suggests that there are cognitive mechanisms that may explain the relationships observed between Type D and poor health outcomes. Considering that Type D personality is characterised by psychological distress that is exacerbated in social situations, some authors have hypothesised that by avoiding social interactions, individuals with Type D reduce their experience of stress but simultaneously negatively reinforce their social inhibition (Grynberg, Gidron, Denollet, & Luminet, 2012).

One explanation for a cognitive mechanism for Type D is the theory that Type D individuals are more likely to cognitively appraise a social situation as more threatening or worrisome than it actually is, thereby reinforcing avoidant behaviours (Grynberg et al., 2012). In order to test this theory, Grynberg et al (2012) recruited a sample of 42 healthy adults and proposed theoretical social scenarios that varied along two dimensions: 1) neutral or negative, and 2) clear or ambiguous. They found that Type D individuals reported more anticipatory worry and concern for ambiguous or neutral social interactions than did non-Type D individuals. The researchers suggested the results indicated that Type D individuals
demonstrated an interpretation bias. The Type D individuals attended to social cues with less accuracy than non-Type D individuals, particularly in social situations that were perceived as ambiguous and negative. The results also showed that Type D personality interacted with clarity of the scenario. Compared to non-Type D individuals, Type D individuals reported much higher ratings of anticipatory distress in situations that were rated as ambiguous, which suggests that they may have relied on a cognitive interpretation bias to assume the worst.

The studies discussed above show that Type D individuals may interpret their illness and associated symptoms with a cognitive bias. It may be that the negative affectivity component of Type D leads people to see the world through a particularly negative lens, leading to greater catastrophising or perceptions of things being worse than they are. Of course it should be noted that although Type D people report more symptom severity and lower quality of life than non-Type D individuals, there is not yet evidence to indicate that these perceptions are false or exaggerated. For example, the increased allostatic load associated with increased psychological distress and stress reactivity (Pedersen, Bovbjerg, et al., 2009) may heighten physiological sensitivity to pain and introduce new functional impairments. To date however, Type D research indicates that Type D personality is associated with cognitive distortions that appear to lead to increased catastrophising, and a tendency to ruminate on negative aspects of health.

3.3.2.3 Illness Control and Maladaptive Coping

Controllability is the actual or perceived ability to determine an outcome or outcomes of an event (Fournier, de Ridder, & Bensing, 2002a). Studies investigating the achievement or failure aspect of controllability often do not investigate the construct in isolation, instead combining it with at least two other attributional domains – typically internal vs external, and stable vs variable (Corrigan et al., 2000). Studies of attribution and controllability sometimes use the constructs of responsibility and blame interchangeably with controllability which can have a muddying effect on the clarity of the construct in applied research (Mantler, Schellenberg, &
Page, 2003). In one example, the constructs of controllability, causality, answerability, and moral accountability were aggregated into an overarching construct of reliability (Schlenker, Britt, Pennington, Murphy, & Doherty, 1994).

Various behavioural and attitudinal models have contributed to the development and understanding of the construct of controllability, including (but not limited to) locus of control (Rotter, 1966), self-efficacy (Bandura, 1982), optimistic explanatory style (Peterson & Seligman, 1987), and personal control (Peterson & Stunkard, 1989). Despite the lack of a uniform definition of controllability in the health literature, it does appear that the health implications of perceived controllability are numerous. Early attribution and control models (e.g. Kelley & Michela, 1980; Kelley, 1967) were developed within a social psychological framework, however more recent adaptations have focused on how perceived controllability may influence health cognition, coping styles, and health behaviours.

Type D personality is characterised by poor coping practices in response to stress (Martin et al., 2011; Polman et al., 2010), however the exact mechanism that leads Type D individuals to adopt maladaptive coping techniques is unclear. Emotion-focused coping, a coping style typically adopted in situations where control is limited or non-existent, has been found to be a common strategy adopted by Type D individuals (Martin et al., 2011; Williams & Wingate, 2012). Negative affectivity has also been directly associated with emotion-focused coping (Gruszczyńska, 2013). It could be possible that maladaptive coping styles generally, and emotion-focused coping in particular, are, to some extent, a product of the cognitive bias and general negative lens through which Type D individuals tend to see the world.

In an attempt to integrate the various aspects of controllability, that is, the contributing aspects of various theories as well as the practical utility of the construct, Fournier et al (2002a; 2002b) developed the concept of controllability awareness, which demonstrated predictive power with respect to levels of stress tolerance in a cross-section of clinical and non-clinical
groups. Controllability awareness refers to an individual’s collective understanding of their capacity to influence a number of aspects within their current situation. For example, controllability in this context is divided into four aspects that may impact the outcomes of an illness. The four aspects include: 1) personal control – the ability of the individual to affect change, 2) others in control – the necessity to rely on others to affect change, 3) shared control – the combined cooperative inputs from the individual and others to affect change, and 4) no control – no one has control, outcomes will be determined by chance (Fournier et al., 2002b).

Controllability awareness is the capacity to recognise the actual level of control available within each of these aspects, and to respond to the situational demands (Fournier et al., 2002b). According to Heth et al (2003), the ability of an individual to recognise different types of control as distinct from each other (i.e. acceptance of no control vs willingness to work with others to achieve an outcome), increases the likelihood of an individual seeing the situation as a challenge rather than a disabling threat. This framework of illness control also resonates with Type D personality characteristics, particularly the tendency to avoid social contacts. The lack of help-seeking behaviours and the tendency to see neutral and ambiguous social situations as threatening may be central to a lack of perceived illness control (Denollet & de Potter, 1992; Grynberg et al., 2012; Pelle, Schiffer, et al., 2010).

The conceptualisation of high and low controllability awareness supports the coping research evidence cited above (e.g. Scharloo & Kaptein, 1997), however earlier research conducted by Felton and Revenson (1984) showed that controllability is independent of coping style. Felton and Revenson (1984) investigated the coping strategies of patients with a number of chronic illnesses that varied in controllability (rheumatoid arthritis, cancer, hypertension, and diabetes mellitus). Contrary to expectation, there was no difference in style of coping between the conditions considered to be high in controllability (hypertension and diabetes mellitus) and those considered to be low in controllability (cancer and rheumatoid arthritis).
People who engaged in active information seeking, and who therefore had more accurate perceptions of their illness, engaged in better coping and demonstrated less negative affect than patients who did not engage in active information seeking. The results were consistent across illness groups, indicating that controllability did not account for coping, and that coping and illness perceptions may be due to other influences, such as the resilience or personality style of the individual.

The tendency for Type D individuals to hold and express catastrophised and exaggerated beliefs about the seriousness of their illness and symptoms may be related, in some part, to a perceived lack of ability to change their health situation. For example, in a study of 750 cancer patients, those with a Type D personality profile demonstrated heightened self-monitoring and somatic awareness due to fears that their illness may worsen or return (if in remission) (Mols, Denollet, Kaptein, Reemst, & Thong, 2012). One possible explanation for the Type D-related behaviours and perceptions could be that a perceived or actual inability to control disease behaviour may have heightened the effects of negative affectivity in the Type D patient group.

Moderate to high levels of perceived illness controllability have been associated with greater adoption of problem-solving coping strategies, such as information seeking, whereas perceived low controllability has been associated with emotion-focused coping, such as avoidance or denial (Scharloo & Kaptein, 1997). In a study that investigated levels of satisfaction with medical information provision in over 4,000 cancer patients, Husson et al (2013) found that patients with a Type D personality profile perceived having received less information, and deemed the information they did get as less useful, than did patients without Type D personality. One explanation for the apparent distortion of perception demonstrated by Type D participants was the tendency of Type D individuals to adopt maladaptive or avoidant coping practices. The authors postulated that even if a large amount of information were provided, the disengagement associated with maladaptive and avoidant coping styles may
inhibit the patient’s ability to process the information in a meaningful way. The authors also speculated that the presence of social inhibition may influence the patient’s willingness, or ability, to establish and maintain an effective doctor-patient relationship, a factor that has been found to increase information uptake and understanding.

Controllability appears to play a considerable role in the development and maintenance of chronic illness (e.g. see Heth et al., 2003). Research examining the role of low perceived control and poor coping in chronic illness patients has found that the greater the amount of perceived controllability a patient has over the development and treatment of an illness, the greater their level of active engagement in treatment. Furthermore, the perception of illness controllability held by friends, family or even the general public may affect the level of blame attributed and/or helping behaviour offered to the patient (Fournier et al., 2002a).

Although Type D personality has not been studied explicitly within the context of illness control, many of the research findings to date show the possibility of some overlap or relationship with the concept of control. For example Type D individuals tend to report more symptoms than non-Type D individuals, a pattern seen also in chronically ill individuals with low levels of perceived illness control. Individuals with low perceived control report more symptoms than those with the same illness but who have high perceptions of control (Heth et al., 2003; Mantler et al., 2003). Chronically ill individuals who perceive their illness as controllable, that is, that it can be altered via behavioural (e.g. treatment adherence), social (e.g. helping behaviour from others), or psychological (e.g. effective coping) factors, also perceive their illness as having less severity, a shorter duration, and expect better outcomes (Heth et al., 2003).

The cognitive and behavioural characteristics of Type D personality certainly seem to resonate with the notion of low illness controllability, indicating that personality constructs such as negative affectivity, social inhibition, or even pessimism and optimism may play a
considerable role in the development and course of chronic illness, in conjunction with constructs such as control and coping (Peterson & Seligman, 1987).

3.3.2.4 Social Support

Broadly, social support is typically conceptualised in one of two main ways – from the perspective of the provider or the perspective of the recipient. Various frameworks emphasise different aspects of social support, such as emotional support, cognitive support, and instrumental support, and most acknowledge the need for interactional involvement from the provider and recipient (a detailed comparison of the major frameworks can be found in King, Willoughby, Specht, & Brown, 2006). The provision of social support, or even general helping behaviour, may be contingent on the help providers’ perceptions and/or understanding of the illness of their intended support recipient.

The concept of social support has been closely associated with Type D personality, and appears to play a particular role in Type D-related behaviours. Type D individuals typically report less perceived social support from friends and family, more social alienation, and they often inhibit emotional expression in social interactions in order to avoid social disapproval (Denollet, 2005; Sararoudi, Sanei, & Baghbanian, 2011). The social inhibition element of Type D personality tends to elicit the perception that social resources are unavailable to an individual, perhaps even when they are available.

A lack of social support has been associated with increased psychological distress and increased risk of mortality in clinical groups (Khayyam-Nekouei, Neshatdoost, Yousefy, Sadeghi, & Manshaee, 2013; Sararoudi et al., 2011; Williams et al., 2008). The lack of perceived social support that is often reported by Type D individuals has been suggested to contribute to negative health behaviours such as reluctance, or failure, to seek advice or assistance with health-related concerns (Williams & Wingate, 2012).
A study of the effects of social support, negative life events, and mental health collected data from 1,010 health adults. At a 10 year follow-up interview, 510 of the original 1,010 adult participants were able to be located and agreed to be re-interviewed with the same interview schedule (Dalgard, Bjørk, & Tambs, 1995). After a test re-test period of 10 years, the results showed that social support had a buffering effect on mental health status, particularly in the context of negative life events. The buffering effect only applied to individuals who had an external locus of control, which suggests that individuals who perceived little personal control over their lives relied on support from others in order to manage negative life events and maintain optimal mental health. If individuals with Type D personality possess low perceptions of control, the buffering effect of social support would not occur (Dalgard et al., 1995). Subsequent coping with stress and illness by Type D individuals may promote or perpetuate unhealthy behaviours and emotion-focused coping.

Social support has also been associated with higher self-esteem in chronic illness patients, which, in turn, was found to increase optimism and decrease depression (Symista, 2003). Health behaviours, such as healthy eating (Gunderson, 1995), reducing smoking, and gaining sufficient exercise (Kulik & Mahler, 1993) have been found to be positively influenced by the perceived or actual presence of social support. Increased social support was also found to be strongly related to medication adherence in hypertension patients (Stanton, 1987).

3.4 Measurement of Type D Personality

The assessment of Type D personality relies on measuring its constituent traits, negative affectivity and social inhibition. The first instrument designed to measure both traits was a 16 item scale that was referred to as the DS16 (Denollet, 1998). Additionally, an extended version of the DS16, the DS24, included three facet scales (each consisting of four items). Presently, the standard measurement of Type D personality is the DS14, a revision of the DS16. The development of each version of the Type D scale is reviewed.
3.4.1 The DS16/DS24 Scale

The DS16 was developed primarily as a means of directly measuring the traits of negative affectivity and social inhibition. Denollet developed a pool of 66 items, some of which were purpose-developed and some that were derived from an item-level factor analysis of the Minnesota Multiphasic Personality Inventory. The scale items were tested with two discreet samples of CHD patients (Denollet, 1998). The first sample consisted of 400 men who had a mean age of 57.3 years. The second sample consisted of 90 men and 10 women who had a mean age of 55.9 years. The participants completed the prospective pool of 66 Type D items, as well as the State-Trait Anxiety Scale (van der Ploeg et al., 1980) and the Social Inhibition Scale (Erdman et al., 1986). The questionnaires were completed at three to six weeks post the coronary event.

All participants were initially categorised as either having a Type D personality or not having a Type D personality by applying a median split on the scores of the trait scale of the State-Trait Anxiety Scale (van der Ploeg et al., 1980) and the Social Inhibition Scale (Erdman et al., 1986). The participants rated the extent to which they agreed with each Type D item on a 5-point Likert scale that ranged from 0=false to 4=true. The item criterion was the capacity to discriminate between the individuals who had been assessed as having a Type D personality and individuals who had been assessed as not having a Type D personality. Cross-tabulation and a principle component analysis were used to establish the validity of the items. The results yielded 16 items, each of which was then assessed for construct validity via Pearson’s correlation and a principle component analysis of scale scores. The 16 items arrived at by Denollet are presented in Table 3.2.

A variation of the DS16 scale is the DS24. The DS24 includes all 16 items of the DS16, but adds a further 12 facet items. The facets represent ‘closeness’, ‘withdrawal’, and ‘non-expression’ (Denollet, 1998). In addition to the DS16 items, a further 12 items represent Type
D facet information in the DS24. Six items represent the negative affectivity domains of *insecurity related to the self, dysphoria, and tension*. A further six items represent the social inhibition domains of *insecurity related to others, reticence, and withdrawal*.

**Table 3.2**

*DS16 scale items with associated subscale information*

<table>
<thead>
<tr>
<th>Item</th>
<th>Negative Affectivity</th>
<th>Social Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 I am happy most of the time</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>2 I take a gloomy view of things</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>3 I often talk to strangers</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>4 I have little impact on other people</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>5 I find it hard to express my opinions to others</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>6 The future seems hopeful to me</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>7 I often find myself taking charge in group situations</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>8 I find it hard to make &quot;small talk&quot;.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>9 I am often in a bad mood</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>10 I often feel unhappy</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>11 I make contact easily when I meet people</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>12 I often find myself worrying about something</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>13 I like to be in charge of things</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>14 When socialising, I don't find the right things to talk about</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>15 I feel at ease most of the time</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>16 I am often down in the dumps</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Denollet (2008)*

Denollet and De Fruyt (2002) investigated the convergent and discriminant validity of the DS16 and DS24 scales by calculating the amount of shared variance between the Type D scales and three other well-validated personality and health scales; the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992a), the Job Stress Survey (JSS; Spielberger & Vagg, 1999), and the General Health Questionnaire (GHQ28; Goldberg, 1978). The participants in the study included 95 policemen and 60 nurses, of which 85 were female and 66 were male (four
participants did not specify a gender). The participants completed the questionnaires in their own time and at a location of their choosing.

The results showed that about half of the variance of both the DS16 and the DS24 was predicted by the Five-Factor Model dimensions, primarily neuroticism and extraversion. The authors noted that there were differences between the DS16 and the DS24. The DS16 scales were additionally predicted by the NEO-FFI factors of agreeableness and openness to experience, leading the authors to conclude that the DS16 reflected a more heterogeneous representation of the NEO-FFI traits than did the DS24.

The comparison of Type D versus non-Type D prediction for the remaining two personality scales (i.e. Job Stress Inventory, General Health Questionnaire) study showed that there was no difference between Type D and non-Type D personalities on the measure of job stress, however Type D individuals reported significantly more somatic complaints, sleeping problems and anxiety than non-Type D individuals (De Fruyt & Denollet, 2002). The authors concluded that the DS16 and DS24 scales were effective and valid measures of Type D personality. Despite this, a further revision of the DS16 was undertaken in order to develop a scale that consisted of the least amount of items required to effectively assess Type D personality.

3.4.2 The DS14 Scale

In order to create a Type D scale that required the least amount of burden for practitioners and patients to complete, Denollet (2005) selected seven items for each of the Type D domains based on their psychometric properties as well as their conceptual fit (see Appendix A). Using a sample of 3,678 participants from the (Belgian) general public and patients from cardiac health care facilities, the validity of the DS14 was assessed against the NEO-FFI, the Global Mood Scale (GMS; Denollet, 1993b), and the Health Complaints Scale (HCS; Denollet, 1994).
A factor analysis was used to assess the internal-structural validity of the DS14. The construct validity of the DS14 was assessed via Pearson’s correlations and a factor analysis of scale sores. Test-retest correlations were also calculated over a three month period to assess the stability of the measure.

The results showed that all of the 14 items (seven for negative affectivity and seven for social inhibition) loaded onto their corresponding NEO-FFI factor. Cronbach’s alpha scores (0.88 and 0.86) and Pearson’s correlations (0.52-0.75) reflected a high level of internal consistency for the scale. The construct validity of the scale was established via further correlational analyses that revealed that 35% to 46% shared variance with the NEO-FFI scales. The degree of shared variance indicated that negative affectivity and social inhibition were related to neuroticism and extraversion, but not so much that they could be considered the same. Finally, the temporal stability of the DS14 was confirmed via a factor analysis. From the sample of cardiac patients, 121 participants completed the NEO-FFI, Global Mood Scale, and Health Complaints Scale again, three months after the initial assessment. The results showed that the DS14 scores were stable over the three month time period, more so than the mood scales and health scale items.

3.4.3 Construct and Concurrent Validity of the DS14 Measure of Type D Personality

A number of studies have investigated the reliability and validity of the Type D construct and the Type D personality measurement instrument, the DS14. The earliest publications reporting the construct’s reliability and validity were, not surprisingly, published by the Denollet group (De Fruyt & Denollet, 2002; Denollet, 2005; Denollet et al., 2000). From 20 Type D validation studies, 15 were independent from creators of the construct and supported the contention that Type D is a reliable risk factor for illness morbidity and mortality in healthy and clinical populations. Eleven papers reported on the internal consistency of the DS14 measure, with negative affectivity subscale scores ranging from .79-.90, and social inhibition
subscale scores ranging from .73-.91 (Alçelik et al., 2012; Barnett, Ledoux, Garcini, & Baker, 2009; Bergvik, Sørlie, Wynn, & Sexton, 2010; Bunevicius et al., 2013; Christodoulou et al., 2013; Condén et al., 2014; Đurka & Ruch, 2014; Howard & Hughes, 2012; Kaur, Zainal, Low, Ramasamy, & Sidhu, 2014; Lee et al., 2012; Ogińska-Bulik & Juczyński, 2009; Sajadinejad, Molavi, Asgari, Kalantari, & Adibi, 2012; Spindler, Kruse, Zwisler, & Pedersen, 2009; Straat, van der Ark, & Sijtsma, 2012; Svansdottir et al., 2012; Vilchinsky et al., 2012; Weng et al., 2013).

Two examples of Type D validation research are publications by Barnett, Ledoux, Garcini, and Baker (2009) and Spindler, Kruse, Zwisler, and Pedersen (2009). Barnett et al. (2009) investigated the construct and concurrent validity of the DS14 by comparing the negative affectivity and social inhibition subscales with similar subscales of the MMPI-2 (depression, psychasthenia and social introversion). The results indicated strong internal consistency among the sample of chronic pain patients, and the combined scales obtained a Cronbach’s $\alpha$ of .91. Negative affectivity and social inhibition obtained .91 and .87 respectively. Barnett et al. (2009) also found that the MMPI-2 subscales of depression and psychasthenia were related to 48% of the variance in the negative affectivity subscale, and that social introversion was related to 44% of the variance in the social inhibition subscale.

In the same year, Spindler et al (2009) investigated the validity of the DS14 instrument in a sample of Danish cardiac patients. Using the Eysenck Personality Questionnaire and the Hospital Anxiety and Depression Scale, Spindler et al (2009) noted that Cronbach’s $\alpha$ may be problematic in establishing internal validity of the DS14 due to the heavy reliance on item numbers. As the DS14 has only 14 items, these authors reported both Cronbach’s $\alpha$ and mean inter-item correlation (MIIC). The results indicated strong internal consistency with the Cronbach’s $\alpha$ for the negative affect and social inhibition subscales with .87 and .91 respectively, however the corresponding MIIC scores of .49 and .59 were substantially lower.
The Hospital Anxiety and Depression Scale (HADS) has been used in a number of studies, each reporting moderate to strong correlations between the DS14 subscales and the HADS (Alçelik et al., 2012; Christodoulou et al., 2013; Howard & Hughes, 2012; Kaur et al., 2014; Spindler et al., 2009).

Together these results added weight to the concept of Type D as a reliably assessed constellation of personality traits, and the DS14 as a robust measurement instrument designed to detect them. Of particular interest to the present discussion are the studies that have compared Type D personality subscales with the Big 5 factors of neuroticism and extraversion. Now that Type D research had established empirical support for the theoretical basis of the construct, the next stage of research was to: identify the mechanisms by which it influenced health, and develop a standardised metric for assessing Type D personality in clinical populations.

Since its development, the DS14 has been employed in a growing number of studies ranging from Type D personality in specific illness groups, to population prevalence studies. The following chapter will review the use of the DS14 in health research and highlight particular gaps in the Type D literature that the present thesis will aim to address.
CHAPTER 4 - TYPE D PERSONALITY IN HEALTHY AND CHRONIC ILLNESS POPULATIONS

The previous chapter outlined the Type D construct and its possible mechanisms of effect regarding health and well-being. In this chapter, the applications of Type D personality in health research are considered. First, past research that has contrasted the Type D constituent traits of negative affectivity and social inhibition with the Big 5 factors is described. Second, a review of Type D population prevalence research is presented. Finally, Type D research in clinical populations is considered, with a specific emphasis on functional somatic syndromes.

4.1 Type D Personality and the Big 5 Factors

In order to better understand the nature of the Type D construct, a number of published studies have aimed to validate the Type D construct by investigating the correlation between the Type D subscales (i.e., negative affectivity and social inhibition) and the Big 5 factors of personality, neuroticism, extraversion, agreeableness, openness, and conscientiousness (e.g. see De Fruyt & Denollet, 2002; Grande, Romppel, Glaesmer, Petrowski, & Herrmann-Lingen, 2010; Svansdottir et al., 2012). Collectively, the studies have shown that there are strong associations between the Big 5 factors (particularly neuroticism and extraversion) and the Type D subscales, however, the relationship is not so strong as to indicate that Type D can be fully explained by the Big 5 factors.

The relative newness of any personality construct can, to a large extent, limit its utility in research. The standard approach to validation and reliability assessment of a new construct is typically a series of contrasts with well-established personality frameworks. Personality research has frequently relied on the versions of the NEO Personality Inventory (Costa & McCrae, 2008) to map traits onto common chronic disorders such as depression (Wardenaar, Conradi, Bos, & de Jonge, 2014), and cardiovascular disease (Namdar, Taban Sadeghi, Sabourimoghaddam, Sadeghi, & Ezzati, 2014). The Big 5 factors can be measured via the 60
item NEO Five Factor Inventory (NEO-FFI) or the full-scale 240 item full scale NEO Personality Inventory Revised (NEO-PI-R). A review of the Type D literature was undertaken to identify Type D validation papers where either the NEO-FFI or the NEO-PI-R was the primary validation instrument.

4.1.1 Search Strategy

Papers were sourced from four relevant computer databases: MEDLINE Complete, Global Health, PsycINFO and PsycARTICLES; all databases were accessed through EBSCO Host. Only published peer-reviewed papers in English that included measures of Type D personality and key search terms (below) were included. No restrictions were placed on publication dates. Searches included combinations of the following groups of key terms: 1) Type D, type-d, 2) NEO*, 3) Big 5, Big-5, 4) valid*. This search strategy aimed to maximise the potential of sourcing all relevant published papers. Searches were last conducted in January 2016.

4.1.2 Inclusion and Exclusion Criteria

Papers were included in the search if they specifically examined Type D personality and its relationship to the Big 5 factors, and were written in English. Papers were excluded from the search if they: 1) did not include a Big 5 scale (e.g. NEO-PI, NEO-PR-R, NEO-FFI), 2) did not utilise a sample that could be considered to be reasonably representative of the general population (e.g. a single-sex sample), 3) did not include the standard dichotomous measure of Type D personality, or 4) did not use an adult sample.

4.1.3 Review Procedures/Data Abstraction

Prior to applying the exclusion criteria, 55 papers were identified. Twenty papers remained following the initial screening stage, which were all then read and further assessed against the inclusion and exclusion criteria. This process resulted in the removal of a further 14 papers, leaving six to be included in this review. Data from the studies were collated in
order to facilitate the comparison of the study findings with regards to the validity of Type D when compared with the Big 5 factors. All six studies were cross-sectional in design and all had used the NEO-FFI. The six studies are listed and the findings are presented in Table 4.1.

Table 4.1
Published correlations between DS14 subscales and NEO Big 5 factors

<table>
<thead>
<tr>
<th>Study</th>
<th>Type D Subscale</th>
<th>N</th>
<th>E</th>
<th>O</th>
<th>A</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denollet 2005 (2005)</td>
<td>NA</td>
<td>.68</td>
<td>-.42</td>
<td>-.03</td>
<td>-.30</td>
<td>-.36</td>
</tr>
<tr>
<td></td>
<td>SI</td>
<td>.31</td>
<td>-.65</td>
<td>.03</td>
<td>-.27</td>
<td>-.42</td>
</tr>
<tr>
<td>Grande, Glaesmer &amp; Roth 2010 (2010)</td>
<td>NA</td>
<td>.58</td>
<td>-.32</td>
<td>.07</td>
<td>-.23</td>
<td>-.28</td>
</tr>
<tr>
<td></td>
<td>SI</td>
<td>.20</td>
<td>-.53</td>
<td>-.18</td>
<td>-.22</td>
<td>.02</td>
</tr>
<tr>
<td>Svansdottir et al. 2012 (2012)</td>
<td>NA</td>
<td>.80</td>
<td>-.48</td>
<td>-.02</td>
<td>-.33</td>
<td>-.20</td>
</tr>
<tr>
<td></td>
<td>SI</td>
<td>.47</td>
<td>-.64</td>
<td>-.07</td>
<td>-.21</td>
<td>-.25</td>
</tr>
<tr>
<td>Svansdottir et al. 2013 (2013)</td>
<td>NA</td>
<td>.82</td>
<td>-.48</td>
<td>-.04</td>
<td>-.35</td>
<td>-.19</td>
</tr>
<tr>
<td></td>
<td>SI</td>
<td>.45</td>
<td>-.67</td>
<td>-.11</td>
<td>-.27</td>
<td>-.27</td>
</tr>
<tr>
<td>Sajadinejad et al. 2012 (2012)</td>
<td>NA</td>
<td>.78</td>
<td>-.52</td>
<td>-.05</td>
<td>-.51</td>
<td>-.19</td>
</tr>
<tr>
<td></td>
<td>SI</td>
<td>.47</td>
<td>-.57</td>
<td>-.16</td>
<td>-.30</td>
<td>-.34</td>
</tr>
<tr>
<td>Durka &amp; Ruch 2014 (2014)</td>
<td>NA</td>
<td>.80</td>
<td>-.49</td>
<td>.02</td>
<td>-.37</td>
<td>-.29</td>
</tr>
<tr>
<td></td>
<td>SI</td>
<td>.46</td>
<td>-.69</td>
<td>-.01</td>
<td>-.26</td>
<td>-.25</td>
</tr>
<tr>
<td>Average correlation</td>
<td>NA</td>
<td>.74</td>
<td>-.45</td>
<td>-.01</td>
<td>-.35</td>
<td>-.25</td>
</tr>
<tr>
<td></td>
<td>SI</td>
<td>.39</td>
<td>-.63</td>
<td>-.08</td>
<td>-.26</td>
<td>-.25</td>
</tr>
</tbody>
</table>

*Note: N = neuroticism, E = extraversion, O = openness, A = agreeableness, C = conscientiousness, NA = negative affect, SI = social inhibition.*

4.1.4 Summary of Type D and NEO-FFI Validation Studies

The collective results showed strong correlations between negative affectivity and
neuroticism (mean $r = .74$) and between social inhibition and extraversion (mean $r = -.63$). More moderate correlations can also be seen for extraversion with negative affectivity, neuroticism with social inhibition, and agreeableness and conscientiousness with both. The correlations indicate that Type D subscales have substantial overlap with the Big 5 factors, but also that meaningful unique variance remains.

What is most notable from the summary of Type D and Big 5 factor studies is the absence of any study where the full scale NEO-PI-R was employed. By virtue of the fact that facet-level information requires data to be collected via the NEO-PI-R, there is no investigation of how Type D might be explained by the facets that underpin the Big 5 factors. Given that the facets have been argued to provide a more nuanced explanation of personality (Otero-López & Villardefrancos Pol, 2013), their use in research that aims to understand the mechanisms of Type D seems logical. Chapter 5 will aim to address these gaps in the Type D literature by collecting NEO-PI-R data from members of the general public and conducting a facet-level investigation of specific characteristics of Type D personality.

**4.2 Type D personality in the General Population**

The Type D literature has demonstrated that it is possible to estimate the prevalence of Type D personality in a population (e.g. see Howard & Hughes, 2012). Theoretically, Type D personality should exist to some extent in healthy populations, as the traits that make up Type D are assumed to be both common and normally distributed (Denollet, 2005). The major benefit to estimating a population prevalence of Type D personality, or any potential health-related risk factor, is the ability to determine the likelihood of current and/or future biopsychosocial risk to individuals and communities, and the associated economic risk to governments or corporations that provide, or subsidise, healthcare services (e.g. see Mokdad et al., 2003).
In 2010, Mols and Denollet published a systematic review of Type D personality in the general population. The aim of the publication was to: 1) to review all available Type D literature where members of the general population had been included in the study sample, and 2) discuss the implications of the findings for health research, work-related issues, and possible disease-promoting mechanisms in non-clinical populations. The review included 19 published studies, after removal of duplicates and exclusions. The inclusion criteria required that each publication: 1) included a description of Type D personality in the general population, 2) was an original article, 3) was published in a peer-reviewed journal, and 4) was written in English. Studies were excluded on the basis of: 1) including a clinical sample, and 2) results that reflected only negative affectivity or social inhibition instead of overall Type D personality (Mols & Denollet, 2010b). The samples of the final 19 articles included children, tertiary students and adults, with an age range (means) of 10.7 years to 54.2 years.

The review compared studies by design, participant characteristics, prevalence of Type D in the sample, and overall findings. The conclusions drawn from the review indicated Type D personality, in the general population, was associated with an increased experience of distress, anxiety, depression, and mental health problems. Furthermore, Type D individuals in the general population were found to have a poorer physical health status, and greater reporting of somatic complaints. Type D was found to be associated with health-related difficulties in the workplace, and a number of possible biological disease-promoting mechanisms associated with Type D were considered.

Although the review was able to draw some interesting conclusions regarding the associations between Type D personality and various aspects of physical and mental health, many of the studies in the review included very specific and restricted samples (e.g. right-handed men, de Gelder, van de Riet, Grezes, & Denollet, 2008), or utilised a sample size that would be considered too small from which to draw a population estimate, based on the sample
size estimation calculation provided by Daniel (2009; see 6.3). Two studies included only males (Borkoles, Polman, & Levy, 2010) or females (Thomas, de Jong, Kooijman, & Cremers, 2006), and others used samples of participants engaged in a specific occupation (e.g. psychiatrists and nurses; Oginska-Bulik, 2006). As such, this chapter will revisit the systematic review process for Type D personality in the general population, but a more stringent set of inclusion and exclusion criteria will be applied. As the Mols and Denollet review was published in 2010, the review undertaken in this chapter will provide a current assessment of Type D in the general population by incorporating prevalence research that has been published in the six years hence.

4.2.1 Search Strategy

Papers were sourced from four relevant computer databases: MEDLINE Complete, Global Health, PsycINFO and PsycARTICLES; all databases were accessed through EBSCO Host. Only published peer-reviewed papers in English that included measures of Type D personality and key search terms (below) were included. Searches included combinations of the following groups of key terms: 1) Type D, type-d, 2) personality, 3) prevalence, 4) population, and 5) health*. This search strategy aimed to maximise the potential of sourcing all relevant published papers. Searches were last conducted in January 2016.

4.2.2 Inclusion and Exclusion Criteria

Papers were included in the search if they specifically examined Type D personality and its estimated prevalence in a national population, and were written in English. Papers were excluded from the search if they: 1) utilised a clinical sample, 2) did not utilise a sample that could be considered representative of the general population (e.g. a single-sex sample), 3) did not include the standard dichotomous measure of Type D personality, 4) did not use an adult sample, 5) or did not use a sample size appropriate for a population prevalence estimate (see section 6.3).
4.2.3 Review Procedures/Data Abstraction

Prior to applying the exclusion criteria, 1,221 papers were identified. Forty-five papers remained following the initial screening stage, which were all then read and further assessed against the inclusion and exclusion criteria. This process resulted in the removal of a further 36 papers, leaving 16 Type D prevalence studies. Of the final 16, only nine met all of the inclusion and exclusion criteria required to be included in this review. Data from the studies were collated in order to facilitate the comparison of the study samples, measures, and findings with regards to estimated Type D prevalence (See Table 4.2). All nine studies were cross-sectional in design, hence this information is not presented in Table 4.2. The seven studies that specifically reported Type D prevalence rates, but were not included in the review, are listed in Table 4.3 along with the criteria on which they were excluded.

4.2.4 Summary of Type D Population Prevalence Studies

Amongst healthy populations, estimated rates of Type D personality have varied from 16% in Taiwan (Weng et al., 2013) to 38.5% in a UK and Irish sample (Williams et al., 2008). The reasons for the large range of percentage scores is unclear. Each of the studies in Table 4.2 assessed Type D by using either the DS16 or DS14, and scoring the scales as the standard dichotomous representation. Cultural factors that are thought to influence the reporting of symptoms or emotions may provide some explanation for the differences. Williams et al (2008) suggested that the quite high rate of Type D found in their sample of healthy individuals from the UK and Ireland may be due to a cultural tendency to express less emotion in public, compared to other populations, and, hence, increased social inhibition scores. Similarly, Vilchinsky et al. (2012) speculated that the very low rate of Type D in the Israeli population may be due to a cultural tendency to be very uninhibited in social situations, and more likely to show emotions than those from other cultural backgrounds.
Type D population prevalence studies demonstrate two important points, that: 1) Type D personality is not merely an artefact of chronic illness, it is present in a high proportion of healthy individuals, and 2) the geographical and cultural disparateness of the populations in which Type D has been found speaks to the possibility that, consistent with dispositional theory generally, Type D personality is a fundamentally biological construct in nature. Although social and cultural influence cannot be discounted, at the very least the studies suggest that Type D in unlikely to be wholly a product of sociocultural conditioning.

The presence of Type D in healthy populations also suggests that it is not solely a product of the illness process. That is, Type D does not seem to only emerge as a function of having a chronic illness. The associations between Type D and poor health behaviours in healthy individuals may also help to explain, in part, the relationship between Type D and poor health outcomes. Many studies have noted that healthy individuals with a Type D personality profile have a greater tendency to engage in deleterious health behaviours such as smoking, excessive alcohol consumption, and poor diet and exercise practices compared to non-Type D healthy individuals (Gilmour & Williams, 2012; Habra, 2003; Mommersteeg et al., 2010; Williams et al., 2008). Type D could be a chronic illness pre-cursor, given its association with well-known illness-inducing and perpetuating behaviours.
Table 4.2
Summary of Type D personality prevalence studies and their findings

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>n</th>
<th>Age</th>
<th>Measures</th>
<th>Estimated Prevalence %</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UK/Ireland</td>
<td>1012</td>
<td>M= 20.5, R=17-61</td>
<td>DS14, Eysenck Personality Questionnaire (EPQ, short version) neuroticism subscale, General Preventative Health Behaviours Checklist, Quality of Social Network and Social Support Scale</td>
<td>38.5</td>
<td>Williams et al. (2008)</td>
</tr>
<tr>
<td>2</td>
<td>Poland</td>
<td>1154</td>
<td>M=30.5, R=20-70</td>
<td>DS14, NEO-Five Factor Inventory (NEO-FFI) neuroticism and extraversion subscales, Positive and Negative Affect Scale (PANAS), Perceived Stress Scale (PSS-10), Temperament Questionnaire (FCZ-KT)</td>
<td>34.8</td>
<td>Ogińska-Bulik &amp; Juczyński (2009)</td>
</tr>
<tr>
<td>3</td>
<td>Germany</td>
<td>2698</td>
<td>M=52, R=35-74</td>
<td>DS14, Hospital Anxiety and Depression Scale (HADS), DEpression and EXhaustion subscales of the von Zerßsen symptom checklist, Jenkins Activity Scale, Patient Health Questionnaire (PHQ-9)</td>
<td>23.4</td>
<td>Hausteiner, Klupsch, Emeny, Jens, &amp; Ladwig (2010)</td>
</tr>
<tr>
<td>4</td>
<td>Germany</td>
<td>2495</td>
<td>M=48.8, R=14-92</td>
<td>DS14</td>
<td>31.0</td>
<td>Grande, Rompple, Glaesmer, Petrowski, &amp; Herrmann-Lingen (2010)</td>
</tr>
<tr>
<td>5</td>
<td>Israel</td>
<td>1350</td>
<td>M=52.4, R=18-90</td>
<td>DS14, Temperament and Character Inventory (TCI-140), Toronto Alexithymia Scale-20 (TAS-20), Positive and Negative Affect Scale (PANAS), Fagestrom Nicotine Tolerance Questionnaire</td>
<td>24.1</td>
<td>Zohar, Denollet, Ari, &amp; Cloniger (2011)</td>
</tr>
<tr>
<td>6</td>
<td>Germany</td>
<td>4928</td>
<td>M= not stated, R=35-74</td>
<td>DS14, Patient Health Questionnaire (PHQ-9), General Anxiety Disorder Scale GAD-7), Mini-Spin, Cambridge</td>
<td>22.2</td>
<td>Beutel et al (2012)</td>
</tr>
<tr>
<td></td>
<td>Country</td>
<td>Sample Size</td>
<td>Mean Age (M), Range (R)</td>
<td>Measures</td>
<td>Mean Score</td>
<td>Reference</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>7</td>
<td>Korea</td>
<td>954</td>
<td>M=43.3, R=not stated</td>
<td>DS14, Eysenck Personality Questionnaire (EPQ, short version) neuroticism and extraversion, subscales, State subscale of Spielberger State and Trait Anxiety Inventory (STAI-S), Centre for Epidemiologic Studies Short Depression Scale (CESD), General Health Questionnaire/ Quality of Life-12 (GHQ)</td>
<td>27.8</td>
<td>Lim et al. (2011)</td>
</tr>
<tr>
<td>8</td>
<td>Iceland</td>
<td>4753</td>
<td>M=49.1, R=20-73</td>
<td>DS14, Icelandic Heart Association Risk Calculator</td>
<td>22.0</td>
<td>Svansdottir et al (2013)</td>
</tr>
<tr>
<td>9</td>
<td>Taiwan</td>
<td>421</td>
<td>M=52.4, R=18-90</td>
<td>DS-14, Trait Anxiety subscale of State-Trait Anxiety Inventory (STAI-TA), Beck Depression Inventory (BDI-II), Chinese Hostility Inventory Short Form (CHI-SF)</td>
<td>16.0</td>
<td>Weng et al (2013)</td>
</tr>
</tbody>
</table>
Table 4.3
Summary of excluded Type D prevalence studies, exclusion criteria, and evidence

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Exclusion Criteria</th>
<th>Evidence</th>
<th>Estimated Prevalence %</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Ukraine</td>
<td>2 &amp; 5</td>
<td>University students only, n=250</td>
<td>22.4</td>
<td>Pedersen et al (2009)</td>
</tr>
<tr>
<td>11</td>
<td>Ireland</td>
<td>2 &amp; 5</td>
<td>University students only, n=134</td>
<td>29.9</td>
<td>Howard &amp; Huges (2012)</td>
</tr>
<tr>
<td>12</td>
<td>Greece</td>
<td>5</td>
<td>n=80</td>
<td>13</td>
<td>Christodoulou et al. (2013)</td>
</tr>
<tr>
<td>13</td>
<td>Trinidad</td>
<td>5</td>
<td>n=152</td>
<td>26</td>
<td>Changoor &amp; Hutchinson (2013)</td>
</tr>
<tr>
<td>14</td>
<td>Japan</td>
<td>2</td>
<td>Adults ages 65 years and over only</td>
<td>46.2</td>
<td>Kasai, Suzuki, Iwase, Doi, &amp; Takao (2013)</td>
</tr>
<tr>
<td>15</td>
<td>Slovakia</td>
<td>2</td>
<td>University students only</td>
<td>33.1</td>
<td>Đurka &amp; Ruch (2014)</td>
</tr>
</tbody>
</table>

Note: Exclusion criteria stated in Section 4.1.2.

At the time of writing, no published study has estimated the prevalence of Type D in the Australian population. Estimating the prevalence of Type D personality in the Australian population would be akin to estimating the size of the burden of illness, at least in part, that healthcare services are likely to carry into the future. It could also provide a basis for determining how to invest financial resources into related research and clinical support services. An Australian Type D prevalence study would also contribute to research aimed at establishing the cross-cultural validity of Type D personality. Study 2 aims to address this gap in the Type D literature by replicating the methodology of a Type D population prevalence study undertaken in the United Kingdom and Ireland (Williams et al., 2008) using an Australian sample.
4.3 Type D in Clinical Samples

Type D personality research was founded in studies of potential risk factors for long-term mortality in cardiac patients, most of whom were middle aged males (e.g. see Denollet, 1998; Denollet, Sys, & Brutsaert, 1995; Denollet et al., 1996). Although clinical Type D research is still largely focused on cardiac-related conditions (e.g. cardiovascular disease, hypertension, myocardial infarction) there is a growing interest in how Type D personality may be associated with other high-impact, high-prevalence chronic conditions such as type 2 diabetes (e.g. Nefs et al., 2015), cancer (e.g. Mols et al., 2012), and metabolic syndrome (e.g. Mommersteeg, Herr, Bosch, Fischer, & Loerbroks, 2011).

The possible mechanisms by which Type D personality may influence health have been discussed in section 3.3. No single mechanism has been implicated in the relationship between Type D and chronic illness onset and maintenance, and indeed a multi-factorial relationship would be likely to offer a more parsimonious explanation. A meta-analysis of seven studies investigating the relationship between Type D and health outcomes found evidence of a strong and reliable relationship between Type D personality and cardiac-related illnesses. Across all seven studies, the presence of Type D personality was indicative of poorer medical outcomes, however, again, the exact mechanisms that mediated the relationship were unclear (Reich & Schatzberg, 2010).

The authors of the meta-analysis suggested that personality traits may exert an influence that is secondary to an individual’s endophenotype. Endophenotype refers to the genetic underpinning of a behavioural symptom, thereby allowing a stable phenotype (an observable and predictable symptom) to be identified. In this explanation, Type D traits would be considered to have emerged in response to observable endophenotypes (Reich & Schatzberg, 2010). That is, the traits of negative affectivity and social inhibition would be considered a ‘symptom’ of an underlying mechanism, rather than a possible cause of illness.
Another potential explanation for the relationship between Type D and poor health is the more obvious conclusion that personality traits may influence behaviours that lead to illness onset and maintenance (e.g. smoking behaviour, excess alcohol consumption). This explanation is pleasingly parsimonious, and appears to be well supported in the trait literature generally, and Type D literature specifically. For example, the Big 5 traits of neuroticism and conscientiousness have both been demonstrated to have polar influences on health – that is, neuroticism predicted higher mortality in later life (Wilson, Mendes de Leon, Bienias, Evans, & Bennett, 2004) whereas conscientiousness and optimism predicted longevity (Danner, Snowdon, & Friesen, 2001).

Over the past decade, interest in the Type D construct and its proposed effects has grown considerably. Research has investigated the role that Type D personality has in the recovery of CHD patients, as well as in their projected quality of life post cardiac event. Denollet, Vaes and Brutsaert (2000) investigated the five year prognosis of 319 CHD patients who had experienced myocardial infarction or coronary bypass/angioplasty in the preceding two months before entry into the study. Patients with a major comorbidity (e.g. cancer) were excluded. Episodic distress and chronic stress were assessed while all patients undertook a standard cardiac rehabilitation program, and end point measures were perceived quality of life and repeat cardiac events. The study found that Type D personality was an independent predictor of poor prognosis in the cardiac patient sample.

Further to this, the end point measures suggested that quality of life was more influenced by behavioural/psychological factors (e.g. Type D personality, smoking, depressive symptomatology) than biomedical indexes (Denollet, Vaes et al. 2000). Despite appropriate treatment, Type D personality remained stable, and predicted both morbidity and poor quality of life in that sample of patients.
The Type D literature also shows that Type D is associated with illnesses other than cardiac-related conditions. Recent research has investigated the role of Type D in the onset and the prognosis of a number of chronic diseases and illnesses such as cancer (Mols et al., 2012), metabolic syndrome (Mommersteeg et al., 2011), Parkinson’s disease patients (Dubayova et al., 2009), post-traumatic stress disorder (Rademaker, van Zuiden, Vermetten, & Geuze, 2011), and type 2 diabetes (Nefs, Pouwer, Denollet, & Pop, 2012). Given the generality of the mechanisms thought to underlie Type D, it could be reasonable to expect that Type D may influence a wider range of chronic illnesses than have been investigated to date. Some chronic conditions may prove to be particularly vulnerable to the effects of Type D personality. One such group of conditions is functional somatic syndromes.

4.3.1 Functional Somatic Syndromes

Functional somatic syndromes are conditions that have manifest physical and psychological symptoms, but appear to have no apparent or known biological cause (Barsky & Borus, 1999). Conditions such as Gulf War syndrome, irritable bowel syndrome, fibromyalgia, and CFS are examples of functional somatic syndromes (Barsky & Borus, 1999; Kroenke, 2007). Many functional somatic syndromes share a high degree of symptom overlap, so much so that the question of whether the conditions are distinct from each other has been raised a number of times in the literature (Kroenke, 2007; Morris, Anderson, Galecki, Berk, & Maes, 2013; Poeschla, Strachan, Dansie, Buchwald, & Afari, 2013; Wolfe, Walitt, Katz, & Häuser, 2014). The emerging consensus appears to be that functional somatic syndromes may be akin to a cluster of poorly understood and unexplained somatic symptoms, rather than discrete disorders (Abbi & Natelson, 2013; Kroenke, 2007; White, 2010).

Personality research in functional somatic syndromes is scarce (Van Houdenhove, Kempke, & Luyten, 2010) however there are some key features of the functional somatic syndromes of CFS and fibromyalgia that suggest that they may more vulnerable, or
susceptible, to the influence of Type D personality traits. Numerous studies have indicated that there is a high rate of concurrent psychiatric and mood disorders in functional somatic syndromes, up to 82% in CFS (Ciccone, Busichio, Vickroy, & Natelson, 2003; Wessely, 1996) and 80% in fibromyalgia (Epstein et al., 1999; Stein, 2013). Specifically, CFS and fibromyalgia research has demonstrated that personality traits such as perfectionism (Malin & Littlejohn, 2012; White & Schweitzer, 2000), negative attitudes (Malin & Littlejohn, 2012), psychoticism (Montoro & Reyes del Paso, 2015) and neuroticism (Fiedler et al., 2000; Nater et al., 2010) contribute to the severity of both, however one study was unable to replicate the trait perfectionism findings (Wood & Wessely, 1999). Personality disorders are also highly prevalent in CFS (Nater et al., 2010) and fibromyalgia (Sansone, Whitecar, Meier, & Murry, 2001).

CFS and fibromyalgia appear to share common (possible) underlying causes, and behavioural and psychological manifestations with Type D personality. Like Type D personality, both CFS and fibromyalgia have been associated with a range of biopsychosocial health-related mechanisms such as HPA axis dysfunction (e.g. Adler et al., 1999; Wheatland, 2005), genetic factors (e.g. Kirk, Hickie, & Martin, 1999), mood disorders (e.g. Afari & Buchwald, 2003), increased somatisation (e.g. Katon & Walker, 1993), and a tendency to adopt maladaptive coping styles in response to stress (e.g. Davis, Zautra, & Reich, 2001; Johnson, Zautra, & Davis, 2006). There are similarities that exist between Type D personality and CFS and fibromyalgia, that do not appear to exist with clearly defined (in terms of diagnosis and treatment) chronic illnesses such as type 2 diabetes or arthritis. The biopsychosocial commonalities between Type D personality and CFS and fibromyalgia may mean that functional somatic syndromes are more vulnerable to the maladaptive health-related behaviours and perceptions associated with Type D personality.
An alternative theory could be that Type D personality could precede the onset of a functional somatic syndrome such as CFS or fibromyalgia, or vice versa. Both scenarios could be plausible, either: 1) having a Type D personality may increase the tendency to focus on bodily complaints and experience high levels of psychological stress, thereby triggering the onset of a functional somatic syndrome, or, 2) the uncertainty, stress, and functional impairment associated with functional somatic syndromes may alter, or amplify, normal levels of negative affectivity and inhibition (social or emotional) resulting in a change in personality.

Although the mechanisms of effect are not yet clear, there appears to be potential for Type D personality to be considered a reliable risk factor for particular chronic conditions. Given the relative ease of administration of the Type D measurement scale, the DS14, and predictable nature of health-related behaviours and perceptions associated with Type D, health research could aim to identify whether Type D personality could be considered a general risk factor for poor health, rather than a risk factor for cardiac conditions specifically. Chapter 7 aims to address this question by investigating the role of Type D personality in five chronic conditions that have received little or no prior Type D research attention: CFS, fibromyalgia, type 2 diabetes, osteoarthritis, and rheumatoid arthritis. If Type D personality is found to be a general risk factor for chronic illness onset and maintenance, it could provide a new avenue for healthcare services to develop chronic illness treatment and prevention strategies.
CHAPTER 5 - EVIDENCE OF THE NOVELTY AND VALIDITY OF THE TYPE D PERSONALITY CONSTRUCT: A FACET-LEVEL EXAMINATION

Costa and McCrae’s (1992a) Five-Factor Model is the dominant model of personality currently used in personality and individual differences research. A key element of the Five-Factor Model is the Big 5 factors. The Big 5 factors are broad personality descriptors that each encompass a range of more narrowly defined traits, referred to as facets. A number of studies have attempted to understand the underlying structure of Type D personality by comparing the negative affectivity and social inhibition subscales with the Big 5 factors. Chapter 4 reviewed six published Type D validation studies where the Big 5 factors were included in the analyses (Table 4.1). The studies all reported a strong positive correlation between the Big 5 factor of neuroticism and the Type D subscale of negative affectivity (average of .74 across the studies). The studies also reported a moderate negative correlation between the Big 5 factor of extraversion with the Type D subscale of social inhibition (average of -.63 across the studies).

Using the Big 5 factors to understand Type D personality has been useful in identifying overarching personality correlates. What is less able to be distilled from the Big 5 factors are more nuanced aspects of personality. A limitation of using broad personality factors in research is their reduced ability to detect or predict subtle personality differences (Otero-López & Villardefrancos Pol, 2013). The detection or prediction of subtle differences in personality can be achieved by including the 30 facets that underpin the Big 5 factors in correlational or regression analyses. The facets are argued to represent a better, more targeted, set of predictors than the facets (Otero-López & Villardefrancos Pol, 2013). Hence, a facet-level analysis of negative affectivity and social inhibition may reveal subtleties of Type D that the relative ‘bluntness’ of the factors could mask.
5.1 Study Background

A number of theoretical and practical issues within the Type D personality literature formed the basis of the present study. Two issues that require contextualisation are presented. The issues are: 1) the claim that Type D personality is not a novel or valid construct, and 2) that the dichotomisation of Type D is at odds with prevailing theories of the general structure of personality. Each issue is discussed in relation to the development of the aims of the present study.

5.1.1 The Novelty and Validity of Type D

Type D personality is described as a dichotomous personality typology that consists of elevated levels of both negative affectivity and social inhibition (Denollet, 2005). As described in Chapter 3, a major criticism of Type D personality theory is that it may not be a new or valid contribution to the personality literature. Critics of Type D personality theory have claimed that it is merely a re-branded composite of two of the Big 5 factors, neuroticism and extraversion (Lespérance & Frasure-Smith, 1996). These concerns are not unfounded. Previous research has reported correlational analyses that show a high degree of overlap between the Type D subscales of negative affectivity and social inhibition with the Big 5 factors of neuroticism and extraversion. Reported correlations between negative affectivity (as measured by the DS14) and neuroticism have ranged from .58 (Grande, Glaesmer, et al., 2010) to .82 (Svansdottir, van den Broek, et al., 2013). Similarly, social inhibition has been found to have a moderate negative correlation with extraversion (e.g. -.69 Đurka & Ruch, 2014; -.67 Svansdottir, van den Broek, et al., 2013). The moderate to strong correlations observed between the Big 5 factors and the Type D subscales demonstrate a considerable alignment between the constructs. The alignment has led to concerns about the uniqueness and novelty of the Type D construct in an already ‘congested’ field of personality research (Lespérance & Frasure-Smith, 1996; Perbandt et al., 2006). In order for Type D research to
progress, it is necessary to establish whether Type D represents a novel contribution to personality theory. Establishing the novelty of Type D could be achieved by undertaking a more fine-grained analysis of the two traits that underpin Type D personality, negative affectivity and social inhibition.

5.1.2 Dichotomous Type D Personality and the Big 5 Factors

Despite the existing research on how negative affectivity and social inhibition relate to the Big 5 factors, less is known about how a continuous representation of Type D would relate to the Big 5 factors. This may be due, in part, to Type D being represented as a dichotomous typology. The theoretical and statistical issues associated with the dichotomisation of continuous variables have been discussed in Chapter 2. Despite the decision-making expediency afforded by a dichotomous diagnostic tool, taxometric research, both in general (e.g. Haslam et al., 2012) and in relation to Type D (e.g. Ferguson, Williams, O'Connor, et al., 2009), commonly points to personality having an underlying continuous representation. The issue that this presents for the present study is the inability to include the dichotomous representation of Type D in any analysis that requires a continuous variable (e.g. correlations).

Previous research that has investigated the structure of Type D has been limited, in most cases, to separately analysing the continuous subscales of negative affectivity and social inhibition. Given that Type D personality theory defines Type D as the interaction of negative affectivity and social inhibition, analysing the subscales as separate variables could be argued to be a misrepresentation of Type D. In one study, De Fruyt and Denollet (2002) constructed a one-dimensional (i.e. continuous) representation of Type D that ranged from neurotic introversion with low conscientiousness to stable extraversion with high conscientiousness. Using confirmatory factor analysis, the authors formed a continuous representation of Type D by extracting the first unrotated component of items from the Type
D measurement scale in use at that time, the DS24. The first unrotated component is thought to be the best estimate of the shared variance within a group of related measures (Jensen, 1998). Unsurprisingly, the one-dimensional representation of Type D correlated strongly with neuroticism (.71) and moderately with extraversion (-.57). These results are important as they provide a preliminary consideration of how Type D could be conceptualised as a continuous measure. However, it is still unclear whether the Big 5 factors would explain more or less variance in a continuous Type D scale than in the separate negative affectivity and social inhibition subscales. It is also unknown whether the facets would provide any incremental prediction of a continuous measure of Type D. The present study will aim to address these issues.

5.2 Aims and Hypotheses

Study 1 had four primary aims:

1) To assess the validity and basic structure of Type D personality against the Big 5 factors.
2) To determine whether the 30 facets provide incremental prediction of Type D over the Big 5 factors.
3) To determine whether the Big 5 factors would explain more or less variance in a continuous Type D scale than in the separate subscales.
4) To examine factor and facet-level personality difference between individuals with Type D personality compared to individuals without Type D personality.

Based on prior research, it was hypothesised that:

1) The Type D subscales of negative affectivity and social inhibition would demonstrate moderate to strong correlations with the Big 5 factors of neuroticism.
(+), (+) and extraversion (-).

2) The 30 facets would provide significant incremental prediction of Type D personality where the facets were related to affective states. Specifically, it was predicted that the facets of anxiety (+), depression (+), and positive emotions (-) would incrementally predict negative affectivity, and the facets of gregariousness (-) and self-consciousness (+) would incrementally predict social inhibition.

3) That a continuous representation of Type D would achieve a similar level of prediction from the Big 5 factors, and incremental prediction from the 30 facets, as the negative affectivity and social inhibition subscales.

4) Type D individuals would exhibit significantly lower extraversion, and significantly higher neuroticism, than non-Type D individuals. The facets related to affective states (see H2) would be significantly different in Type D individuals compared to non-Type D individuals.

5.3 Method

5.3.1 Rationale for the selection of the Method

Two important considerations in the design of Study 1 were: 1) the choice of instruments, and 2) the method of data collection. The rationale for each consideration was derived from the relevant literature and is presented below.

5.3.1.1 Selection of Measurement Instruments

The decision to undertake a facet-level analysis of the Type D construct was informed by the literature concerning the nature of personality structure. Many dominant personality frameworks conceptualise personality as hierarchical in nature with broad factors at one level which are, in turn, composed of narrower facets (Costa & McCrae, 1992b; Goldberg, 1992; John & Srivastava, 1999). In response to both the reductionism of the Big 5 factors, and empirical observations of incremental prediction by facets, several researchers have called for
more facet-level research (Anglim & Grant, 2014a; Ashton, Paunonen, & Lee, 2014). As there has been no published research on facet-level correlates of Type D personality, the present study was designed to address this issue. A facet-level analysis requires participant data to be collected via a personality inventory that structures personality information in a hierarchical fashion consisting of broad factors underpinned by related facets.

A number of personality inventories fulfil the requirement of assessing personality using a factor and facet structure. The HEXACO Personality Inventory assesses the factors and facets that form the basis of the HEXACO model (Lee & Ashton, 2004). HEXACO is an acronym for the six factors that the model represents: honesty-humility, emotionality, extraversion, agreeableness, conscientiousness, and openness to experience. Each factor is underpinned by four facets (Ashton, 2013). Similarly, the Multidimensional Personality Questionnaire (MPQ) assesses a personality structure based on 11 primary traits, that each load onto four higher-order traits (Tellegen, 1982). The four orthogonal higher-order traits are positive emotionality, negative emotionality, constraint, and absorption. Although the MPQ does not refer to factors and facets specifically, the basic hierarchical structure is largely equivalent to that of factors and facets.

The full-scale NEO-PI-R is an inventory that assesses factor and facet information based on the Five-Factor Model (Costa & McCrae, 2008). The Big 5 factors are each underpinned by six facets. As previous Type D research is primarily based in Five-Factor Theory, the use of the NEO-PI-R was deemed most appropriate. Additionally, and importantly, the use of the NEO-PI-R ensured that the findings of the present study could be compared to similar previously published Type D research.

In addition to the NEO-PI-R, the study also required participant data from the standard measure of Type D personality, the DS14. As there is no current alternative to the DS14, no
further rationale for its inclusion in Study 1 is required. Both instruments are described in section 5.5, and can be found in Appendix A and Appendix B.

5.3.2 Selection of Data Collection Process

It was decided that the present thesis would collect data using web-based surveys. The surveys were distributed via social media platforms and illness support group websites. The decision to undertake the data collection via a web-based survey was informed by human factors and psychological evaluation research that outlined numerous benefits to this methodology. The use of the internet for research is becoming increasingly common, and the benefits of collecting data this way make it a very attractive option for researchers. However, there are limitations to web-based data collection. Both the advantages and the disadvantages must be considered before adopting a web-based survey design. The rationale for the decision to use a web-based survey is presented below.

5.3.2.1 Search Strategy and Inclusion Criteria

A review of the psychological and human factors literature pertaining to methods of survey data collection and human information technology usage was undertaken. Papers were sourced from four relevant computer databases. Science Direct was limited to two journals: 1) Computers and Education, and 2) Computers in Human Behaviour. The databases of Applied Science and Technology Source, PsycINFO and PsycARTICLES were accessed through EBSCO Host. Only English language, published peer-reviewed papers that included an evaluation of online data collection methods found via the key search terms (below) were included. Searches included combinations of the following groups of key terms: 1) Web*, Wed-based 2) survey, 3) evaluation, and 4) research. This search strategy aimed to maximise the potential of sourcing all relevant published papers. Searches were last conducted in March 2016.
Papers were included in the search if they: 1) specifically examined the effectiveness of web-based research designs, 2) examined the characteristics of responders and non-responders in web-based research, 3) were published from 2000 onwards, and 4) were written in English. Papers were excluded from the search if they did not utilise a sample that could be considered comparable to the sample in the present study (e.g. significant cultural differences that may reflect different patterns of information and communication technology [ICT] use). Prior to applying the exclusion criteria, 106 papers were identified. After screening, eleven papers remained and were used in the review:

1) Bjornsdottir, Almarsdottir, Hansdottir, Thorsdottir, Heimisdottir, Stefansson, and Brennan (2014)
2) Correa, Hinsley, and De Zuniga (2010)
4) Greenlaw and Brown-Welty (2009)
5) Hewson, Vogel and Laurent (2015)
6) Huang and Liaw (2005)
7) Oulasvirta, Rattenbury, Ma and Raita (2012)
8) Sax, Gilmartin and Bryant (2003)
9) Sills and Song (2002)
11) Yang and Tan (2015)

5.3.2.2 Factors Influencing the Use of Web-Based Data Collection

There are a number of factors to consider in any research design: 1) maximizing the response rate, 2) time and monetary costs of administration, 3) the target population, and 4) the characteristics of responders and non-responders. The first factor, maximizing the response rate, is, to a large extent, contingent on the three subsequent factors listed previously. If costs, target population, and characteristics of responders are set aside momentarily, the question of how to maximize response rates in a survey design study can be answered by examining the mode of survey delivery. Web-based surveys have replaced
paper-based survey methods in recent years, so much so that online data collection is becoming a standard practice in research (Hewson, Vogel, & Laurent, 2015). A growing body of evidence indicates that web-based surveys are broadly accepted (by participants) as meeting the needs of the information era (Huang & Liaw, 2005). They are also a low-cost and efficient means of collecting survey data (Yang & Tan, 2015).

A number of studies have compared modes of survey administration to try to determine whether one method is superior to others in terms of participant engagement. A 2003 study of the response rates attributed to different methods of survey administration found that a paper-based method with the option of web-based access to the survey yielded the greatest response rate in a sample of 4,498 US college students (24%; Sax, Gilmartin, & Bryant, 2003). Second to the combined paper and web option was a paper-only option (22%), and third was a web-only option (19.8%).

Similar results were found in a later study (2009) which also compared the response rates of three types of survey administration: 1) paper-based administration, 2) web-based administration, and 3) mixed-mode administration (both paper and web-based invitations to participate) (Greenlaw & Brown-Welty, 2009). The sample in this study consisted of 3,842 employed adult members of a US-based organisation (American Evaluation Association). Of the three methods examined, mixed-mode administration yielded the highest response rate (60%, compared to 52% web, 42% paper). Interestingly, when the responses were collated into type of response chosen by the participants (i.e. web or paper), regardless of administration mode (paper-only, web-only, choice of paper or web), 61.7% of the responses were via the web.

A comparison of web-based survey methodology with telephone survey methodology found differences in the demographic characteristics of respondents for each approach. A Taiwanese study reported response rates and responder characteristics of 1,313 participants
who responded to a web-based survey of attitudes towards the National Health Insurance scheme, compared to 2,411 participants who responded to the same survey via a random dialing telephone survey (Yang & Tan, 2015). The results indicated that web-based respondents tended to be younger, unmarried, non-smokers who had higher levels of education and higher incomes than telephone-based respondents. The web-based respondents reported worse self-reported health status than telephone-based respondents, however they were less likely to report suffering from a chronic illness.

Although there is evidence to suggest that demographic variables may influence uptake of web-based surveys, recent research has found that the nature of the responses to scale items is not influenced by the mode of survey delivery. In a study designed to examine measurement invariance of paper-and-pencil and web-based survey administration techniques, 401 undergraduate students in Taiwan completed a test-retest humour survey in one of four groups: a) paper-and-pencil at time 1 and time 2, b) paper-and-pencil at time 1 followed by web-based at time 2, c) web-based at time 1 followed by paper-and-pencil at time 2, and d) web-based at time 1 and time 2 (Wang et al., 2013). The results of the study showed that there were no significant differences between the pre and post-test survey scores, except for one subscale (attitudes to humour subscale). The findings provide a level of confidence that the quality of responding appears to be largely unaffected by mode of survey delivery, despite the differences in demographic variables between the two methods. Furthermore, a 2014 study assessed the equivalency of responses between paper-based and web-based administration of the NEO Five Factor Inventory (NEO-FFI). A total of 88 Icelandic adult participants completed the NEO-FFI in both paper-based and web-based formats, with an average of 63 days between the two administrations (Bjornsdottir et al., 2014). The study found that response style did not differ between administration modes on most indexes. The indexes that did differ indicated that web-based respondents were more
prone to mid-point responding, the tendency to acquiesce, and engage in more longstring responding. The differences, however, did not translate into meaningful differences in the internal consistency reliability of the test, which supports the contention that the quality of responses is unaffected by the mode of administration (Bjornsdottir et al., 2014).

Although these findings are interesting, and can inform research design decisions, it may be pertinent to note that much of the data from the studies described above were collected up to 10 years ago. The Law of Accelerating Returns is a mathematical formula used to predict the rate of increase in human information technology ability over time. According to the Law of Accelerating Returns, human technological competency should have increased by 64% from 2009 to 2016 (Kurzweil, 2004). In other words, people’s familiarity and competency in an online environment is likely to have improved substantially in the last seven years alone.

An excellent example of the accelerated uptake and engagement of technology is the introduction of applications. Applications are computer programs designed to run on mobile devices such as smartphones and tablets. The first applications, commonly referred to as ‘apps’, began to appear in 2008. In the eight years since they were first introduced, applications have become a billion dollar industry with over 1.6 million applications now available to consumers via their mobile device (Statista, 2016). Applications have become ubiquitous in day-to-day life for technology users, and their use has been cited as a driver of sociocultural and behavioural change (Oulasvirta, Rattenbury, Ma, & Raita, 2012). It could be argued that such a rapid acceleration of technological competency, and technology uptake, would render the findings of web-based preference research from a decade ago quite out of date. It is possible, if not probable, that current internet users may prefer to complete a web-based survey over a paper-based survey, simply because so much of day-to-day personal activity is now completed in a digital space.
The second factor in determining an appropriate study design is the time and monetary costs that will be encountered. Administering a paper-based survey to a large sample (or even a medium-sized sample) requires a time-consuming process of printing the surveys, printing addresses of intended recipients, and putting the surveys into the envelopes before posting them. Once the surveys are returned, the process of manual data entry begins. In contrast, the design and dissemination of web-based surveys is an efficient process and does not require particular skills beyond basic information technology literacy. With a range of free-ware (free software) options available, web-based surveys can be created, uploaded, and disseminated in a matter of hours (Greenlaw & Brown-Welty, 2009). The collection and storage of web-based data are immediate, with data typically entered straight into a database in whatever configuration the researcher selects. The major benefit of collecting data online is that the data are collected securely and the requirement to manually transcribe responses is removed. The removal of human data transcription necessarily removes the chance for human error to occur (Greenlaw & Brown-Welty, 2009).

The monetary costs of web-based survey designs are typically much less than paper-based surveys. The main expenses encountered in paper-based surveys are printed materials, data entry, and postage. In a cost-per-response analysis, web-based surveys were estimated to cost US$0.64 per response, compared to US$4.78 per response for paper-based surveys (Greenlaw & Brown-Welty, 2009). Similarly, a cost per response analysis for web-based surveys compared to telephone-based surveys estimated the monetary cost of web-based surveys to be US$0.71 per response compared to US$3.98 per response for telephone-based survey administration (Yang & Tan, 2015).

The third factor to consider in deciding between traditional paper-based methodology and web-based methodology is the target population of the study. This factor is an important consideration if the population of interest is likely to have reduced internet access or possess
few digital literacy skills. Non-response bias in web-based surveys can be due to a number of demographic variables including age, race, gender, education, and income (Sills & Song, 2002). An example of demographic variables influencing non-response rates is the finding that people with low-levels of education or who have a low socio-economic status are less likely to have internet access compared to high-income and educated people (Gosling, Vazire, Srivastava, & John, 2004). Similarly, elderly individuals may be less likely to favor an online approach to survey responding than younger individuals who may be more comfortable or familiar with an online environment. If the target population for a study is the general population, and not a specific subset such as the elderly, web-based surveys are likely to produce a representative sample. In Australia, 86% of households have internet access, and 85% of the population (aged 15 years or over) are regular internet users (ABS, 2015).

Finally, the characteristics of responders and non-responders is a factor to consider in either web-based or paper-based survey methods. Web-based surveys practically guarantee anonymity, which may attract respondents who might otherwise be hesitant or even uneasy about being approached by postal invite or in person. In studies of people who regularly use social media, particular personality traits such as extraversion, emotional stability, and openness to experience have been associated with different styles of social media use (Correa, Hinsley, & De Zuniga, 2010). Extraversion and openness to experience were both associated with increased social media use, while emotional stability was found to be associated with less social media use. These findings are of particular relevance to any survey design where the variables under examination may be influenced by the respondent’s personality. Study 1 in the present thesis was designed to investigate both the respondent’s personality traits and the relationship between personality traits and health status. The knowledge that individuals who are more anxious and worrisome are also more likely to use
social media was an important consideration, particularly given the surveys were to be distributed, partly, via social media.

The characteristics of non-respondents is also an important consideration, but is not unique to web-based survey methods. Any method of data collection has some bias inherent in the data, as all research relies on respondents who have a tendency to volunteer their time and information. What may be of note is whether non-response is associated with mode of administration. A way to reduce non-response due to administration mode could be to employ a multi-mode method, such as the paper and web options described previously. The downside of this approach is that time and monetary efficiencies gained through web-based design would be reduced considerably.

In summary, the advantages of web-based data collection were deemed to substantially outweigh the disadvantages for the present research. In addition, further advantages that were not outlined in published research were considered in the design of Study 1. For example, the web-based survey could be constructed so that only one answer per scale item can be accepted. This parameter removes the possibility of accidental double-endorsement of an item by participants. Another advantage that was noted, but not implemented, was the ability to prevent the responses from being submitted if one or more scale items had not been endorsed. This parameter can eliminate the issue of missing data. On consideration of the possible ethical implications of this parameter, the researcher determined that a forced-choice survey style may violate the participant’s right to not answer one or more items, and was therefore not implemented in Study 1. On balance, it was decided that the most effective and appropriate data collection design for Study 1 was a web-based survey.
5.4 Participants

The participants were recruited through the Deakin University Integrative Health Research Unit website, social media (Facebook and Twitter), and online health and wellbeing forums. The recruitment period took place between December 2013 and June 2014. Although the recruitment period for each study in the present thesis overlap to some extent, each study utilised data from a unique sample. Of the 273 participants who undertook the questionnaires, data from 268 were used in the study. Cases were excluded on the basis of either, 1) greater than 10% missing data, or 2) Mahalanobis distance greater than 80 (suggested random responding). The gender distribution had a female bias, with 22% (n=59) male and 76% (n=203) female participants. Six participants (2%) elected to not state their gender. The possible impact of a gender bias in the sample will be considered in Chapter 8. Ages ranged from 18 to 69 years, with a mean age of 32.0 years (SD = 14.3). Of the sample, 20% (n=53) had completed a secondary education, 41% (n=109) had completed undergraduate education, 17% (n=46) had completed post-graduate education, 4.5% (n=12) completed a trade qualification, 6% (n=16) listed their education level as ‘other’, and 11.5% (n=32) elected not to supply educational attainment information. The possible impact of an education bias in the sample will be considered in Chapter 8. The sample predominantly consisted of participants who were born in Australia (87%), including six individuals who identified as indigenous Australians (2.2%). The percentage of indigenous participants was representative of the proportion of indigenous Australians within the overall Australian population (ABS, 2016). English was the primary language for 97.8% of the sample.

5.5 Measures

Along with basic demographic information, the study collected participant data using two formal measures of personality. First, Type D personality was assessed via the standard Type D measurement instrument, the DS14. The second instrument was the NEO-PI-R. The
full-scale version of the NEO-PI-R was required to access facet information for each of the Big 5 traits. Each formal measure, and the basic demographic information collected, is described below.

5.5.1 Demographic Information

The demographic information collected from each participant was age, gender, country of birth, level of education, and primary language spoken.

5.5.2 Type D Personality Scale (DS14)

The DS14 (see Appendix A) is a 14 item scale designed to measure the traditional dichotomous representation of Type D personality (Denollet, 2005). Items are rated on a 5-point Likert scale ranging from 0 = false to 4 = true. The measure consists of two 7 item subscales, negative affectivity (NA) and social inhibition (SI), which are scored as the sum of respective items after any necessary item reversal. Sample items from this scale include ‘I often feel unhappy’ (NA subscale), and ‘I am a closed kind of person’ (SI subscale). An individual is classified as having Type D personality if they score 10 or more on both subscales (Denollet, 2005). The DS14 subscales have been found to be internally consistent (Cronbach’s $\alpha$ of .88 (NA) and .86 (SI)) and stable over a 3-month period (test-retest $r = .72$ (NA) and .82(SI); Denollet, 2005). In the present study, both subscales showed good internal consistency (Cronbach’s $\alpha$ of 0.89 (NA) and 0.87 (SI)).

5.5.3 NEO Personality Inventory Revised (NEO-PI-R)

The NEO-PI-R (see Appendix B) is a 240 item well-validated and widely adopted personality inventory measuring the Big 5 factors and their associated 30 facets (Costa & McCrae, 1992b, 2008). The factors and facets are listed in Table 2.4. Factors and facets are arranged hierarchically such that each factor is composed of six facets. Items are rated on a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Sample items
from this scale include ‘I really like talking to people’ (extraversion factor, warmth facet), ‘I have trouble resisting my cravings’ (neuroticism factor, impulsiveness facet), and ‘I often try new and foreign foods’ (openness factor, action facet). As per the NEO-PI-R scoring procedure, facet scores were obtained by taking the mean of constituent items after any necessary item reversal. Factor scores were the mean of constituent facet scores. For example, the neuroticism factor score was the mean of anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability facet scores.

5.6 Procedure

Ethics approval was obtained from the Deakin University Human Research Ethics Committee (see Appendix G). The measures were completed via online administration. Before commencing the measures, the participants were asked to read a Plain Language Statement (PLS) and indicate their consent to proceed by clicking a button labelled ‘I consent’ at the bottom of the PLS. Participants first answered demographic items followed by the DS14 and finally the NEO-PI-R. The measures took approximately 40-50 minutes to complete and were undertaken at a time and location that was of the participant’s convenience. All data were collected anonymously. All data are stored on secure Deakin University servers.

5.7 Data Analytic Method

5.7.1 Variables

The incremental prediction of facets over factors analysis required a series of linear regression analyses. The dependent variables for the regression analyses were continuous Type D, negative affectivity and social inhibition. The first regression analysis predicted the dependent variables from five independent variables, the Big 5 factors. The second regression analysis predicted the three dependent variables from 30 independent variables, the 30 facets. Although specific directional hypotheses have been proposed, the results of all analyses are
reported as two-tailed tests so as to ensure that significant group differences in either
direction are both detected and not over-stated.

5.7.2 Incremental Prediction by Facets over Factors

The present study adopted recent recommendations for the analysis of incremental
prediction of personality facets over factors (Anglim & Grant, 2014a, 2014b). These
recommendations overcome issues with some previous approaches that led to biased
parameter estimation, ill-defined population parameters, lack of confidence interval reporting,
and a lack of parsimony in incremental facet assessment. Specifically, the recommended
approach involved estimating the population incremental variance explained by facets over
factors by subtracting adjusted r-squared values for a regression analysis with five factor
predictors from one with 30 facet predictors: i.e., \( \Delta \hat{\rho}^2 = R^2_{adj(\text{facets})} - R^2_{adj(\text{factors})} \). Double adjusted
r-squared bootstrap confidence intervals were used to quantify the uncertainty of this
estimate. In order to overcome problems with parsimony associated with facet–criterion zero-
order correlations, a two-step approach was adopted. First, the standardised beta coefficients
of a regression predicting Type D from personality factors provided a factor-level
perspective. Second, the incremental value of particular facets was assessed by obtaining the
semi-partial correlations between each facet and each Type D scale after adjusting each facet
for overlap with the Big 5 factors. Also, given the large number of facets, a more stringent
significance level than .05 was used for facets (\( \alpha = .001 \); i.e., \( .05 / 30 \text{ facets} \approx .001 \)).

Based on the sample size rule-of-thumb formula, \( N \geq 50 + 8m \) (where \( m \) is the number of
independent variables; Tabachnick & Fidell, 2013), a regression analysis with 30 independent
variables (i.e. 30 facets) would require a sample size of 290 participants. The rule-of-thumb
assumes a medium size relationship between the independent variables and the dependent
variables, \( \alpha = .05 \) and \( \beta = .20 \) (Tabachnick & Fidell, 2013). The sample size in the present
study (N=268) was slightly less than the estimate provided by the rule-of-thumb formula. Despite the sample size falling short of the estimated N required, statistical research pertaining specifically to incremental criterion prediction by facets over factors states that a sample size of more than 200 participants is adequate for precision in estimating incremental variance (Anglim & Grant, 2014a). As such, the sample of 268 was considered adequate for the analyses performed.

5.7.3 Continuous Type D

In order to examine factor and facet correlates with an overall Type D composite measure, a continuous representation of Type D was formulated. The continuous measure was calculated as the sum of all 14 items, or, equivalently, the sum of negative affectivity and social inhibition subscales. Though Type D has been conceptualised as the interaction of negative affectivity and social inhibition (i.e. NA × SI), statistical and empirical arguments generally support the superiority of taking the sum rather than the product when combining variables to form a composite (Bobko, Roth, & Buster, 2007; Wang & Stanley, 1970). The idea of obtaining a continuous measure of Type D is similar to De Fruyt and Denollet (2002) who examined the first unrotated principal component of DS24 (DS14 predecessor) items. The rationale for constructing a continuous measure of Type D as the sum of items rather than the first principal component was that Type D is defined as a formative construct that equally weights SI and NA, irrespective of whether SI and NA share variance.

5.8 Results

Before the analyses were conducted, assumption checks for each analysis were undertaken following the guidelines recommended by O’Rourke, Psych, and Hatcher (2013). The data were found to be normally distributed, with no transformations required. The relationships between variables were linear, and visual examination of standardised residual plots indicated the assumption of homoscedacity had been met. Hence, the data were
considered to be both adequate and appropriate for use in the analyses. Within the sample, Type D personality was present in 45.9\% of participants (n=123).

5.8.1 Reliability and Factor Analysis

An examination of the reliabilities and factor structures indicated that both the DS14 and the NEO-PI-R had good internal psychometric properties. Cronbach's alpha reliabilities were generally high with mean alphas of .88 for Type D subscales (see Table 5.1), .90 for Big 5 factors (see Table 5.1), and .74 for personality facets (see Table 5.2). Exploratory factor analyses (EFA) were conducted to examine whether the 14 items of the DS14 loaded onto two factors corresponding to negative affectivity and social inhibition, and whether the 30 facets loaded onto five factors. In both cases the EFA involved maximum likelihood estimation with a Promax rotation. The scree plot for the EFA of the DS14 supported a two factor solution with 60.3\% of variance explained. All 14 items loaded maximally on their theorised subscales with no cross-loadings above .30. The smallest loading for any item was .51. The scree plot from an EFA of the facets supported the expected five factor solution with 62.3\% of the variance explained. Of the 120 possible cross-loadings, only five were greater than .30. Only one facet did not load maximally on its theorised factor.

5.9 Correlations between Type D Subscales and Personality Factors and Facets

Table 5.1 presents the descriptive statistics and correlations between the Big 5 factors and Type D personality. Correlations between the factors and the Type D subscales were broadly similar to those found in past research (see Table 4.1). The expected large correlations of negative affectivity with neuroticism (.75) and social inhibition with extraversion (-.73) were observed. Similarly, large correlations were observed for continuous Type D with neuroticism (.76) and extraversion (-.67).
Table 5.1
Descriptive statistics, reliabilities and correlations between personality factors and Type D scales

<table>
<thead>
<tr>
<th>Variable</th>
<th>α</th>
<th>M</th>
<th>SD</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>1. Cont. Type D</td>
<td>.83</td>
<td>22.62</td>
<td>11.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Negative Affect</td>
<td>.88</td>
<td>11.51</td>
<td>6.26</td>
<td>.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Social Inhibition</td>
<td>.87</td>
<td>11.11</td>
<td>6.28</td>
<td>.88</td>
<td>.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Agreeableness</td>
<td>.89</td>
<td>3.53</td>
<td>0.40</td>
<td>-.33</td>
<td>-.35</td>
<td>-.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Conscientiousness</td>
<td>.91</td>
<td>3.39</td>
<td>0.42</td>
<td>-.32</td>
<td>-.32</td>
<td>-.25</td>
<td>.17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Extraversion</td>
<td>.91</td>
<td>3.24</td>
<td>0.46</td>
<td>-.67</td>
<td>-.46</td>
<td>-.73</td>
<td>.16</td>
<td>.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Neuroticism</td>
<td>.92</td>
<td>2.99</td>
<td>0.54</td>
<td>-.76</td>
<td>.75</td>
<td>.59</td>
<td>-.28</td>
<td>-.45</td>
<td>-.49</td>
<td></td>
</tr>
<tr>
<td>8. Openness</td>
<td>.89</td>
<td>3.49</td>
<td>0.41</td>
<td>-.14</td>
<td>-.05</td>
<td>-.20</td>
<td>.24</td>
<td>.07</td>
<td>.28</td>
<td>-.05</td>
</tr>
</tbody>
</table>

Note: α is Cronbach's alpha reliability. Significant correlations (p < .01) are presented in bold.

Along with descriptive statistics, Table 5.2 shows the correlations between the Type D subscales and personality facets, reporting both zero-order correlations and semi-partial correlations where facets were adjusted for shared variance with the Big 5 factors. While the zero-order correlations revealed a large number of significant correlations, it is the semi-partial correlations that highlight the unique contribution of personality facets. The results were only partially consistent with expectations. Significant semi-partial correlations were obtained for warmth (-), activity (+), and gregariousness (-) with social inhibition, and assertiveness (+), positive emotions (-), and self-consciousness (-) with negative affectivity. Interestingly, there were no significant semi-partial correlations for continuous Type D.
Table 5.2
Descriptive statistics, zero-order correlations between facets and Type D, and semi-partial correlations between facets and Type D controlling for factors

<table>
<thead>
<tr>
<th>Personality Facet</th>
<th>$M$</th>
<th>$SD$</th>
<th>$\alpha$</th>
<th>Continuous Type D</th>
<th>Negative Affectivity</th>
<th>Social Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1: Trust</td>
<td>3.38</td>
<td>0.73</td>
<td>.87</td>
<td>-.49 (.02)</td>
<td>-.44 (.04)</td>
<td>-.43 (.02)</td>
</tr>
<tr>
<td>A2: Straightforwardness</td>
<td>3.58</td>
<td>0.64</td>
<td>.76</td>
<td>-.23 (.01)</td>
<td>-.28 (-.02)</td>
<td>-.15 (-.01)</td>
</tr>
<tr>
<td>A3: Altruism</td>
<td>3.99</td>
<td>0.48</td>
<td>.71</td>
<td>-.39 (.04)</td>
<td>-.31 (-.02)</td>
<td>-.40 (-.08)</td>
</tr>
<tr>
<td>A4: Compliance</td>
<td>3.20</td>
<td>0.62</td>
<td>.74</td>
<td>-.20 (.01)</td>
<td>-.28 (-.05)</td>
<td>-.09 (.02)</td>
</tr>
<tr>
<td>A5: Modesty</td>
<td>3.57</td>
<td>0.63</td>
<td>.78</td>
<td>.09 (.04)</td>
<td>.03 (.04)</td>
<td>.13 (.04)</td>
</tr>
<tr>
<td>A6: Tender-mindedness</td>
<td>3.62</td>
<td>0.46</td>
<td>.57</td>
<td>-.08 (.01)</td>
<td>.07 (-.03)</td>
<td>-.08 (.01)</td>
</tr>
<tr>
<td>C1: Competence</td>
<td>3.59</td>
<td>0.48</td>
<td>.62</td>
<td>-.32 (.00)</td>
<td>-.32 (-.01)</td>
<td>-.25 (.02)</td>
</tr>
<tr>
<td>C2: Order</td>
<td>3.19</td>
<td>0.58</td>
<td>.68</td>
<td>-.17 (.00)</td>
<td>.15 (.02)</td>
<td>.16 (-.01)</td>
</tr>
<tr>
<td>C3: Dutifulness</td>
<td>3.79</td>
<td>0.49</td>
<td>.59</td>
<td>-.24 (.00)</td>
<td>-.25 (.03)</td>
<td>-.19 (-.03)</td>
</tr>
<tr>
<td>C4: Achievement</td>
<td>3.34</td>
<td>0.61</td>
<td>.74</td>
<td>-.18 (.03)</td>
<td>-.16 (-.01)</td>
<td>-.15 (.07)</td>
</tr>
<tr>
<td>C5: Self-discipline</td>
<td>3.22</td>
<td>0.70</td>
<td>.83</td>
<td>-.45 (.05)</td>
<td>.47 (-.10)</td>
<td>-.35 (.00)</td>
</tr>
<tr>
<td>C6: Deliberation</td>
<td>3.24</td>
<td>0.60</td>
<td>.74</td>
<td>-.09 (.00)</td>
<td>-.13 (.06)</td>
<td>-.03 (-.06)</td>
</tr>
<tr>
<td>E1: Warmth</td>
<td>3.77</td>
<td>0.63</td>
<td>.83</td>
<td>-.61 (.05)</td>
<td>-.41 (.03)</td>
<td>-.68 (-.14)</td>
</tr>
<tr>
<td>E2: Gregariousness</td>
<td>3.00</td>
<td>0.74</td>
<td>.80</td>
<td>-.62 (.08)</td>
<td>-.42 (-.01)</td>
<td>-.68 (-.14)</td>
</tr>
<tr>
<td>E3: Assertiveness</td>
<td>2.99</td>
<td>0.65</td>
<td>.79</td>
<td>-.40 (.05)</td>
<td>-.23 (.13)</td>
<td>-.48 (-.03)</td>
</tr>
<tr>
<td>E4: Activity</td>
<td>3.02</td>
<td>0.56</td>
<td>.68</td>
<td>-.47 (.08)</td>
<td>-.36 (.02)</td>
<td>-.47 (-.03)</td>
</tr>
<tr>
<td>E5: Excitement-seeking</td>
<td>3.12</td>
<td>0.63</td>
<td>.63</td>
<td>-.16 (.04)</td>
<td>-.06 (-.04)</td>
<td>-.22 (.12)</td>
</tr>
<tr>
<td>E6: Positive Emotion</td>
<td>3.52</td>
<td>0.71</td>
<td>.82</td>
<td>-.64 (.07)</td>
<td>-.51 (-.14)</td>
<td>-.63 (.12)</td>
</tr>
<tr>
<td>N1: Anxiety</td>
<td>3.17</td>
<td>0.72</td>
<td>.82</td>
<td>.66 (.03)</td>
<td>.68 (.10)</td>
<td>.49 (-.04)</td>
</tr>
<tr>
<td>N2: Angry Hostility</td>
<td>2.77</td>
<td>0.69</td>
<td>.80</td>
<td>.56 (.01)</td>
<td>.63 (.07)</td>
<td>.37 (-.09)</td>
</tr>
<tr>
<td>N3: Depression</td>
<td>2.99</td>
<td>0.84</td>
<td>.85</td>
<td>.71 (.05)</td>
<td>.69 (.08)</td>
<td>.57 (.02)</td>
</tr>
<tr>
<td>N4: Self-consciousness</td>
<td>3.12</td>
<td>0.68</td>
<td>.74</td>
<td>.63 (.03)</td>
<td>.52 (-.15)</td>
<td>.60 (.09)</td>
</tr>
<tr>
<td>N5: Impulsiveness</td>
<td>3.28</td>
<td>0.59</td>
<td>.70</td>
<td>.39 (.01)</td>
<td>.38 (.10)</td>
<td>.32 (.08)</td>
</tr>
<tr>
<td>N6: Vulnerability</td>
<td>2.60</td>
<td>0.62</td>
<td>.78</td>
<td>.56 (.02)</td>
<td>.59 (.03)</td>
<td>.41 (-.07)</td>
</tr>
<tr>
<td>O1: Fantasy</td>
<td>3.40</td>
<td>0.64</td>
<td>.76</td>
<td>.04 (.01)</td>
<td>.12 (.03)</td>
<td>-.05 (-.01)</td>
</tr>
<tr>
<td>O2: Aesthetics</td>
<td>3.25</td>
<td>0.76</td>
<td>.81</td>
<td>-.12 (.01)</td>
<td>-.04 (.06)</td>
<td>-.18 (-.02)</td>
</tr>
<tr>
<td>O3: Feelings</td>
<td>3.40</td>
<td>0.53</td>
<td>.70</td>
<td>-.09 (.01)</td>
<td>.03 (.02)</td>
<td>-.20 (-.05)</td>
</tr>
<tr>
<td>O4: Actions</td>
<td>3.03</td>
<td>0.57</td>
<td>.57</td>
<td>-.31 (.06)</td>
<td>-.25 (-.04)</td>
<td>-.31 (-.08)</td>
</tr>
<tr>
<td>O5: Ideas</td>
<td>3.57</td>
<td>0.73</td>
<td>.85</td>
<td>-.04 (.03)</td>
<td>-.02 (-.01)</td>
<td>-.05 (.07)</td>
</tr>
<tr>
<td>O6: Values</td>
<td>3.89</td>
<td>0.47</td>
<td>.65</td>
<td>-.10 (.00)</td>
<td>-.12 (-.07)</td>
<td>-.06 (.08)</td>
</tr>
</tbody>
</table>

Note: $\alpha$ is Cronbach's alpha reliability. $r$ is the zero-order correlation between each personality facet and Type D scales. $sr$ is the semi-partial correlation indicating the unique contribution of personality facets over and above the Big 5 personality factors in explaining Type D scales. Significant correlations ($p < .001$) are presented in bold.

### 5.10 Prediction of Type D from Personality Factors and Facets

To examine the incremental prediction of Type D by personality facets over factors, multiple linear regressions were run. Table 5.3 reports the standardised regression coefficients for the factor-level regression, adjusted $r$-squared values for both factor- and facet-level regressions, and estimates with confidence intervals of the amount of incremental population prediction by facets. The factor-level regression coefficients were broadly similar to the correlations in highlighting the importance of neuroticism and extraversion, although agreeableness was a significant predictor for negative affectivity and continuous Type D. Overall, facets provided modest but meaningful incremental prediction of both negative affectivity and social inhibition. In contrast, facets provided minimal incremental prediction of continuous Type D. The Big 5 factors also explained substantially more variance in continuous Type D than it did for either subscale of Type D.
Table 5.3
Incremental variance explained in Type D by personality facets over personality factors

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Cont. Type D</th>
<th>Negative Affect</th>
<th>Social Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>.54</td>
<td>.66</td>
<td>.30</td>
</tr>
<tr>
<td>Extraversion</td>
<td>-.40</td>
<td>-.13</td>
<td>-.58</td>
</tr>
<tr>
<td>Openness</td>
<td>.02</td>
<td>.05</td>
<td>-.01</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>-.13</td>
<td>-.15</td>
<td>-.08</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>.03</td>
<td>.02</td>
<td>.03</td>
</tr>
</tbody>
</table>

Percentage Variance Explained

<table>
<thead>
<tr>
<th></th>
<th>$R_{adj}^2$ (factors)</th>
<th>$R_{adj}^2$ (facets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Factors</td>
<td>.71</td>
<td>.59</td>
</tr>
<tr>
<td>30 facets</td>
<td>.72</td>
<td>.65</td>
</tr>
</tbody>
</table>

Incremental Variance Explained by Facets

$$\Delta \hat{\rho}^2 = R_{adj}^2 (\text{facets}) - R_{adj}^2 (\text{factors})$$

<table>
<thead>
<tr>
<th></th>
<th>$\Delta \hat{\rho}^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Factors</td>
<td>.02</td>
</tr>
<tr>
<td>30 facets</td>
<td>.06</td>
</tr>
</tbody>
</table>

95% CI for $\Delta \hat{\rho}^2$ | [0.00 to 0.05] | [0.01 to 0.11] | [0.01 to 0.10] |

Note. Significant beta coefficients ($p < .05$) are bolded. Standardised betas are from a regression model predicting Type D scales from just the Big 5 factors. The symbol $\Delta \hat{\rho}^2$ denotes the estimated incremental variance explained in the population by a regression with 30 facets over one with 5 factors: i.e., $\Delta \hat{\rho}^2 = R_{adj}^2 (\text{facets}) - R_{adj}^2 (\text{factors})$.

5.11 Factor and Facet Differences between Type D and non-Type D Participants

To examine the factor and facet-level differences between Type D and non-Type D individuals, a series of independent t-test analyses were conducted. Table 5.4 reports the means and standard deviations for each contrast. Cohen’s d was calculated to determine the effect size of group differences. Cohen’s (2013) guidelines for interpreting effect sizes recommends the following interpretations: .2 = small, .5 = medium, .8 = large. Significant differences are presented in bold.
The largest effect sizes for the comparison of groups on the Big 5 were seen in extraversion (-1.25) and neuroticism (1.58). The results indicate that Type D participants were significantly less extraverted and more neurotic than non-Type D individuals. The effect size for each indicates a very large difference between the groups. There was a significant difference between the groups for agreeableness and conscientiousness, each with a medium effect size. There was no difference between the groups on the Big 5 factor of openness.

Table 5.4
Personality factor and facet differences between participants with and without Type D

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-Type D</th>
<th>Type D</th>
<th>Cohen's d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=145)</td>
<td>(n=123)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M  SD</td>
<td>M  SD</td>
<td></td>
</tr>
<tr>
<td>Agreeableness</td>
<td>3.67 0.38</td>
<td>3.44 0.40</td>
<td>-0.56</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>3.47 0.46</td>
<td>3.31 0.42</td>
<td>-0.40</td>
</tr>
<tr>
<td>Extraversion</td>
<td>3.48 0.38</td>
<td>2.95 0.43</td>
<td>-1.25</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>2.68 0.43</td>
<td>3.35 0.42</td>
<td>1.58</td>
</tr>
<tr>
<td>Openness</td>
<td>3.53 0.40</td>
<td>3.43 0.42</td>
<td>-0.25</td>
</tr>
<tr>
<td>A1: Trust</td>
<td>3.66 0.62</td>
<td>3.08 0.74</td>
<td>-0.78</td>
</tr>
<tr>
<td>A2: Straightforwardness</td>
<td>3.69 0.57</td>
<td>3.46 0.68</td>
<td>-0.33</td>
</tr>
<tr>
<td>A3: Altruism</td>
<td>4.14 0.44</td>
<td>3.82 0.47</td>
<td>-0.67</td>
</tr>
<tr>
<td>A4: Compliance</td>
<td>3.31 0.59</td>
<td>3.08 0.64</td>
<td>-0.36</td>
</tr>
<tr>
<td>A5: Modesty</td>
<td>3.54 0.58</td>
<td>3.62 0.64</td>
<td>0.14</td>
</tr>
<tr>
<td>A6: Tender-mindedness</td>
<td>3.66 0.43</td>
<td>3.58 0.51</td>
<td>-0.17</td>
</tr>
<tr>
<td>C1: Competence</td>
<td>3.69 0.49</td>
<td>3.48 0.46</td>
<td>-0.45</td>
</tr>
<tr>
<td>C2: Order</td>
<td>3.23 0.59</td>
<td>3.13 0.59</td>
<td>-0.17</td>
</tr>
<tr>
<td>C3: Dutifulness</td>
<td>3.84 0.52</td>
<td>3.72 0.44</td>
<td>-0.26</td>
</tr>
<tr>
<td>C4: Achievement-striving</td>
<td>3.41 0.56</td>
<td>3.26 0.66</td>
<td>-0.23</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------</td>
<td>------------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td>3.41 0.70</td>
<td>3.24 0.60</td>
<td>4.05 0.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.00 0.64</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

*Note.* Significant group mean differences based on independent samples t-test \((p < .001)\) are bolded.

At the facet level, there were several significant group differences with very strong effect sizes. The facets of *warmth, activity, positive-emotions, anxiety, angry-hostility, depression,* and *self-consciousness* all had effect sizes greater than 1. The facets of *depression* and *anxiety* had the strongest effect sizes (1.32 and 1.31 respectively). Table 5.4 reports all the significant facet-level group differences, all of which have effect sizes ranging from -.41 *excitement-seeking* to .94 *vulnerability*.
5.12 Discussion

The present study aimed to develop a richer understanding of Type D personality by examining facet-level relationships between the standard measure of Type D personality, the DS14, and the well-validated and widely utilised personality inventory, the full-scale NEO-PI-R. A discussion of the results as they relate to each of the four hypotheses is presented. In general, the overall results were consistent with previous research. The results supported two of the four hypotheses (H1 & H4), partially supported one hypothesis (H2), and did not support one hypothesis (H3).

5.12.1 Hypothesis 1: Validity and Basic Structure of Type D

The first hypothesis predicted that the Type D subscales of negative affectivity and social inhibition would demonstrate moderate to strong correlations with the Big 5 factors of neuroticism (+) and extraversion (-) respectively. Prior to investigating the basic structure of Type D in relation to the Big 5 factors, the validity of the Type D measurement scale (DS14) was assessed. The reliability and factor analyses indicated that the Type D measurement scale had good internal consistency and construct validity. As predicted, a two-factor structure of Type D emerged on which all items loaded onto their respective subscales. With the validity of the DS14 established in the current data set, all subsequent analyses were able to proceed with confidence.

As predicted, and consistent with previous research, strong correlations were observed between the Big 5 factors of neuroticism and extraversion and the Type D subscales. Neuroticism was positively correlated with negative affectivity and extraversion was negatively correlated with social inhibition. In addition to neuroticism, negative affectivity also correlated significantly with the factors of agreeableness (-), conscientiousness (-), and extraversion (-). In addition to extraversion, social inhibition also correlated significantly with agreeableness (-), conscientiousness (-), neuroticism (+), and openness (-). The observed
correlations between the Type D subscales and agreeableness, conscientiousness, and openness were weak (.20 -.35) and may only add a small amount of meaningful explanatory information to the basic structure of Type D.

The results also revealed correlations between negative affectivity and extraversion, and social inhibition and neuroticism. The size of these correlations was moderate, which indicates that there are features of both neuroticism and extraversion in both of the Type D subscales. Negative affectivity and social inhibition also correlated moderately with each other (see Table 5.1). The positive correlation between negative affectivity and social inhibition indicates a reasonable degree of convergent validity within the scales. Given that emotions such as anxiety, depression, and fear are at the core of both negative affectivity and social inhibition, reasonable convergent validity should be expected. The zero-order correlations supported this assumption. The neuroticism facet of self-consciousness demonstrated a stronger correlation with social inhibition (.60) than with negative affectivity (.52). Although self-consciousness underpins neuroticism, its features reflect emotions that are predominantly associated with social inhibition, such as shame, embarrassment, and sensitivity to ridicule (Costa & McCrae, 2008).

In terms of the variance explained in Type D by the Big 5 factors, three factors predicted both negative affectivity and social inhibition. As expected, neuroticism and extraversion each predicted both negative affectivity and social inhibition. Agreeableness also predicted negative affectivity (see Table 5.3). In terms of variance explained by the Big 5 factors, Type D could be described as largely equivalent to neuroticism and extraversion, with a small amount of disagreeableness.

5.13 Hypothesis 2: Facet-Level Examination of Type D

The second hypothesis predicted that the facets would provide significant incremental prediction of Type D personality where the facets were related to affective states.
Specifically, it was predicted that the facets of anxiety (+), depression (+), and positive emotions (-) would incrementally predict negative affectivity, and the facets of gregariousness (-) and self-consciousness (+) would incrementally predict social inhibition. The discussion of how the results relate to Hypothesis 2 is presented in two parts. First, an examination of the significant zero-order correlations is presented. Second, an examination of the semi-partial correlations is presented. The semi-partial correlations provide the information needed to determine whether Hypothesis 2 was supported, however they should be considered in the light of zero-order correlations.

5.13.1 Zero-order Correlations

The general pattern of facet-level zero-order correlations was broadly aligned with the meaning of the Type D subscales. All of the neuroticism facets reached significance and positively correlated with negative affectivity (Table 5.2). Similarly, all of the extraversion facets reached significance and negatively correlated social inhibition (Table 5.2). The reverse order of correlations was also true; all of the neuroticism facets reached significance for social inhibition, and all of the extraversion facets, bar excitement-seeking, reached significance for negative affectivity.

Other significant, yet modest, zero-order correlations between negative affectivity and the facets were observed, such as vulnerability (+), trust (-), self-discipline (+), and impulsiveness (+). An interpretation of these relationships might suggest that along with the experience of negative emotions, negative affectivity could be described as an inability to cope with stress or difficult situations (vulnerability), increased tendency to see others as untrustworthy or dangerous (trust), reduced distractibility when undertaking tasks (self-discipline), and an increased inability to resist urges or cravings (e.g. food or cigarettes; impulsiveness). Similarly, social inhibition correlated significantly with facets such as altruism (-), and depression (+). An interpretation of these relationships might suggest that
social inhibition could be thought of not only as feelings of fear of judgement and rejection from others, but also as a tendency to be inwardly focused, self-centred, and unconcerned with the problems of others, while at the same time experiencing feelings of guilt, sadness or loneliness.

The relationship between the agreeableness facet of trust was moderately negatively correlated with both negative affectivity (-.49) and social inhibition (-.44). The NEO-PI-R manual describes the facet of trust as ‘a disposition to believe that others are honest and well intentioned’ (p.17; Costa & McCrae, 2008). The relationships observed in the present study suggest that as both negative affectivity and social inhibition increase, a person’s willingness or tendency to be trustful of others decreases. Low scores on the trust facet scale indicate a tendency to be sceptical and cynical in life, and possess the belief that other people are dangerous (Costa & McCrae, 2008). The description seems very apt for Type D personality. The definition of negative affectivity, as it relates to Type D personality, describes individuals who tend to hold a negative view of the world and others, while perceiving their environment as hostile and frequently scanning it for threats (Denollet, 2000). The theoretical relationship between negative affectivity and trust has been supported by empirical evidence. Individuals high in negative affectivity were found to have greater amygdala reactivity in response to threatening stimuli compared to individuals low in negative affectivity (Kret et al., 2011).

5.13.2 Semi-partial Correlations

After controlling for the Big 5 factors, the semi-partial correlations revealed that two of the predicted correlations had reached significance: gregariousness with social inhibition (-) and positive emotions with negative affectivity (-). These relationships can be intuitively understood. As negative affectivity is characterised by negative emotions, an inverse relationship with a measure of positive emotions should be expected. Similarly, a socially
inhibited individual is unlikely to seek and enjoy the company of others, which is the central aspect of *gregariousness* (Costa & McCrae, 2008). Along with the two expected semi-partial correlations, four unexpected semi-partial correlations were observed. The extraversion facet of *assertiveness* (+) and the neuroticism facet of *self-consciousness* (-) provided incremental prediction for negative affectivity, while the extraversion facets of *warmth* (-) and *activity* (+) provided incremental prediction of social inhibition.

The semi-partial correlations between negative affectivity and both *assertiveness* (+) and *self-consciousness* (-) were surprising and less easily explained than the predicted semi-partial correlation with *positive emotions*. The *assertiveness* relationship suggests that as negative affectivity increases, so does the tendency to exhibit more assertiveness qualities such as dominant or forceful behaviour, and even leadership qualities (Costa & McCrae, 2008). The *self-consciousness* relationship suggests that people with higher levels of negative affectivity are likely to experience fewer feelings of embarrassment or discomfort around others (Costa & McCrae, 2008). These relationships are difficult to explain and, to some extent, appear counter-intuitive. One possible explanation could be that people with high levels of negative affectivity may require a degree of assertiveness and self-confidence to be able to verbalise psychosomatic complaints, or express their negative emotions, to others. Along with a requirement for assertiveness, the ability to convey personal, sensitive, and potentially embarrassing health information to others may also require a reduced sense of self-consciousness on the part of the individual.

The semi-partial correlations between social inhibition and both *warmth* (-) and *activity* (+) were more easily reconciled with Type D theory. The *warmth* relationship suggests that as social inhibition increases, the tendency to seek affection or friendship with others decreases. The relationship also suggests that socially inhibited individuals are more likely to be emotionally distant and reserved (Costa & McCrae, 2008). Based on the descriptions of
warmth and activity, it could be argued that they contribute most to the moderate overlap of social inhibition and extraversion. While the behaviours and tendencies described for warmth do reflect those of a socially inhibited individual, they are not necessarily contingent on social interaction. The behaviours and tendencies related to warmth are primarily associated with introversion, and would likely be present in an introverted individual who is also quite comfortable in social situations. The facet, in this case, simply reflects a preference for the type and amount of social interaction that an individual may seek, rather than behaviours designed to reduce fear and anxiety associated with social interactions. The activity relationship may offer insight into why socially inhibited individuals are less likely to form close attachments with others. The activity facet relates to a tendency to possess a need to keep busy and active (Costa & McCrae, 2008). The need to keep busy and active could be interpreted as a means of avoiding social engagements (i.e. because the individual is ‘too busy’ to attend). However, again, it may simply be a reflection of a lesser need to spend time forming and developing meaningful relationships rather than a social avoidance strategy per se. These results are interesting as they may indicate that social inhibition, as it pertains to Type D personality, is not simply characterised by the more obvious traits of increased self-consciousness or decreased assertiveness, but that it also speaks to a reduced need for, or willingness to seek, personal intimacy and close attachments with others.

Although two of the five predicted semi-partial correlations were significant, three were not significant. Specifically, the predicted semi-partial correlations between negative affectivity and both depression and anxiety facets were not significant. Also, the predicted semi-partial correlation between social inhibition and self-consciousness was not significant. When considering why these predicted relationships did not reach significance, it is important to note how the meaning of facets can change substantially once the Big 5 factors are partialled out. Arguably, neuroticism has negative affectivity at its core and the centrality of
negative affectivity to neuroticism may explain why facets like depression and anxiety correlated substantially with negative affectivity, but did not provide significant incremental prediction after neuroticism was partialled out. In other words, the negative affectivity component of Type D, as it relates to aspects of depression and anxiety, can be accounted for by the broader trait of neuroticism. The same centrality could be assumed for social inhibition and introversion. Social inhibition correlated negatively with extraversion, which indicates that it is closely related to introversion. A possible explanation of why self-consciousness did not incrementally predict social inhibition may be because social inhibition represents a dominant feature of introversion. Hence, introversion (as measured by the extraversion factor) may fully account for the characteristics of social inhibition that relate to feelings of self-consciousness.

5.14 Hypothesis 3: Continuous Representations of Type D

The third hypothesis predicted that a continuous representation of Type D would achieve a similar level of prediction from the Big 5 factors as did negative affectivity and social inhibition. Additionally, it was also predicted that a continuous representation of Type D would achieve the same incremental prediction from the facets, as the negative affectivity and social inhibition subscales. The continuous representation of Type D correlated significantly with each of the Big 5 factors except for openness. There was a moderate correlation between continuous Type D and extraversion, and a strong correlation with neuroticism.

The Big 5 factors explained more of the variance in continuous Type D than in the subscales. Interestingly, and contrary to expectation, the facets did not predict any incremental variance in continuous Type D. These results cast some doubt over the idea that Type D is a novel construct. With no incremental prediction from the facets, there is reason to question whether a continuous representation of Type D is sufficiently different from neuroticism and extraversion. The observation that the subscales appear to be more distinct
from the Big 5 factors than in continuous Type D may indicate that some of the predictive power of Type D has potentially been masked by the dichotomous way that it is typically scored.

There is substantial evidence (Ferguson, Williams, O'Connor, et al., 2009; Haslam et al., 2012) that personality traits are more accurately conceptualised as continuous constructs rather than dichotomous ones. From this perspective, Type D is a formative rather than reflective construct that, in specific terms, combines negative affectivity and social inhibition. Furthermore, there is a substantial literature that critiques formative constructs (Edwards, 2010). The general argument is that formative constructs obscure the causal and correlational relationships between underlying variables. Thus, while there may be clinical utility in having a short-form dichotomous measure as a clinical decision-making tool, there is also an argument that it is less than ideal for more fundamental public health research.

5.15 Hypothesis 4: Factor and Facet-level Personality Differences between Type D and non-Type D Individuals

The fourth hypothesis predicted that Type D individuals would exhibit significantly lower extraversion, and significantly higher neuroticism, than non-Type D individuals. Furthermore, the facets related to affective states (anxiety, depression, positive emotions, gregariousness, and self-consciousness) would be significantly different in Type D individuals compared to non-Type D individuals.

As predicted, Type D participants were significantly higher in neuroticism and lower in extraversion than non-Type D participants. The effect sizes (based on Cohen, 2013) for both neuroticism and extraversion were very strong, indicating a very large difference between the groups for each factor. The results are consistent with Type D personality theory, insofar as high neuroticism is associated with high negative affectivity, and low extraversion (or high introversion) is associated with high social inhibition. Two further group differences were
observed for the Big 5 factors – agreeableness and conscientiousness. Type D individuals were significantly less agreeable and conscientious than non-Type D individuals. The agreeableness and conscientiousness group differences each had a moderate effect size. The finding that Type D individuals are less agreeable than non-Type D individuals indicates a tendency to be somewhat egocentric, sceptical and competitive (Costa & McCrae, 2008). The finding that Type D individuals are also characterised by low conscientiousness indicates that they are less likely to be able to control impulses, or be effective at planning, organising, and completing tasks than non-Type D individuals (Costa & McCrae, 2008). These behaviours, when applied in a health and wellbeing context, could be interpreted as a tendency to be self-absorbed in one’s own maladies and somatic complaints, while at the same time feeling as though others cannot be trusted to help if asked. Low agreeableness may mean that health problems become inwardly focused on by a Type D individual rather than outwardly addressed with social or medical support. Additionally, low conscientiousness may see health problems exacerbated by the tendency of Type D individuals to not adhere to positive health behaviours or complete treatment regimens.

The facet-level group differences reflected the factor-level differences. The Type D and non-Type D groups differed significantly on all of the extraversion and neuroticism facets. The strongest effect sizes from the neuroticism facets were depression and anxiety. The effect sizes for the depression and anxiety facets were very large, indicating two important points of distinction between Type D and non-Type D individuals. The results are unsurprising and reflect the rationale of Hypothesis 2 (i.e. that facets related to affective states would significantly predict negative affectivity and social inhibition). Although the depression and anxiety facets did not add incremental prediction to negative affectivity, these results demonstrate the importance and centrality of the constructs to understanding Type D personality.
The extraversion facets that demonstrated the largest group difference effect sizes were gregariousness and positive emotions. The effect sizes for these two facets were also very strong. Although positive emotions is an extraversion facet, the zero-order correlations in Table 5.2 demonstrate that negative affectivity also correlates moderately with it. Interestingly, the correlations in Table 5.2 show that the strongest correlate with positive emotions was continuous Type D.

The significant facet-level group differences demonstrated that the groups differed on each of the predicted facets that were related to affective states, providing support for Hypothesis 4. However, the groups also differed on many more facets that were not predicted. For example, the facets of altruism (agreeableness) and actions (openness) differed with medium to large effect sizes. In fact, the groups differed significantly on 17 out of 30 facets, with the lowest effect size being -.41 (excitement-seeking). The breadth of facets on which the Type D and non-Type D groups differed could be considered as support for the idea that Type D is a personality typology that identifies a subgroup of people with considerably different personality profiles compared to those of the general population.

5.16 Summary, Implications, and Limitations

5.16.1 Summary of the Findings

At the factor-level, strong positive associations were observed between neuroticism and negative affectivity, and strong negative associations were observed between extroversion and social inhibition. Extending beyond the factor-level, facets explained a moderate amount of incremental variance in both negative affectivity and social inhibition. Specifically assertiveness, positive emotion, and self-consciousness provided incremental information about negative affectivity. In addition, warmth, activity, and gregariousness provided incremental information about social inhibition.
Taken together, the results of the zero-order and semi-partial correlations illustrate a clear picture of negative affectivity and social inhibition as measured by the DS14. The zero-order correlations may be interpreted as showing that negative affectivity represents a tendency to experience emotions such as guilt, sadness, tension, frustration, and anger (Costa & McCrae, 2008), and this is consistent with Type D personality theory. In addition, new information about the characteristics of negative affectivity was observed. The results showed that other facets correlate to a reasonable degree with negative affectivity, such as vulnerability (+), trust (-), self-discipline (+), and impulsiveness (+). Similarly, the zero-order correlations showed that social inhibition represents a tendency to experience emotions such as shame or embarrassment in social situations, and to be overly-sensitive to ridicule. These descriptors are also consistent with Type D theory. However, again, other facets correlated significantly with social inhibition, such as altruism (-), and depression (+). The additional significant factor and facet relationships suggest that there may be more complexity to Type D than first thought.

The results of the facet-level examination demonstrate that there are aspects of negative affectivity and social inhibition that cannot be fully accounted for by trait neuroticism or extraversion. These findings offer support for the suggestion that the Type D, to some extent, is distinct from neuroticism and extraversion and may represent a novel contribution to the personality literature. It is important to note that a substantial amount of variance was explained by neuroticism and extraversion, however the incremental prediction of six facets was significant and, therefore, meaningful to the theory of Type D.

The Big 5 factors explained substantially more variance in continuous Type D than it did for either subscale of Type D. Additionally, the facets did not predict any incremental variance for continuous Type D. The results point to the possibility that combining negative
affectivity and social inhibition to form a continuous model of Type D may result in a loss of unique prediction from each subscale.

Finally, the results of the factor and facet group difference analyses between Type D and non-Type D individuals showed that the predicted differences occurred. The groups differed significantly on extraversion and neuroticism, with the effect sizes indicating a very large difference between the groups. The finding that the Type D and non-Type D groups differed significantly on 17 out of 30 facets, and four out of five factors, adds weight to the claim that Type D is a personality typology that is different to ‘average’ personality profiles within the general population.

5.16.2 Implications

Firstly, the results contribute to the debate in the literature regarding the validity and novelty of Type D personality. Both the two-factor structure and the absence of item cross-loading in the present study is consistent with previous Type D validity research. Of particular importance is the finding that six NEO facets provide incremental prediction of negative affectivity and social inhibition. These results are a positive first step in addressing the issue of the supposed lack of novelty and uniqueness of Type D personality. While there is a good deal of overlap between the Type D subscales and the Big 5 factors, there is evidence to indicate that negative affectivity and social inhibition represent more than trait neuroticism and trait extraversion. Future research could aim to replicate and extend these findings. A facet-level analysis of Type D in clinical samples may reveal different mechanisms of personality at play. Alternatively, the facets of Type D personality could be investigated with an alternative instrument, such as the HEXACO Personality Inventory (Lee & Ashton, 2004) or the Multidimensional Personality Questionnaire (Tellegen, 1982).
Further research may be informed by the Type D and non-Type D group differences that are presented in the present thesis. The range of factor and facet differences suggests that the Type D personality profile may be a lot more complex than previously assumed. Replication of the facet-level examination would help to support the findings of the present thesis, as well as start to build a clearer picture of the particular personality characteristics that underpin the Type D profile beyond negative affectivity and social inhibition. Such information may further our understanding of the behaviours, beliefs, and perceptions that are associated with Type D. A better understanding of Type D-related behaviours, beliefs, and perceptions would, in turn, facilitate the development of more targeted cognitive and behavioural therapeutic approaches.

From a practical perspective, the findings may assist in designing effective interventions for individuals with Type D personality. For example, social skills training may be an effective intervention aimed at improving traits that may negatively influence health behaviours if underdeveloped, such as assertiveness, warmth and gregariousness. Mindfulness training or cognitive behaviour therapy may enable a person with Type D to identify and manage their negative emotions, distrust of others, and feelings of vulnerability.

The present findings also have implications for future Type D research. The issue of whether a dichotomous representation of Type D is theoretically and statistically valid has been touched on in the present study. The evidence indicates that a continuous additive representation of Type D (i.e. NA+SI) is meaningfully different to negative affectivity and social inhibition where variance is accounted for by the Big 5 factors and their facets. Future research could aim to further investigate the questions of how best to represent Type D personality. Perhaps dichotomous Type D is optimal for use in clinical settings but a continuous representation may be more appropriate for research.
5.16.3 Limitations

This study contains several limitations that should be noted. First, while the use of the NEO-PI-R is advantageous in terms of its highly regarded psychometric properties, the instrument, and the Big 5 theory generally, are primarily descriptive (Smith & Williams, 1992). Hence, it was only possible to identify what elements of personality are represented by Type D. The important questions of why or how those elements influence health can only be speculative for now. The inability to infer causation was compounded by the correlational nature of the study. Thus, causal mechanisms that underpin the observed relationships between the Five Factor Model and Type D could not be identified.

Second, participants were recruited using Australian social media platforms. While such a sampling strategy generated a diverse sample of Australian adults, future research could investigate the robustness of findings in a range of other populations including non-Australians or people with chronic conditions such as diabetes, cardiovascular disorders, or obesity.

Third, the present study used a data analytic approach based on observed variables. While this approach provided particular benefits in obtaining unbiased estimates of incremental facet prediction, future work could consider bifactor modelling and other latent variable approaches to examine latent structural relations (e.g., McAbee, Oswald, & Connelly, 2014).

Fourth, the length of the questionnaire may have limited the collection of data. The NEO-PI-R is a 240 item scale, and with the addition of the DS14 and demographic variables, the entire survey was 259 items long. It is possible that participants became bored or fatigued while completing the survey and may have elected to quit the survey rather than finish it and submit their data.
5.17 Conclusion

Despite the limitations, the present study makes several contributions to the understanding of Type D personality. In particular it is the first published study, to the author’s knowledge, to identify the unique contribution of personality facets over personality factors in explaining Type D. It has helped reveal subtleties of the nature of Type D that broad personality measures such, as the Big 5 factors, are less able to detect. In addition, the incremental prediction of Type D by the facets provides modest preliminary evidence of the novelty of Type D personality. The research highlights how a continuous composite of the Type D subscales tends to smooth over the unique facet contributions. The continuous representation of Type D was quite well-explained by the Big 5 factors, in contrast to the separate subscales. Finally, the comparison of Type D and non-Type D Big 5 factor and facet profiles clearly demonstrates the scope and size of personality differences between individuals with Type D personality and those without Type D personality. It is hoped that this research will contribute meaningfully to the debate in the literature regarding the novelty of Type D personality, as well as stimulate research to further question whether Type D personality should continue to be represented as a dichotomous type.

The results of the present study have been used to develop the second avenue of enquiry in the present thesis. Given that the evidence in Study 1 supports the claim that Type D personality is a novel and valid construct in personality research, its application in a previously untested population would now be justified. At the time of writing, no published study had investigated the prevalence of Type D personality in the Australian general population. Hence, Study 2 aimed to address this issue.

Along with assessing the prevalence of Type D in the Australian population, Study 2 also aimed to build on the findings in Study 1 that relate to the uniqueness of Type D personality. Study 1 found support for the claim the Type D is, to some extent, different to neuroticism
and extraversion. This criticism will be examined again in Study 2, this time by determining whether neuroticism mediates a relationship between Type D and social support, and a relationship between Type D and health behaviour.
CHAPTER 6 - EVIDENCE FOR THE PRESENCE OF TYPE D PERSONALITY IN THE AUSTRALIAN GENERAL POPULATION: A PREVALENCE STUDY

In Chapter 5, reasonable evidence of the novelty and validity of the Type D personality construct was established via a Big 5 factor and facet-level examination of negative affectivity and social inhibition. The incremental prediction of particular facets over the factors demonstrated modest evidence that Type D personality is not simply a re-branding of neuroticism and extraversion. Furthermore, the findings adequately established that the Type D personality construct does represent a novel and meaningful contribution to the personality trait literature. Therefore, based on the results of Study 1, the continued application of Type D personality theory to health research was merited.

In Study 2, the primary aim of the research was to establish an estimation of the prevalence of Type D personality in the Australian general population. To date, there is limited Type D research where Australian samples have been utilised. Of the published Australian-based papers, only specific and non-representative populations have been tested (e.g. female participants only, Borkoles et al., 2015; cardiac patients, Tully et al., 2011). Although no published study has provided a prevalence estimate for Type D in the Australian population, a number of prevalence estimations have been published for other countries. For example, the Type D literature shows prevalence estimates for populations that include (but not limited to) the UK and Ireland (Williams et al., 2008), Korea (Lim et al., 2011), Israel (Zohar et al., 2011), Iceland (Svansdottir, Denollet, et al., 2013), and Poland (Ogińska-Bulik & Juczyński, 2009). A summary of Type D prevalence studies can be found in Section 4.2.

The benefit of estimating the population prevalence of any condition or construct lies in the increase in ability to forecast the resources that primary and secondary care agencies may require to manage the impact of the condition or construct under examination. Establishing
the estimated prevalence of Type D in the Australia population could help to identify a factor
that may contribute to the incidence of chronic illnesses. Type D has been found to represent
a four-fold increase in cardiovascular disease (Denollet et al., 2013) and 15-fold increased
odds of emotional distress in patients with type 2 diabetes (Nefs et al., 2015).

Compared to non-Type D individuals, individuals with a Type D personality profile have
been found to engage in fewer positive health behaviours (e.g. regular exercise, healthy diet;
Williams et al., 2008) and more negative health behaviours (e.g. smoking, excessive alcohol
consumption; Gilmour & Williams, 2012). In addition, Type D individuals are more likely to
adopt passive or avoidant coping styles with regards to their health (Bergvik et al., 2010), and
feel that they have limited social support to draw upon (Williams et al., 2008) compared to
non-Type D individuals. Having a Type D personality profile has also been associated with
poor medication adherence (Molloy et al., 2012; Williams, O'Connor, Grubb, & O'Carroll,
2011a), and increased utilisation of healthcare services (Michal, Wiltink, Grande, Beutel, &
Brähler, 2011). Each of the health-related behaviours or perceptions mentioned above has
been found to contribute significantly to the development of a number of high-prevalence and
high-impact chronic illnesses that contribute significantly to the overall burden of illness in
Australia. It is impractical to undertake a prevalence study to search for a cluster of
behaviours and/or perceptions that may place individuals at a higher risk of chronic illness
onset. It is practical, however, to undertake a population prevalence study for a single
construct, such as Type D personality, which is associated with each of the health-related
behaviour and perceptions noted previously.

A further benefit of establishing the prevalence of Type D personality within the
Australian population would be to allow healthcare clinicians, researchers, and policy-makers
to determine the magnitude of individual, social, and economic risk that could be associated
with having a Type D personality. Estimating the magnitude of risk would help to determine
how much, or how little, attention and resources should be allocated to Type D and its associated health-related behaviours and perceptions. For example, if the prevalence of Type D in the Australian population was similar to that in a socio-culturally similar country like the UK (38%, Williams et al., 2008), the magnitude of risk to the Australian healthcare system could be considerable. Potentially, over one third of the population could be considered at higher risk of engaging in deleterious health behaviours (such as poor diet, smoking, and excessive alcohol consumption) that are known risk factors for a number of chronic and costly conditions.

Ideally, a reduction in the incidence and prevalence of chronic illness would be achieved via the use of prevention strategies. An early identification of Type D personality in pre-morbid individuals could allow clinicians and their patients to optimally manage the negative health behaviours and perceptions that are associated with Type D. Similarly, for individuals with an existing chronic illness, treatment plans could be re-assessed to include behavioural and psychological interventions to help attenuate the effects of Type D-related poor health behaviours and perceptions. Prevention strategies and interventions could, to some degree, attenuate the potential impact of Type D-related behaviours and perceptions, but only if Type D has first been identified as a risk factor for a significant percentage of the population.

6.1 Study Background

The primary focus of the present study was to estimate the prevalence of Type D personality within the Australian general population. Study 2 also aimed to extend the findings of Study 1. Specifically, Study 2 further explored one of the criticisms of Type D personality, that it is not a novel or valid construct. A discussion of each issue in relation to the development of the aims of the study is presented.
6.1.1 Prevalence Studies

A review of the psychological and human factors literature pertaining to methods of survey data collection and human information technology usage was undertaken. Very little recent literature that evaluated methods of prevalence studies was found. The apparent lack of recently published research evaluating the methodology of prevalence studies may simply reflect a general acceptance of established methods without a perceived need for revision or modification.

6.1.1.1 Search Strategy

Papers were sourced from four relevant computer databases. The four databases, MEDLINE Central, PsycINFO, Global Health, and PsycARTICLES, were accessed through EBSCO Host. Only English language, published, peer-reviewed papers that included an evaluation of population prevalence methods found via the key search terms (below) were included. Searches included combinations of the following groups of key terms: 1) population, 2) prevalence stud*, and 3) epidemiolo*. Including the search term of ‘prevalence’ without the addition of ‘stud*’ resulted in an unmanageable number of returns (300,000+). Adding ‘stud*’ reduced the return rate to articles with the terms ‘prevalence study/studies’ in the title. This search strategy aimed to maximise the potential of sourcing all relevant published papers. Searches were last conducted in March 2016.

Papers were included in the search if they: 1) specifically examined the methodology and utility of research designs, 2) were published from 2000 onwards, and 3) were written in English. Papers were excluded from the search if they were reporting the prevalence of a specific condition rather than reviewing prevalence research in general. Prior to applying the exclusion criteria, 43 papers were identified. All 43 papers were then read and further assessed against the inclusion and exclusion criteria. This process resulted in the removal of 42 papers, leaving only one paper for inclusion in the design rationale. The
paper included in the present review was *A tool for assessing the usefulness of prevalence studies done for surveillance purposes: the example of hypertension* diseases (Silva, Ordúñez, Rodríguez, & Robles, 2001). The 42 papers that were excluded each reported data pertaining to a population prevalence study of a particular condition, rather than a review of the utility of population prevalence studies *per se*.

### 6.1.1.2 Rationale for Undertaking a Prevalence Study

Prevalence studies are becoming an increasingly popular means of surveilling population risk factors for chronic, non-communicable. They are often used to highlight aspects of public health that may require attention from researchers or policy-makers. They can provide a baseline for the comparison of future data collection. The inspection of prevalence data over multiple measurement points can elucidate shifts in, or features of, chronic illnesses over time (Silva et al., 2001). An important consideration of any prevalence study design is to ensure it is both replicable and comparable with other data.

### 6.1.2 Novelty of Type D personality

Study 2 aimed to further investigate one of the criticisms of Type D personality, that it is simply another name for neuroticism (Lespérance & Frasure-Smith, 1996). The criticism was discussed in detail in section 5.1.1. Study 1 found modest evidence that Type D represented a typology that was more than simply neuroticism and extraversion. Study 2 replicated the methodology of the Williams et al (2008) study which also aimed to investigate the novelty of Type D personality. Williams et al (2008) aimed to determine if any significant relationships between Type D and health behaviours, and Type D and social support, remained after controlling for the effects of neuroticism. Hence, Study 2 also aimed to investigate the same relationships with data from the Australian general population.

### 6.2 Aims and Hypotheses

The prevalence study had three primary aims:
1) To estimate the prevalence rate of Type D personality in the Australian population.

2) To determine if Type D personality is associated with reduced levels of perceived social support and a reduced number of positive health behaviours in an Australian sample.

3) To determine whether any significant relationships between Type D and social support, and Type D and health behaviours, remained significant after controlling for the effects of neuroticism.

It was hypothesised that:

1) The estimated prevalence rate of Type D personality in the Australian general population would not be significantly different from the estimated Type D prevalence rate in the UK and Ireland (38.5%; Williams et al., 2008).

2) Type D participants would report fewer positive health behaviours and perceive less social support than non-Type D participants.

3) Any significant relationship between Type D and social support, and Type D and health behaviours, would remain significant after controlling for the effects of neuroticism.

6.3 Method

6.4 Rationale for the Selection of the Method

As there has been no published study of the prevalence of Type D personality in the Australian general population, it was deemed prudent for the methodology in the present study to be guided by Type D prevalence studies from other countries. Of the published prevalence studies available during the design phase of the present study, the populations that
logically shared the most sociocultural and political similarities to Australia, were the UK and Ireland. Hence, the method was designed to replicate and extend a Type D prevalence study based on the populations of the UK and Ireland (Williams et al., 2008). The major benefit of replicating an existing study is the ability to compare findings. Without a point of comparison, the meaning of the results of a prevalence study would be less clear.

6.4.1 Selection of Measurement Instruments

The selection of measurement instruments and statistical analyses for the present study were guided the Williams et al (2008) study. The measurement instruments consisted of the DS14, General Preventative Health Behaviours Checklist, Quality of Social Network and Social Support Scale, and the neuroticism subscale of the Eysenck Personality Questionnaire. Each instrument is described in section 6.5. The administration of one scale was modified in the present study. The General Preventative Health Behaviours checklist is a 29 item scale that measures the type and frequency of health-related behaviours (described in section 6.6.2). Williams et al (2008) elected to include eight items from the checklist, however the present study included all 29 items. The decision to deviate from the methodology of the study upon which the present research is based, was due to the desire to extend our understanding of the relationship between Type D and health behaviours. Whereas Williams et al (2008) chose to focus on specific health behaviours, the present study will investigate the relationship between Type D and a more global assessment of health-related behaviour.

6.4.2 Selection of Data Collection Process

The data collection process for Study 2 was the same as that utilised in Study 1. Details of the process, and the rationale for its selection, are outlined in section 5.3.2.

6.4.3 Calculation of Minimum Sample Size for a Population Prevalence Estimate

Prior to commencing recruitment, the minimum sample size required for a prevalence study was calculated. Daniel (2009) proposed a relatively straight forward calculation to
determine a minimum sample size for a prevalence study, with 5% precision (i.e. 1.96
standard errors of the estimate equal to 0.05). The formula is represented as:

\[ n = \frac{Z^2 P(1-P)}{d^2} \]

where

- \( n \) = sample size
- \( Z \) = \( Z \) statistic for a level of confidence (1.96 standard errors)
- \( P \) = expected prevalence rate in proportion of one (e.g. 30\% = 0.3)
- \( d \) = precision in proportion of one (e.g. 5\% = 0.05)

In order to determine the precision (\( d \)), the rule-of-thumb proposed by Naing, Than, and Rusli (2006) was used. These authors recommended a precision value of 5\% (0.05) if the prevalence estimate is between 10\% and 90\%. For estimates outside this range, a precision value of 1\% (0.01) is recommended. The calculation also required an estimate of the prevalence being sought (\( P \)). Given the sociocultural similarities between the Australian population and the population of the UK and Ireland, it was considered reasonable to expect the rates of Type D personality to be similar. On that basis, the prevalence estimate for the Australian population was set at 38.5\% (0.038), in line with the rate identified by Williams et al (2008). After substituting values:

\[ n = 1.96^2 \times 0.38(1-0.38) \]

\[ n = 3.84 \times \frac{0.38-0.62}{0.05^2} \]

\[ n = 3.84 \times \frac{0.38-0.62}{0.0025} \]

\[ n = \frac{0.9216}{0.0025} \]
\[ n = 368 \]

From this basis, a sample of at least 368 participants was needed to detect a population prevalence of 38%, with a 95% confidence interval (33%-43%). The final sample size in Study 2 exceeded the minimum sample size by approximately 2.5 times. The size of the sample was attributed to a very successful social media recruitment exercise which saw a very fast take-up of the questionnaire.

6.5 Participants

The participants were recruited via the same method outlined in Study 1, section 5.3.2. The recruitment period took place between February 2012 and July 2014. Of the 1,020 participants who completed the study, data from 955 were used in the analyses. Cases were excluded in the basis of: 1) greater than 10% missing data, or 2) were not an Australian resident at the time of assessment. Missing data were replaced using median substitution. The highest Mahalanobis value within the data set did not exceed the critical value for three predictor variables (16.27), hence no multivariate outliers were detected.

The gender distribution had a strong female bias, with 20.3% \((n=194)\) male and 79.7% \((n=761)\) female participants. The possible impact of a gender bias in the sample will be considered in Chapter 8.

The age distribution indicated that 46.5% \((n=444)\) of participants were in the 18 – 25 years range, 23.5% \((n=224)\) were in the 26 – 35 years range, 13.0% \((n=124)\) were in the 36 – 45 years range, 10.9% \((n=104)\) were in the 46 – 55 years range, 4.1% \((n=39)\) were in the 56 – 65 years range, and 2.1% \((n=20)\) were in the 65+ years range. Of the sample, 24% \((n=229)\) had completed a secondary education, 38% \((n=363)\) had completed undergraduate education, 14.3% \((n=137)\) had completed post-graduate education, 7.2% \((n=69)\) completed a trade qualification, 4.8% \((n=46)\) listed their education level as ‘other’, and 11.6% \((n=111)\) elected not to supply educational attainment information. The possible impact of an education bias in
the sample will be considered in Chapter 8. The sample included 37 individuals (3.9\%) who identified as indigenous Australians. The percentage of indigenous participants is slightly higher than the proportion of indigenous Australians within the overall Australian population (3\%; ABS, 2016).

6.6 Measures

Along with basic demographic information, the study collected participant data using four formal measures of personality and health. First, Type D personality was assessed via the standard Type D measurement instrument, the DS14. The second instrument was the General Preventative Health Behaviours Checklist, which is designed to assess the frequency of health-related behaviours. Third, the participants perceived level of social support was measured with the Social Network and Support Scale. Finally, the neuroticism subscale of the Eysenck Personality Questionnaire was administered. Each formal measure, and the basic demographic information collected, is described below.

6.6.1 Demographic Information

The demographic information collected from each participant was age, gender, country of birth, level of education, and primary language spoken.

6.6.2 Type-D Personality

The DS14 scale information is presented in Study 1, section 5.5.2. In the present study both DS14 subscales were internally consistent (Cronbach’s alpha of 0.89 (NA) and 0.88 (SI)).

6.6.3 Health Behaviours

The second measure used in the present study was the General Preventive Health Behaviours Checklist (Amir, 1987; see Appendix C). The General Preventive Health Behaviours Checklist examines specific preventative health-related behaviours and provides
a global index of health behaviour ranging from 0 to 29. The General Preventive Health Behaviours Checklist requires participants to indicate to what degree they perform 29 different health-related behaviours, each assessed on a 3-point scale. The scale points are 0= do not do it, 1= sometimes do it, and 2= yes always, or almost always do it. Sample items from this scale include ‘Do not smoke’, ‘Limit alcohol intake’, and ‘Get a regular medical check-up’. Williams and colleagues (2008) reported a Cronbach’s alpha statistic of .42 for the scale, which suggests low internal consistency. The alpha statistic obtained by Williams et al (2008) may have been influenced by the decision to use only eight of the 29 checklist items. The authors stated that the items were intended to be used as stand-alone measures, rather than comprise a single scale. In the present study the internal consistency of all 29 items was good (Cronbach’s alpha = .77).

6.6.4 Social Support

A shortened version of the Quality of Social Network and Social Support Scale (Dalgard et al., 1995; see Appendix D) questionnaire, which is a 9 item measure of the total level of a participant’s reported quality of support from friends and family, was also administered. Participants were requested to indicate their degree of agreement with the item responses provided. Scale response options varied between items, with either three or four response options from which to choose. Sample items from this scale include ‘How strongly do you feel attached to your close family?’, ‘Do you feel closely attached to your friends?’, and ‘Do you feel apart, even among friends?’ Williams et al (2008) made a case for excluding one subscale from this measure (support from neighbours) on the basis that the item was considered to limit the predictive validity of the measure of their sample. As they did not encounter any methodological issues with the removal of scale items, the present study also omitted the same items. The internal consistency of this scale in the present sample was found to be very good (Cronbach’s alpha = .82).
6.6.5 Neuroticism

The final measure used in this study was the neuroticism subscale of the revised Eysenck Personality Questionnaire (Eysenck, Eysenck, & Barrett, 1985; see Appendix E). The 12 item neuroticism subscale required participants to indicate yes/no responses to each sale item. Sample items from the neuroticism subscale include ‘Do you worry too long after an embarrassing experience?’, ‘Are you a worrier?’, and ‘Are your feelings easily hurt?’ The internal consistency of the scale in the present sample was found to be very good (Cronbach’s alpha = .86).

6.7 Procedure

Ethics approval was obtained from the Deakin University Human Research Ethics Committee (see Appendix H). The study design and questionnaire administration was the same as that outlined in Study 1, section 5.3. Participants completed the DS14, Quality of Social Network and Social Support Scale, General Preventative Health Behaviour Checklist, and Eysenck Neuroticism subscale, in that order. The questionnaire, which consisted of 70 items, took approximately 15-20 minutes to complete.

6.8 Data Analytic Method

In order to replicate the Williams et al (2008) prevalence study and obtain comparable results, the data analytic method used by Williams et al (2008) was also replicated. An overview of each analysis is presented, along with a description of the variables in Study 2.

6.8.1 Variables

In the comparison of Type D and non-Type D individuals on the measures of health behaviours and social supports, Type D personality was the independent variable. The dependent variables were level of perceived social support and number of reported positive health behaviours. In the formal test of mediation, Type D personality was the causal
variable, while social support and health behaviours were outcome variables. Neuroticism was the mediating variable.

6.8.2 Prevalence Estimation

The prevalence of Type D personality was determined simply as a percentage of participants who met the traditional dichotomous criteria for Type D personality (see section 5.2.2). In order to compare the rate of Type D in the Australian sample with that of the Williams et al (2008) sample from the UK and Ireland, a chi square goodness of fit analysis was undertaken using the respective proportions of Type D and non-Type D from each sample.

6.8.3 Type D, Health Behaviour, and Social Support

In order to compare Type D and non-Type D participants on their reported health behaviours and perceived social support, a one-way between-groups multivariate analysis of variance (MANOVA) was performed.

6.8.4 Formal Test of Mediation

The final analyses were formal tests of mediation that were designed to determine if any significant relationship between Type D and health behaviour, or Type D and social support, would remain significant while controlling for the effects of neuroticism.

6.9 Results

Before the analyses were conducted, assumption checks for each analysis were undertaken following the guidelines recommended by O’Rourke, Psych, and Hatcher (2013). Multivariate normality was violated for three of the measures, social support, health behaviour, and neuroticism. As MANOVA is sufficiently robust to withstand violations of normality, the data can be non-normal to a significant degree without seriously affecting the validity of the $p$ values or the power of the test (Tabachnick & Fidell, 2013). This is
particularly so if no outliers are detected (O’Brien & Kaiser, 1985). Hence, the integrity of the data were not considered to have been compromised. Pearson product moment correlations showed no evidence of multicollinearity between the three dependent variables (neuroticism/health behaviour $r=-.332, p<.001$; neuroticism/social support $r=-.468, p<.001$; health behaviour/social support $r=.305, p<.001$). Finally, Box’s M test indicated that there was no violation of the assumption of homogeneity of variance-covariance matrices.

Although specific directional hypotheses have been proposed, the results of Study 2 are reported as two-tailed tests where appropriate so as to ensure that significant group differences in either direction are both detected and not over-stated.

6.10 Type D Prevalence and Descriptive Statistics

From the sample of 955 participants, 379 (39.7%) individuals were classified as having Type D personality using the recommended diagnosis cut off of $\geq 10$ on both the negative affectivity and social inhibition subscales. Means and standard deviations for all measures can be found in Table 6.1. Where higher scores in health behaviours represent more positive health behaviours undertaken. Non-Type D participants undertook significantly more positive health behaviours than participants with Type D.

| Table 6.1 |
| --- | --- |
| Means and standard deviations for Type D subscales and dependent variables by Type D status | |

<table>
<thead>
<tr>
<th>Scale</th>
<th>Type D</th>
<th>Non-Type D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Affectivity</td>
<td>16.11 (4.39)</td>
<td>7.90 (4.71)</td>
</tr>
<tr>
<td>Social Inhibition</td>
<td>16.16 (4.53)</td>
<td>6.87 (4.41)</td>
</tr>
<tr>
<td>Health Behaviours</td>
<td>8.37 (4.01)</td>
<td>10.69 (4.68)</td>
</tr>
<tr>
<td>Social Support</td>
<td>10.29 (3.46)</td>
<td>13.79 (3.05)</td>
</tr>
</tbody>
</table>
Similarly, higher scores in social support represent a higher amount of perceived support from friends and family. Non-Type D participants perceived significantly higher amounts of social support than participants with Type D.

6.11 Chi Square Goodness of Fit Test

A chi square goodness of fit test showed no statistically significant difference in the proportion of Type D individuals in the Australian sample (39.7%) compared to the proportion obtained in the UK and Irish sample (38.5%), $\chi^2 (1, n = 955) = 0.57, p > .05$. Hence, the prevalence of Type D personality in the Australian population was not statistically different to the prevalence in the populations of the UK and Ireland reported by Williams et al (2008).

6.12 MANOVA

A one-way MANOVA revealed that there was a statistically significant difference between Type D and non-Type D individuals on the combined dependent variables (health behaviours and social support), $F (2, 847) = 128.01, p < .001$; Wilks’ Lambda = .77; partial $\eta^2 = .23$. Univariate analyses indicated that both dependent variables were significantly different between the Type D and non-Type D groups, even after a Bonferroni adjusted alpha level of .025 was applied to control for a possible Type 1 error rate. Type D participants reported significantly fewer positive health behaviours than non-Type D participants, $F (1, 845) = 55.38, p < .001$, partial $\eta^2 = .06$. Type D participants also reported significantly poorer social support than non-Type D participants, $F (1, 845) = 239.18, p < .001$, partial $\eta^2 = .22$. Means and standard deviations can be found in Table 6.1
6.13 Mediation

A series of linear regressions and a formal test of mediation were conducted to examine whether neuroticism mediated the relationship between Type D personality and social support, and Type D and health behaviour. Following the procedure outlined by Baron and Kenny (1986), for full mediation to exist, four conditions must be met: 1) the independent variable (Type D) affects the mediator (neuroticism), 2) the independent variable affects the dependent variable (social support or health behaviours), 3) the mediator affects the dependent variable when the independent variable is controlled, and 4) full mediation is confirmed when the association between the independent variable and the dependent variable is reduced to non-significance when the mediator is controlled. If only conditions 1-3 are met, partial mediation is achieved. In the present study, Type D participant scores were more than double those of non-Type D for both negative affectivity and social inhibition (see Table 6.1). The same pattern was observed for neuroticism.

6.13.1 Mediation of Type D Personality and Social Support

In the present sample, the first three conditions were met. Type D significantly predicted both neuroticism ($\beta = 0.60, t(632) = 18.63, p < .001$) and social support ($\beta = -0.47, t(847) = -15.47, p < .001$), while neuroticism significantly predicted social support ($\beta = -0.47, t(632) = -13.29, p < .001$). However, although the addition of neuroticism to the regression model reduced the beta weight of Type D, it did not reduce it to non-significance. Hence, Type D remained a significant predictor of social support ($\beta = -0.30, t(632) = -7.00, p < .001$). This meant that condition four was not met, and only partial mediation was achieved. A Sobel test confirmed partial mediation ($z = -9.81, p < .001$).

6.13.2 Mediation of Type D Personality and Health Behaviours

The same patterns of results were found for the mediation of Type D and health behaviours. In the present sample, the first three conditions were met. Type D significantly
predicted both neuroticism ($\beta = 0.60$, $t(632) = 18.63$, $p < .001$) and health behaviours ($\beta = -0.23$, $t(847) = -7.44$, $p < .001$), while neuroticism significantly predicted health behaviours ($\beta = -0.33$, $t(632) = -8.84$, $p < .001$). However, once again the addition of neuroticism to the regression model reduced the beta weight of Type D, but did not reduce it to non-significance. Hence, Type D remained a significant predictor of social support ($\beta = -0.14$, $t(632) = -5.30$, $p < .001$). This meant that condition four was not met, and only partial mediation was achieved. A Sobel test confirmed partial mediation ($z = -2.34$, $p < .01$).

6.14 Discussion

The current study had three primary aims: 1) to estimate the prevalence of Type D personality in the Australian general population, 2) to investigate whether the presence of Type D personality was associated with a tendency to carry out fewer positive health behaviours, or to perceive lower levels of social support from friends and family, and 3) to extend the results of Study 1 by determining whether any significant relationships between Type D and social support, and Type D and health behaviours, remain significant while controlling for the effects of neuroticism. A discussion of the results as they relate to each of the three hypotheses is presented. Overall, the results supported all three hypotheses and were found to be consistent with previous research.

6.15 Hypothesis 1: Prevalence of Type D

The first hypothesis predicted that the estimated prevalence rate of Type D personality in the Australian general population would not be significantly different from the estimated rate in the UK and Ireland populations (38.5%; Williams et al., 2008). The results supported the first hypothesis. There was no significant difference in the proportion of Type D individuals in the Australian sample compared to the proportion of Type D individuals obtained in the Williams et al. (2008) study. The results were not unexpected, given the socio-cultural similarities between the populations of the UK and Ireland, and Australia. The rate found in
the Australian population is also consistent with prevalence rates found in Western Europe (e.g. Belgium, 35.5%; De Fruyt & Denollet, 2002), but higher than countries such as Israel (24.1%; Zohar et al., 2011), Ukraine (22.4%; Pedersen, Yagensky, et al., 2009) or Taiwan (16%; Weng et al., 2013).

The results of the prevalence study indicated that Type D personality could represent a reasonable challenge to the functioning of the Australian healthcare system. The association between Type D and poor health behaviours means that almost 40% of the Australian population could be considered to be at higher risk for lifestyle-related chronic conditions such as type 2 diabetes, obesity, or cardiovascular diseases. Furthermore, the same proportion of individuals may be less likely to seek social support regarding their health issues, or adhere to treatment plans and medications when ill. If even half of Type D individuals eventually developed a chronic illness as a result of the behaviours, beliefs, and perceptions that are associated with Type D, the number would represent a sizable challenge for healthcare services in Australia.

6.16 Hypothesis 2: Type D, Health Behaviour, and Social Support

The second hypothesis predicted that Type D participants would report fewer positive health behaviours and perceive less social support than non-Type D participants. Hypothesis 2 was supported and the results were consistent with those reported by Williams et al (2008). Type D individuals reported less positive health behaviours, and less perceived social support, than non-Type D individuals. The results of each contrast are presented in two parts.

6.16.1 Health Behaviours

The results of the comparison of Type D with non-Type D individuals on the number of positive health behaviours undertaken were consistent with previously published research. In a number of studies, Type D personality has been associated with a tendency to perform
fewer positive health behaviours, such as not smoking, little physical inactivity, and poor diet choices, than non-Type D personality (e.g. Gilmour & Williams, 2012; Mommersteeg et al., 2010; Williams et al., 2008). Generally, the results of Study 2 support the findings of Williams et al (2008), however the methodology of Study 2 differed slightly from Williams et al (2008) on the measurement of health behaviours. Study 2 extended the Williams et al (2008) study by incorporating more health behaviours into the study design.

Although the General Preventative Health Behaviours Checklist provides a composite score for 29 health behaviours in a number of distinct domains, Williams et al elected to incorporate only eight of the 29. The authors presented a sound rationale for the omission of 21 items, but in doing so were not able to assess the global measure of health behaviour afforded by the full scale. In contrast, Study 2 included all 29 items of the General Preventative Health Behaviours Checklist. The items can be divided into themes such as safety, personal health, risk avoidance, and relaxation (Amir, 1987). The results of the present study support the proposed idea that poor health behaviours act as prominent psychosocial mechanisms that may mediate the relationship between Type D personality and a susceptibility to ill health in the general population.

6.16.2 Social Support

The present study also found that Type D personality was associated with a lower levels of perceived social support. The results are consistent with those reported by Williams et al (2008). The mechanism or mechanisms that promote a sense of reduced social support in Type D individuals is unclear. One suggestion has been that Type D individuals may also demonstrate higher levels of social alienation and socially-inhibited emotional expression, which may lead to increased perceptions of reduced social support from close friends and family (Sararoudi et al., 2011).
An important point to note when interpreting the present results is that the instrument used to measure social support, the Social Support Network Scale, is a measure of the participant’s perceived social support, not their actual social support. Hence, although Type D participants report less social support than non-Type D participants, the data do not indicate whether their perception is in any way accurate. It is possible that Type D individuals report less social support because they do actually have less social support, compared to non-Type D participants.

It is conceivable that the negative affectivity aspect of Type D personality may influence the quality of relationship a Type D individual has with close friends and family. It would be reasonable to expect that a Type D individual would receive some level of social support from their close friends and family. However, it may also be reasonable to consider the possibility that prolonged engagement with a Type D individual may erode the willingness of others to continue to offer support by close others. Study 1 (see section 5.9) found that many of the traits that describe Type D personality, such as anxious, angry/hostile, depressed, and lacking in personal warmth, are traits that could potentially interfere with positive interpersonal experiences. Similarly, Study 1 found that Type D individuals seemed to be poorly equipped to cope with stress or difficult situations, and possess an increased tendency to see others as untrustworthy or dangerous.

Together these traits could have a very negative impact on the interpersonal relationships of Type D individuals and their close friends and family, potentially resulting in a reduction of the provision of social support to the Type D individual. Hence, until a measure of perceived and actual social support for Type D individuals is obtained, it is difficult to determine whether the reported perceptions of Type D individuals are exaggerated or a reasonably accurate representation of their social situation.
6.17 Hypothesis 3: Novelty of Type D

The third hypothesis predicted that any significant relationships between either Type D and social support, or Type D and health behaviours, would remain significant after controlling for the effects of neuroticism. The results supported Hypothesis 3, and, again, were consistent with those reported by Williams et al (2008). In a formal test of mediation, the significant relationships between Type D and health behaviour, and Type D and social support, remained significant while controlling for neuroticism. By demonstrating that Type D is significantly associated with health behaviours and social support when neuroticism is controlled, the claim that Type D is simply another name for neuroticism is weakened.

In both mediational analyses, three of the four criteria for full mediation were met. Hence, neuroticism was found to partially mediate the relationship between Type D and both health behaviours and social inhibition. Partial mediation is achieved when the path from the causal variable to the outcome variable is reduced in absolute size by the mediator variable, but is still different from zero. Hence, neuroticism did reduce the overall size of the relationship between Type D and both outcome variables (health behaviours and social support), but did not fully account for the relationship.

The partial mediation by neuroticism should be expected. In Study 1, and in many previously published studies pertaining to the structure of Type D (e.g. Svansdottir, van den Broek, et al., 2013), neuroticism was found to explain a large amount of variance in negative affectivity. But consistent with the results of Study 1, these findings suggest that Type D personality represents a typology that is demonstrably more complex than basic neuroticism.
6.18 Summary, Implications, and Limitations

6.18.1 Summary of the Findings

Study 2 has added new information to the growing body of knowledge pertaining to Type D personality, and has provided further support for previously published Type D research. First, Study 2 has provided evidence of the rate of Type D personality in a previously untested population. The prevalence of Type D within the Australian general population was found to be similar to that reported in a previously published prevalence study of the UK and Ireland populations (see Williams et al, 2008).

Study 2 also found that Type D personality is associated with fewer positive health behaviours and lower perceived social support. These results are consistent with Type D research from other populations, and serve to reinforce our understanding of the manifest behavioural and perceptual outcomes associated with Type D personality.

Finally, the relationships between Type D and both health behaviours and social support were found to remain significant even after controlling the effects of neuroticism.

6.18.2 Implications

The results of Study 2 present several important implications for Type D research and theory. First, the knowledge that Type D personality exists within the Australian general population is helpful in reinforcing Type D theory, and establishing the universality of traits such as negative affectivity and social inhibition. The Australian population prevalence results add to the growing list of countries in which Type D has been found to exist. The results of prevalence studies in a variety of populations implies a biological underpinning to Type D, which is consistent with dispositional theory generally. However what is of particular interest for Type D research is how different socio-cultural factors may influence the degree to which Type D personality develops or is expressed. Prevalence studies in a
range of countries and cultures can assist in furthering our understanding of the interaction of biology and environment in general, and of Type D personality specifically.

A further contribution to Type D theory was the finding that the relationship between Type D and both social support and health behaviour remained significant (although somewhat reduced in size) when the effects of neuroticism were controlled. These results add further support to the claim that Type D is a novel and valid construct within the personality trait literature.

Finally, from the perspective of Australian healthcare, the findings of the present study can assist researchers, clinicians, and policy makers to determine whether Type D personality represents a possible challenge to the Australian healthcare system. Given that almost 40% of Australians meet the criteria for Type D, it would be prudent to consider the potential for the Type D-related health behaviours and perceptions to contribute to an increase in chronic illness incidence. For example, Type D has been found to be a risk factor for the development of cardiovascular disease, primarily via the behavioural and perceptual mechanisms associated with Type D (e.g. Denollet & Kupper, 2007; Sher, 2005; Svansdottir et al., 2012). In Australia, cardiovascular disease is the leading cause of death and disease burden (ABS, 2012). The ability to predict who may be at increased risk of developing a high-prevalence, high-impact chronic condition such as cardiovascular disease is an invaluable aid to healthcare management and potentially leading to a reduced incidence of chronic illnesses.

The identification of a relationship between Type D and the tendency to carry out fewer positive health behaviours, and to feel as though the availability of social support is reduced, has positive implications from a practical, clinical perspective. Maladaptive behaviours and perceptions can be altered with the administration of appropriate therapeutic approaches, such
as cognitive behaviour therapy or mindfulness training. Hence, while Type D itself may not be ‘treatable’, its associated behavioural and perceptual outcomes are manageable.

6.18.3 Limitations

This study contains several limitations that should be noted. First, while Study 1 alerted the researcher to the potential for a female gender bias to occur, no interventions were able to be identified that may address the potential bias. Even with a very large sample size, the sample of the present study was again predominantly made up of female participants. Further, the educational attainment level in the present sample was, again, above the national average (52.3% had obtained undergraduate or postgraduate awards, relative to 17% in the Australian population). The implications of both gender and education bias are discussed in Chapter 8.

Second, while the measure of health behaviours used in the present study, the General Preventative Health Behaviours Checklist provides a global score of health-related behaviours in a number of domains, some of the items on the checklist may not be as relevant today as when the scale was first devised (i.e. 1987). For example, items such as ‘take vitamins or dietary supplements’, ‘pray or live by the principles of religion’, and ‘fix broken things around the home’ may not be the best indicators of behaviours that may help to reduce the potential for the development of a chronic illness. Similarly, items that are more reflective of modern health concerns are not included. For example, common risk factors that have been found to be associated with health status, such as education and income, are not included. Also, risk factors that did not exist at the time of the development of the scale are necessarily not included. For example, the amount of time an individual spends on screen-based devices such as smartphones and tablets has been found to be associated with an increase in risk of metabolic syndrome in adolescents (Mark & Janssen, 2008). Furthermore, the items minimally represented specific physical and mental health behaviours other than basic diet, exercise, smoking and drinking items. A more nuanced measure of health behaviours, or
perhaps health beliefs and perception may have shed more light on the mechanisms that underpin the relationship between Type D and health.

Finally, the measure of social support used in the present study, the Quality of Social Network and Social Support Scale, was a measure of perceived social support. Although Type D personality was found to be associated with a reduced sense of perceived social support, it was not possible to determine the accuracy of those perceptions. Without an understanding of perceived versus actual social support, it is difficult to determine whether or not Type D individuals exaggerate their sense of reduced support.

6.19 Conclusion

Despite the limitations, the present study makes several contributions to the understanding of Type D personality. In particular it is the first published study, to the author’s knowledge, to identify the prevalence of Type D personality in the Australian general population. The study also provided support for previously published Type D findings, and contributed to one of the major debates in the Type D literature.

Together, the results of Study 1 and Study 2 have demonstrated that Type D personality can be considered a novel and valid construct in the personality trait literature, and that Type D is a relevant construct in Australia. However, the results of Study 1 and Study 2 prompt further questions of Type D. First, the results of Study 1 suggested that the dichotomous representation of Type D may be problematic for health research. Hence, a further examination of the possible effects of different representations of Type D would be warranted. Second, the results of Study 2 have indicated that Type D is a construct that is relevant to the Australian general population, however how Type D would be relevant to an Australian chronic illness population is less clear. The shortcomings in two of the measures used in Study 2 (General Preventative Health Behaviours Checklist and Quality of Social
Network and Social Support Scale) limited the potential to explore the direct relationships between Type D and specific health-related beliefs and perceptions.

The results of Study 1 and Study 2 informed the final study in the present thesis. Study 3 aimed to explore the limitations and questions of Type D that arose from the preceding two studies. Study 3 aimed to investigate whether Type D personality was associated with a number of high-prevalence, high-impact chronic illnesses within the Australian population. In order to extend the Type D literature, chronic illnesses that have little or no prior Type D research were chosen. Furthermore, the question of how Type D personality should be represented was further explored. The predictive ability of number of different representations of Type D personality were compared in Study 3.
CHAPTER 7 - EVIDENCE OF THE GENERALITY OF TYPE D PERSONALITY: MODELLING SOCIAL SUPPORT, HEALTH BEHAVIOURS, AND SYMPTOM SEVERITY IN FIVE CHRONIC ILLNESS GROUPS

The evidence presented in the previous empirical chapters has indicated that Type D personality can be considered a unique and novel contribution to the personality trait literature, and that it is a typology that is found to a reasonable extent within the Australian population. With this information in mind, the final empirical chapter aimed to extend our knowledge of Type D personality by investigating its effects, and potential generality, in five specific chronic illness groups: CFS, fibromyalgia, type 2 diabetes, rheumatoid arthritis, and osteoarthritis. Historically, Type D research has been based primarily in cardiac-related conditions, however there is a growing body of research dedicated to investigating the role of Type D in conditions other than cardiac-related disorders (e.g. cancer, Mols et al., 2012; metabolic syndrome, Mommersteeg et al., 2010; diabetes, Nefs et al., 2015). Nevertheless, there is still much to be learned about whether Type D is a construct that is relevant to chronic illness generally, or is a construct that is largely specific to cardiac conditions.

In order to further our understanding of Type D and its relationship to chronic illness, the five conditions included in Study 3 were selected on three main criteria: that the illnesses were high-prevalence, high functional impact, and that the illnesses had received little or no prior Type D-related research. The rationale for selecting illnesses on the basis of these criteria is that if there is evidence that Type D personality is associated with negative health behaviours and perceptions in a range of chronic illnesses, an argument could be made for considering Type D to be a general risk factor for poor health rather than a risk factor that is particular to cardiac-related conditions.

Study 3 was primarily designed to investigate the generality of Type D personality to a range of chronic illnesses. However, prior to exploring the generality of Type D, the ongoing
issue of how best to represent Type D personality was further explored. Study 1 reported preliminary results that indicated that some of the predictive power of Type D may be masked by the traditional dichotomous scoring procedure. In order to explore the potential masking effect further, seven possible representations of Type D were established, based on both personality literature in general and previous Type D research specifically. Each representation was tested for predictive utility using the four self-reported dependent variables in Study 3: health behaviour, social support, physical symptom severity, and psychological symptom severity. The representation that yielded superior prediction of health-related variables was then used in the subsequent predictive modelling analyses.

7.1 Study Background

Type D personality theory states that the Type D construct is dichotomous in nature. The issues inherent in conceptualising personality as a dichotomous construct have been discussed in sections 2.8 and 5.1.2. At face value, the notion of an all-or-nothing construct in psychology or psychiatry seems unlikely, particularly given the present inclination towards continuous classification over dichotomous classification in current research and clinical literature (Widiger & Samuel, 2005). For example, the Diagnostic and Statistical Manual, Fifth Edition (DSM-V) categorises more psychiatric diagnoses as continuous than any previous iterations (Regier, Kuhl, & Kupfer, 2013). A dichotomous representation presents certain theoretical challenges for Type D personality theory. Under the current representation, the difference between an individual diagnosed as Type D can be as little as a single DS14 scale score point on either Type D subscale. This idea has been difficult for some to accept conceptually. Based on that idea, Type D and non-Type D individuals, in theory, would have significantly different health behaviours, attitudes, and beliefs from one another, based on a single, arbitrary scale score point.
In order for Type D personality to be a truly taxonic construct, there must be a clear and real boundary whereby Type D begins and non-Type D ends. Additionally, the boundary cannot be one that is assumed solely for a social or descriptive function (Haslam et al., 2012). The latter taxonomy criterion poses the greatest threat to a dichotomous model of Type D personality. The decision to categorise Type D via a median split of negative affectivity and social inhibition was stated to be an ‘operational definition’ (Kupper & Denollet, 2007). As noted by Ferguson et al. (2009) there appears to be no direct support for a dichotomous conceptualisation of Type D, with much of the terminology in the Type D literature adding to the uncertainty of dichotomous versus continuous representation. The subscales of negative affectivity and social inhibition are continuous, which often leads to language surrounding Type D to imply, to some degree, that the overall construct itself has a continuous quality. For example, Type D is often described as the ‘tendency to experience negative affect/social inhibition’ (Denollet, Vrints, & Conraads, 2008).

Adding further to the problems faced by a dichotomous conceptualisation of Type D are the results of a meta-analysis conducted by Haslam, Holland, and Kuppens (2012). In their comprehensive analysis of 177 articles concerning taxometric research, the authors concluded that personality (along with mood disorders, anxiety disorders, eating disorders, externalising disorders, and personality disorders other than schizotypal) showed very little evidence of taxonomy. Type D personality, when conceptualised as dichotomous, appears greatly at odds with the majority of personality theory and research, therefore it may be incumbent on the creators of the construct to validate Type D’s worthiness as a dichotomy.

It is theorised that people with Type D personality tend to engage in more deleterious health-related behaviours and hold maladaptive perceptions about health than those without Type D (Denollet & Pedersen, 2008; Williams et al., 2008). This is thought to be due largely to Type D representing a general susceptibility to psychological distress. The majority of
Type D research has reported negative health outcomes in cardiac-related conditions such as cardiovascular disease (Pedersen & Schiffer, 2011) and chronic heart failure (Conraads et al., 2006). More recently, similar negative health associations have been found in non-cardiac conditions such as cancer (Mols et al., 2012) type 2 diabetes (Nefs et al., 2015), Parkinson’s disease (Dubayova et al., 2013), ulcerative colitis (Sajadinejad et al., 2012) and migraine (Chan & Consedine, 2014). Although most Type D research has focused on cardiovascular disease and chronic heart failure patients, the generality of the mechanisms thought to underpin the relationship between Type D and poor health outcomes generally suggests that Type D could influence a broader range of chronic conditions.

Despite extensive research on Type D personality, several gaps in the literature remain. First, although Type D research has focused on its role in particular diseases, at the time of writing there does not appear to be any published research that has compared the relationship between Type D and health status in healthy controls with chronic illness groups, in order to examine whether Type D represents a generalised risk factor for negative health outcomes and symptom experiences. Second, a range of debates has emerged about how Type D should be represented and integrated into models of health outcomes. Specifically, these debates include: 1) whether Type D is continuous or dichotomous, 2) whether the two subscales of Type D have interactive or only additive effects, 3) whether the two subscales are equally relevant to disease processes, and 4) whether the effect of Type D on general health outcomes differs between chronic illnesses (Coyne & de Voogd, 2012b; Ferguson, Williams, O’Connor, et al., 2009). Thus, the purpose of the present study was to develop and assess the generalisability of a model of Type D on health outcomes in both healthy controls and several high-prevalence, high-impact chronic conditions. As part of building such a model Study 3 aimed to contribute to the ongoing debates about the representation of Type D.
7.1.1 Type D Personality in Chronic Illness

An overview of Type D personality and its relationship with chronic illness was presented in Chapter 4. Although Type D personality is present in healthy and clinical populations, some evidence suggests there are considerable differences in prevalence rates for specific illnesses. For example, in cardiovascular and cardiac samples the rate has been reported to be 21% to 31% (Mols & Denollet, 2010a). The rates reported for cancer patients (19%; Husson et al., 2013) and type 2 diabetes patients (29%; Nefs et al., 2015) rates fall within the same range as the cardiac samples reported by Mols and Denollet (2010a). In contrast, studies have reported rates of Type D as high as 59% of female patients with ulcerative colitis (Sajadinejad et al., 2012) and 45% of chronic pain patients (Barnett et al., 2009).

The variation in prevalence between different illness groups may indicate a tendency for some illnesses to be more vulnerable or susceptible to the effects of Type D personality than others. Using the conditions noted above as an example, there are some distinct differences between ulcerative colitis and chronic pain disorders compared to cardiovascular disease, certain cancers, and type 2 diabetes. One of the main differences between the conditions is illness control. Although cardiovascular disease, certain cancers, and type 2 diabetes are serious conditions with significantly disabling effects, they are, mostly, controllable with well-validated and standardised treatment regimens. In contrast, chronic pain conditions and ulcerative colitis are difficult to treat and manage by both clinician and patient. One theory as to why the rate of Type D has been found to be much higher in ulcerative colitis and chronic pain patients compared to other chronic conditions such as type 2 diabetes may be due to poor illness control. Conditions that are characterised by poor controllability and that lack effective treatment protocol, could perhaps contribute to the development, or exacerbation, of Type D-related traits such as negative affectivity in sufferers.
The perceived or actual inability of chronic illness sufferers to control or manage their condition effectively typically leads to the experience of distress and can result in a tendency to adopt passive or maladaptive coping strategies. Animal (e.g. Lucas et al., 2014) and human (e.g. Gourounti et al., 2012) research has demonstrated how controllability is a key aspect of effective coping and management of stress. It is interesting to note that Type D personality represents a tendency to experience generalised psychological distress, and individuals with Type D also tend to adopt maladaptive or passive coping strategies (e.g. Booth & Williams, 2015; Polman et al., 2010). It is due to the similarities in the experience of stress and subsequent coping style that suggests that sufferers of poorly controlled illnesses may be more vulnerable to the effects of Type D than those with more controllable conditions.

In order to test the idea that illness control may be related to Type D personality, Study 3 included two chronic illnesses of unknown etiology that are characterised by limited controllability, and have no standard treatment protocols: fibromyalgia syndrome and CFS. Fibromyalgia and CFS are each classified as a functional somatic syndromes (APA, 2013) and will be referred to as such hereafter. In order to compare the health-related relationships between Type D and functional somatic syndromes, a ‘control’ group of illnesses was also included. The three ‘control’ illnesses have known etiologies, and are all considered highly controllable with standard treatment protocols: type 2 diabetes, osteoarthritis, and rheumatoid arthritis. Hence, if the level of illness controllability is related to the development of the traits that underpin Type D personality, this should be evident within the functional somatic syndrome illness group.

7.1.2 Type D Personality and Health Outcomes

Type D personality appears to influence health status via a number of interacting biopsychosocial mechanisms. Individuals with Type D personality typically experience a range of heightened negative emotions such as worry and fear, and possess a negative view of
the world, others, and themselves (Denollet, 2005). Additionally, their increased social inhibition means that they are less likely to outwardly express their distress (Denollet et al., 2006) and more likely to engage in maladaptive coping strategies, such as resignation and withdrawal (Martin et al., 2011; Polman et al., 2010). Type D individuals tend to report a greater range and number of symptoms, and perceive their condition as being more serious and prolonged than non-Type D patients (Jellesma, 2008). Nevertheless, they are less likely to engage in constructive health behaviours to maintain or improve their health status (Pelle, Schiffer, et al., 2010; Williams et al., 2008).

Recent studies have reported evidence of HPA axis dysregulation in Type D patient groups, indicating a physiological dimension to the way in which the Type D profile may negatively affect health outcomes (Molloy, Perkins-Porras, Strike, & Steptoe, 2008; Whitehead, Perkins-Porras, Strike, Magid, & Steptoe, 2007). After adjusting for depression, Type D personality independently predicted increased cortisol levels in healthy individuals (Habra, 2003) and both increased cortisol (Whitehead et al., 2007) and oxidative stress (Kupper et al., 2009) in cardiac patients. As such, it is likely that maladaptive responses to stress, such as those seen in Type D individuals, are very likely to have a deleterious effect on health by increasing susceptibility to disease and aging (Habra, 2003; Rosmond & Björntorp, 2000).

While Type D research has focused mainly on cardiovascular diseases, the possible mechanisms of action described above could have influential roles in other high-prevalence and high-impact chronic illnesses. Researchers examining the role of Type D in conditions such as type 2 diabetes (e.g. Nefs et al., 2015), metabolic syndrome (e.g. Mommersteeg et al., 2010), and cancer (Mols et al., 2012) have found that Type D is associated with poorer mental and physical health status, and prolonged illness duration. Following a systematic review of Type D in the general population, Mols and Denollet (2010b) reported that Type D
was associated with increased physical and mental health problems and disease-promoting mechanisms in non-clinical, and even healthy populations. Michal et al. (2011) reported that Type D individuals were at severely increased risk for mental distress, major psychosocial stressors, and increased health care utilisation. In a sample of over 3,000 cancer survivors, Mols et al. (2012) found that Type D patients reported significantly higher levels of general somatic symptoms, sleep disturbance, pain, and fatigue. Similarly, in a recent population survey of more than 5,000 Swedish adolescents, Type D was associated with higher levels of self-reported psychosomatic symptoms, musculoskeletal pain, and sleep disturbance (Condén, Leppert, Ekselius, & Åslund, 2013; Condén et al., 2014).

Other somatic research has found that negative affectivity and social inhibition are also each independently associated with increased somatisation and unexplained symptoms (Watson & Pennebaker, 1989; Wongpakaran & Wongpakaran, 2014). Because Type D personality has been associated with somatic complaints and exaggerated symptom reporting, even in healthy populations, the author hypothesised that conditions that are characterised primarily by general somatic complaints of unclear etiology may be more susceptible to the effects of Type D personality than illnesses of known etiology.

7.1.3 Representations of Type D in Models of Health Outcomes

Type D has traditionally been conceptualised as a dichotomous construct resulting from the combined effects of high negative affectivity and high social inhibition (Denollet et al., 1996). This implies several questionable assumptions about the effect of Type D on health related outcomes. First, it assumes that negative affectivity and social inhibition have an interactive effect that is greater than the sum of the two main effects. Second, it implies that the main effects of negative affectivity and social inhibition are of similar importance in predicting health outcomes. Third, it suggests that there is a point of sharp discontinuity in
the combined effect of social inhibition and negative affectivity on health outcomes, as opposed to a more linear effect that one would expect from a continuous variable.

Assessing personality in a binary fashion almost always discards meaningful variance and has the potential to misclassify people who fall close to either side of the split (Haslam et al., 2012; Vollrath & Torgersen, 2002). Recently several researchers have suggested that conceptualising Type D as a continuous construct is more consistent with personality trait theory, and should lead to greater predictive validity of health outcomes (e.g. see Bergvik et al., 2010; Ferguson, Williams, O’Connor, et al., 2009; Kelly-Hughes et al., 2014; Romppel, Herrmann-Lingen, Vesper, & Grande, 2012). Previous research, including Study 1 of the present thesis, has examined measures of Type D both as the sum and the product (Stevenson & Williams, 2014) of the two Type D subscales. However, there is limited research systematically comparing different representations of Type D in terms of predictive validity for health outcomes. This is a necessary step for the conceptualisation and practical utility of Type D in health research.

7.2 Aims and Hypotheses

Study 3 of the present thesis had three primary aims:

1) To refine our understanding of how Type D personality should be represented.

2) To investigate whether there are Type D-related group differences between healthy versus chronically ill participants, and between functional somatic syndromes and illness of known etiology.

3) To examine predictive models of Type D on perceived social support, health behaviours, and reported physical and psychological symptom severity.

Based on prior research, it was hypothesised that:
1) Negative affectivity and social inhibition would be superior in predicting illness processes and symptom reporting over dichotomous or continuous representations of Type D.

2) The rate of Type D personality would be higher in chronic illness participants compared to healthy controls, and that the rate of Type D would be higher in functional somatic syndromes compared to illnesses of known etiology.

3) That Type D would differentially predict illness processes and reported symptom severity between healthy controls and chronic illness sufferers, and between functional somatic syndromes and illnesses of known etiology.

7.3 Method

Two important considerations in the design of Study 1 were: 1) the selection of instruments, and 2) the method of data collection. The rationale for each consideration was derived from the relevant literature and is presented below.

7.4 Selection of Measurement Instruments

The selection of measurement instruments for Study 3 was guided by previous research and by the findings of Study 2. First, the Type D scale, the DS14, was selected in order to assess the presence of Type D personality. Second, two of the scales used in Study 2, and in past research, were carried over to Study 3: the General Preventative Health Behaviours Checklist, and the Quality of Social Network and Social Support Scale. In addition, and in response to a limitation observed in Study 2, the Rotterdam Symptom Checklist has been included in Study 3. In Study 2, a limitation that the author noted was that the some of the items in the General Preventative Health Behaviours Checklist appear to not be as closely aligned with health behaviours as other items (e.g. pray or live by the principles of religion). The items also do not allow respondents to rate how they perceive their own health in any
systematic manner. Hence, Study 3 included an additional scale that allowed participants to rate the frequency and severity of a combination of 35 physical and psychological symptoms.

7.4.1 Selection of Data Collection Process

The data collection process for Study 3 was the same as that utilised in Study 1. Details of the process, and the rationale for its selection, are outlined in section 5.3.2. Although the data in both Study 1 and Study 2 were found to contain possible gender and educational attainment biases, the online method of data collection was still considered the optimal approach for the data required in Study 3. Collecting survey data from specific illness populations can be difficult for reasons such as over-sampling (i.e. volunteer fatigue), participant defensiveness (e.g. belief that their condition may not be taken seriously in the study results), or simply because the participants are unable to complete surveys due to the nature of their illness. Of the illnesses included in Study 3, each had online support agencies through which sufferers could access support and information regarding their condition. With the cooperation of the various agencies, online and electronic advertising of the study proved to be an efficient way to reach a large number of individuals with a specific illness.

7.5 Participants

Participants were recruited via a number of illness support agencies (Diabetes Australia, CFS/ME Australia, FMS Support Australia) and social media sites (predominantly Facebook and Twitter). The recruitment period took place between December 2013 and June 2015. Of the 452 participants who completed the survey, data from 389 were used. One case was excluded on the basis of greater than 10% missing data. Two cases were omitted due to their diagnosis of type 1 diabetes. Unlike type 2 diabetes, type 1 diabetes is an auto-immune disorder, and its onset and perpetuation is not related to lifestyle factors (Levy, 2011). Sixty participants with one or more comorbid conditions from each illness group (e.g. fibromyalgia and type 2 diabetes) were excluded. The comorbidity exclusion criterion was implemented to
facilitate the clarity of the groupings, as well as to exclude participants with conditions such as depression that may falsely inflate the NA or SI scores of the DS14.

Participants completed an online survey composed of demographic questions, the DS14, the General Preventative Health Behaviours Checklist, the Quality of Social Network and Social Support Scale, and finally the Rotterdam Symptom Checklist. Participants were asked to respond ‘yes’ or ‘no’ to the following statement regarding their health status: ‘Do you have a chronic illness that has been diagnosed by your GP or health care specialist? A chronic illness is defined as an illness that lasts at least six months in duration’. Participants could select any of the five chronic conditions in the present study or enter free text for any condition that differed from, or was comorbid with, any of the five under investigation.

The sample consisted of 208 chronic illness participants and 181 healthy controls. Chronic illness participants were classified as either: a) functional somatic syndrome (n = 100) if they had a diagnosis of CFS or fibromyalgia, or b) illnesses of known etiology (n = 107) if they had a diagnosis of type 2 diabetes, rheumatoid arthritis, or osteoarthritis. The sample was aged between 18 and 77 years (M = 37.8, SD = 15.0) and 80.5% were female. The possible impact of a gender bias in the sample will be considered in the next chapter. Of the sample, 28.5% (n=111) had completed a secondary education, 33.4% (n=130) had completed undergraduate education, 23.9% (n=93) had completed post-graduate education, 6.2% (n=24) completed a trade qualification, 7.5% (n=29) listed their education level as ‘other’, and 0.5% (n=2) elected not to supply educational attainment information. The possible impact of an education bias in the sample will be considered in the next chapter.

Most participants were born in Australia (76.6%) and 3.3% identified as Indigenous Australians. The percentage of indigenous participants was representative of the proportion of indigenous Australians within the overall Australian population (ABS, 2016). There was no difference between the healthy and chronic illness groups on age, gender, or ethnicity. The
illnesses of known etiology participants were slightly older than those with a functional somatic syndrome, possibly due to the age-related degeneration associated with osteoarthritis.

7.6 Measures

Along with basic demographic information, the study collected participant data using four formal measures of personality and health. Three of the measures were introduced in Study 1 and/or Study 2; the DS14, the General Preventative Health Behaviours Checklist, and Social Network and Support Scale. A new scale was introduced to Study 3, the Rotterdam Symptom Checklist. Each formal measure, and the basic demographic information collected, and described below.

7.6.1 Demographic Information

The demographic information collected from each participant included age, gender, country of birth, level of education, and primary language spoken at home.

7.6.2 Type D Personality Scale – DS14.

The DS14 scale information is presented in Study 1, section 5.5.2 of Study 1. The present study found Cronbach’s $\alpha$ of .89 for NA and .87 for SI. Given arguments for conceptualising Type D as a continuous construct (Ferguson, Williams, O’Connor, et al., 2009; Kelly-Hughes et al., 2014) two new representations of continuous Type D were computed: a Type D (product) variable (i.e., product of NA and SI) and a Type D (sum) variable (i.e., the sum of NA and SI).

7.6.3 General Preventative Health Behaviour Checklist

The General Preventive Health Behaviours Checklist scale information is presented in Study 2, section 6.6.2. In Study 3, the General Preventative Health Behaviours Checklist was scored in an alternative way to Study 2. The standard scoring, described in section 6.6.2, yields a total count for the number of health behaviours for which the participant answers ‘Always, or almost always’. The two other scale options, ‘Never, or almost never’ and
‘Sometimes’ are both scored as though the behaviour has not been carried out. In the case of the middle option ‘Sometimes’, the author felt that not counting this behaviour may mean that the total score is not a true reflection of the degree to which participants engage in healthy behaviours. Even if a healthy behaviour is only carried out ‘sometimes’, it still warrants consideration and ‘sometimes’ is quite different to ‘never, or almost never’. Hence, the General Preventative Health Behaviours Checklist scoring procedure for Study 3 was simply a summative total of scores where ‘never, or almost never’ = 0, ‘sometimes’ = 1, and ‘always, or almost always’ = 2. The present study obtained a Cronbach’s $\alpha$ statistic of .82.

7.6.4 Quality of Social Network and Social Support Scale

The Quality of Social Network and Social Support Scale information is presented in Study 2, section 6.6.3. The present study found Cronbach’s $\alpha$ of .78.

7.6.5 Rotterdam Symptom Checklist

The Rotterdam Symptom Checklist (De Haes, 1990) is a 35 item scale used to measure the number of symptoms a person has experienced in the previous week. The measure uses a 4 item response scale where 1 = not at all, 2 = a little, 3 = moderately, 4 = very much. The measure is comprised of two subscales, physical symptoms (e.g. chest pain, headaches) and psychological symptoms (e.g. depressed mood, anxious feelings). Scores for symptom severity are represented as the sum of items. Reliability and convergent validity for the Rotterdam Symptom Checklist is moderate to strong, 0.8 and 0.6 respectively (Pelayo-Alvarez, Perez-Hoyos, & Agra-Varela, 2013). The present study found Cronbach’s $\alpha$ of .92 for psychological symptoms and .93 for physical symptoms.

7.7 Procedure

Ethics approval for this study was granted by the Deakin University Human Research Ethics Committee (see Appendix I). The study design and questionnaire administration was the same as that described in Study 1, section 5.3. Participants completed the DS14, Social
Network Support Scale, General Preventative Health Behaviour Checklist, and Rotterdam Symptom Checklist, in that order. The questionnaires consisted of 92 items and took approximately 15-20 minutes to complete.

**7.8 Data Analytic Method**

### 7.8.1 Variables

An analysis of variance (ANOVA) was conducted to compare the healthy and illness groups on all measures, with the exception of dichotomous Type D (ANOVA requires continuous variables). Dichotomous Type D group comparisons were conducted via a chi square goodness of fit analysis. The independent variable for the ANOVA was group membership (i.e. healthy, known etiology, or functional somatic syndrome). The dependent variables were negative affectivity (NA), social inhibition (SI), health behaviours, social support, physical symptoms, and psychological symptoms.

In order to test various representations of Type D, seven regression analyses were run. The independent (predictor) variables in these regression analyses were the seven representations of Type D: 1) dichotomous negative affectivity and social inhibition main effects, 2) dichotomous negative affectivity and social inhibition main effects and interaction, 3) continuous negative affectivity and social inhibition main effects, 4) continuous negative affectivity and social inhibition main effects and interaction, 5) dichotomous Type D, 6) continuous Type D (Product), and 7) continuous Type D (Sum) (see section 7.9 and Table 7.3). The dependent (response) variables were health behaviours, social support, physical symptom severity, and psychological symptom severity.

In the final analyses, linear regression analyses were used to model the effects of Type D, in various representations on several outcome measures. In the first regression model (see Table 7.4), there were nine independent (sometimes referred to as predictor) variables: 1)
having a chronic illness, 2) having a functional somatic syndrome, 3) negative affectivity, 4) social inhibition, 5) negative affectivity by social interaction, 6) social inhibition by having a chronic illness, 7) negative affectivity by having a chronic illness, 8) social inhibition by having a functional somatic syndrome, and 9) negative affectivity by having a functional somatic syndrome. The dependent (sometimes referred to as *response*) variables were health behaviours and social support.

In the second regression model, the two dependent variables from the first regression, health behaviour and social support, became independent variables. There were seven independent variables in the second regression modelling analysis: 1) having a chronic illness, 2) having a functional somatic syndrome, 3) negative affectivity, 4) social inhibition, 5) negative affectivity by social interaction, 6) social support and 7) health behaviour. The dependent variables in the second regression modelling analysis were physical symptom severity and psychological symptom severity.

Although specific directional hypotheses have been proposed, the results of all analyses are reported as two-tailed tests so as to ensure that significant group differences in either direction are detected and not over-stated.

*7.8.2 Representation of Type D*

In order to contribute to the debate on how best to represent Type D, the predictive validity (i.e., adjusted r-squared) of different representations of Type D predicting each health outcome were compared. This involved comparing a range of dichotomous and continuous representations of Type D with and without interactions. The best predicting representation involved continuous social inhibition and negative affectivity main effects (i.e. independent predictors). There was also preliminary, but weak, evidence for a social inhibition by negative affectivity interaction. As Type D theory states that Type D is the *interaction of*
negative affectivity and social inhibition, this representation was also used in the subsequent regression models of Type D and chronic illness predicting health outcomes.

### 7.8.3 Models of Type D and Illness Processes

In order to model the effect of Type D and illness group on health behaviours, social support, and symptom severity (physical and psychological), a series of linear regressions were run. The models included a superordinate group of chronic illness sufferers to be compared with not having a chronic illness. This group was made up of all participants who reported one of the five illnesses in the study. Also, the models included a group that represented functional somatic syndromes specifically, in order to determine if the effects of Type D are generalisable to a range of chronic conditions, or has a greater effect in functional somatic syndromes.

### 7.9 Results

Before the analyses were conducted, assumption checks for each analysis were undertaken following the guidelines recommended by O’Rourke, Psych, and Hatcher (2013). Missing data were replaced using median substitution. There were 18 outlier cases detected in the General Preventative Health Behaviours Checklist data. The cases did not appear to be associated with random responding and were deemed to be legitimate, albeit extreme, scores in the data set. A variable transformation was undertaken in order to reduce the skew and error variance present in the variable, while maintaining the relative ranking of scores (Tabachnick & Fidell, 2013). Box’s M test indicated that there was no violation of the assumption of homogeneity of variance-covariance matrices. Other than the General Preventative Health Behaviours Checklist, the remaining data were found to be normally distributed.

### 7.10 Group Differences and Correlations

Before engaging in regression modeling, the differences in Type D and illness process
variables between chronic illness and healthy control groups were examined. Also, the differences in Type D and illness processes between participants with functional somatic syndromes and illnesses of known etiology were examined (see Table 7.1). When Type D was treated as a dichotomous variable, chi square tests indicated that the rate of Type D personality was significantly lower in healthy controls (39.0%) than in the illnesses of known etiology group (52.3%, p < .05) and the functional somatic syndrome group (54.0%, p < .05), but there was no significant difference between the two chronic illness groups.

Table 7.1
Descriptive statistics and significance tests of differences between means for healthy, illnesses of known etiology, and functional somatic syndrome groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Healthy (A)</th>
<th>(n = 182)</th>
<th>Known Etiology (B)</th>
<th>(n = 107)</th>
<th>FSS (C)</th>
<th>(n = 100)</th>
<th>Overall</th>
<th>Pairwise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dichotomous Type D</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td>$\chi^2$</td>
<td>$p$</td>
</tr>
<tr>
<td></td>
<td>39.0</td>
<td>52.3</td>
<td>54.0</td>
<td>.02</td>
<td>A&lt;B, A&lt;C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Affectivity</td>
<td>10.77 (5.74)</td>
<td>12.57 (6.53)</td>
<td>13.18 (6.80)</td>
<td>.004</td>
<td>A&lt;B, A&lt;C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Inhibition</td>
<td>10.43 (5.97)</td>
<td>12.04 (6.23)</td>
<td>13.08 (6.09)</td>
<td>.002</td>
<td>A&lt;C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Behaviours</td>
<td>32.29 (8.47)</td>
<td>35.90 (7.86)</td>
<td>34.32 (7.34)</td>
<td>.001</td>
<td>A&lt;B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Support</td>
<td>10.70 (2.21)</td>
<td>9.87 (2.13)</td>
<td>9.87 (2.40)</td>
<td>.002</td>
<td>A&gt;B, A&gt;C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Symptoms</td>
<td>37.28 (10.32)</td>
<td>45.32 (11.86)</td>
<td>58.78 (11.58)</td>
<td>.000</td>
<td>A&lt;B, A&lt;C, B&lt;C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psych Symptoms</td>
<td>17.45 (6.07)</td>
<td>18.70 (6.44)</td>
<td>23.45 (6.71)</td>
<td>.000</td>
<td>A&lt;C, B&lt;C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. FSS = Functional somatic syndrome. Tukey’s HSD and $\chi^2$ indicate significant group difference (p < .05).

Group means and standard deviations along with an overall ANOVA and post-hoc tests
for Type D subscales and illness process variables are also presented in Table 7.1. In terms of Type D subscales, negative affectivity was higher in the illnesses of known etiology and functional somatic syndrome groups than in the healthy controls, while social inhibition was only higher in the functional somatic syndrome group compared to healthy controls.

The correlations between Type D and health-related variables for the healthy controls and the chronic illness group are presented in Table 7.2. Several strong correlations were present between Type D and illness process variables. The pattern of correlations was similar for both healthy and chronic illness groups with the exception that the correlation between social inhibition and health behaviours was smaller in the chronic illness group. Correlations of Type D subscales with illness process variables were generally larger for negative affectivity than for social inhibition.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Negative Affectivity</td>
<td>.52</td>
<td>-.37</td>
<td>-.51</td>
<td>.40</td>
<td>.71</td>
<td></td>
</tr>
<tr>
<td>2. Social Inhibition</td>
<td>-.54</td>
<td>-.32</td>
<td>-.53</td>
<td>.21</td>
<td>.37</td>
<td></td>
</tr>
<tr>
<td>3. Health Behaviours</td>
<td>-.30</td>
<td>-.07</td>
<td>.29</td>
<td>-.18</td>
<td>-.37</td>
<td></td>
</tr>
<tr>
<td>4. Social Support</td>
<td>-.50</td>
<td>-.42</td>
<td>.28</td>
<td>-.28</td>
<td>-.42</td>
<td></td>
</tr>
<tr>
<td>5. Physical Symptoms</td>
<td>.35</td>
<td>.17</td>
<td>-.33</td>
<td>-.29</td>
<td>.67</td>
<td></td>
</tr>
<tr>
<td>6. Psych Symptoms</td>
<td>.74</td>
<td>.44</td>
<td>-.35</td>
<td>-.46</td>
<td>.65</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Chronic illness group (n = 207) correlations are presented in lower diagonal; healthy control group correlations (n = 182) are presented in upper diagonal. Significant correlations (p < .05) are presented in bold.*
7.11 Models of Type D and Illness Processes

Linear regression was used to model the effect of Type D and illness group on health behaviours, social support, and symptom severity (physical and psychological). To facilitate interpretation of regression coefficients, all numeric variables in the models were Z-score standardised. Chronic illness was coded 0 for healthy controls and 1 for chronic illness. The effect of having a functional somatic syndrome was coded 0 for healthy controls or illnesses of known etiology, and 1 for functional somatic syndrome.

Before fitting regression models predicting health outcomes (i.e., health behaviours, social support, physical and psychological symptoms), a systematic comparison of the predictive validity of different representations of Type D was first performed. Specifically, for each health outcome seven regression models were run, each with a different Type D representation: 1) dichotomous negative affectivity and SI main effects (i.e., based on cut-off scores of greater than or equal to 10), 2) dichotomous negative affectivity and SI main effects and interaction, which is also equivalent to including the four categories of low negative affectivity /SI, high negative affectivity only, high SI only, high negative affectivity /SI as per Denollet et al. (2013), 3) continuous negative affectivity and SI main effects, 4) continuous negative affectivity and SI main effects and interaction, 5) dichotomous Type D, 6) continuous Type D (Product), 7) continuous Type D (Sum). The obtained adjusted r-squared values were obtained for each regression (see Table 7.3).

Results showed that dichotomous Type D was the weakest predictor (average adjusted r-squared = .126). Of the two continuous composite measures, the sum of negative affectivity and SI (average adjusted r-squared = .242) was better than the product (average adjusted r-squared = .213). However, reflecting the differential influence of negative affectivity and SI in predicting health outcomes, including continuous negative affectivity and SI as separate main effects provided superior prediction (average adjusted r-squared = .275). Adding the
interaction in addition to continuous negative affectivity and SI main effects resulted in only slightly greater prediction (average adjusted r-squared = .279). Specifically, the negative affectivity by SI interaction only led to a significant r-squared change for health behaviour.

Table 7.3

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Health Behavior Adjusted R²</th>
<th>Social Support Adjusted R²</th>
<th>Physical Symptoms Adjusted R²</th>
<th>Psych. Symptoms Adjusted R²</th>
<th>Average Adjusted R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dichotomous NA and SI main effects</td>
<td>.059</td>
<td>.234</td>
<td>.088</td>
<td>.348</td>
<td>.182</td>
</tr>
<tr>
<td>2. Dichotomous NA and SI main effects and interaction</td>
<td>.068</td>
<td>.233</td>
<td>.086</td>
<td>.347</td>
<td>.183</td>
</tr>
<tr>
<td>3. Continuous NA and SI main effects</td>
<td>.079</td>
<td>.332</td>
<td>.153</td>
<td>.538</td>
<td>.275</td>
</tr>
<tr>
<td>4. Continuous NA and SI main effects and interaction</td>
<td>.092</td>
<td>.332</td>
<td>.154</td>
<td>.538</td>
<td>.279</td>
</tr>
<tr>
<td>5. Dichotomous Type D</td>
<td>.021</td>
<td>.195</td>
<td>.064</td>
<td>.223</td>
<td>.126</td>
</tr>
<tr>
<td>6. Continuous Type D (Product)</td>
<td>.040</td>
<td>.318</td>
<td>.107</td>
<td>.386</td>
<td>.213</td>
</tr>
<tr>
<td>7. Continuous Type D (Sum)</td>
<td>.063</td>
<td>.333</td>
<td>.131</td>
<td>.443</td>
<td>.242</td>
</tr>
</tbody>
</table>

Note. n = 389. Average adjusted R² values represent average variance explain for predictor set averaged over the four illness process outcome variables.

Dichotomous negative affectivity and SI resulted in poorer prediction than continuous negative affectivity and SI, but the general pattern of the interaction providing minimal benefit over the main effects still held. The above regressions were also performed separately for healthy and chronic illness groups and the same relative ranking of regressions emerged.
Given these results, continuous representations of negative affectivity, SI, and the negative affectivity by SI interaction were included in subsequent regression models.

To examine whether the effect of Type D on health outcomes varied by clinical or functional somatic syndrome grouping variables, regression models predicting health behaviour, social support, physical symptoms, and psychological symptoms were compared with and without interaction terms. Specifically, six interactions created by crossing one of the Type D predictors (i.e., NA, SI, or the NA by SI interaction) with one of chronic illness indicator variables (i.e., chronic illness indicator or functional somatic syndrome indicator) were included. Of the 24 interaction terms examined, two were statistically significant. First, the negative effect of negative affectivity on healthy behaviour was reduced in the chronic illness group. Second, the negative effect of negative affectivity on social support was amplified in the functional somatic syndrome group. Thus, the hypothesis that Type D would have a differential effect by group was partially supported. As a result, subsequent regression analyses predicting healthy behaviour and social support retained group by Type D interactions. Because there no significant interactions in predicting symptom measures, interactions were excluded.

To examine the effect of Type D and group membership on health behaviour and social support, two regression models for each outcome variable were fit, where Model 1 included illness group indicators and Type D variables, and Model 2 added negative affectivity by group and social inhibition by group interactions. Coefficients and model fits are shown in Table 7.4. Chronic illness participants reported more positive health behaviours and less social support, but there was no effect of having a functional somatic syndrome compared to an illnesses of known etiology. With regards to Type D, the effect varied by outcome measure. Specifically, negative affectivity and social inhibition were equally predictive of
social support, but negative affectivity was the more consistently important predictor of health behaviour.

**Table 7.4**

*Regression analysis of Type D predicting health behaviour and social support*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Health Behavior</th>
<th></th>
<th>Social Support</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td></td>
<td>(B)</td>
<td>(SE)</td>
<td>(B)</td>
<td>(SE)</td>
</tr>
<tr>
<td>Intercept</td>
<td>-.30*</td>
<td>.07</td>
<td>-.32*</td>
<td>.07</td>
</tr>
<tr>
<td>Gender</td>
<td>.17</td>
<td>.12</td>
<td>.03</td>
<td>.18</td>
</tr>
<tr>
<td>Education</td>
<td>.07</td>
<td>.05</td>
<td>.12</td>
<td>.06</td>
</tr>
<tr>
<td>Chronic Illness</td>
<td>.52*</td>
<td>.11</td>
<td>.54*</td>
<td>.11</td>
</tr>
<tr>
<td>FSS</td>
<td>-.14</td>
<td>.13</td>
<td>-.17</td>
<td>.13</td>
</tr>
<tr>
<td>Negative Affectivity</td>
<td>-.32*</td>
<td>.06</td>
<td>-.31*</td>
<td>.09</td>
</tr>
<tr>
<td>Social Inhibition</td>
<td>-.03</td>
<td>.06</td>
<td>-.19*</td>
<td>.08</td>
</tr>
<tr>
<td>NA x SI</td>
<td>.10*</td>
<td>.04</td>
<td>.09*</td>
<td>.04</td>
</tr>
<tr>
<td>SI x Chronic Illness</td>
<td>.33*</td>
<td>.14</td>
<td>.10</td>
<td>.12</td>
</tr>
<tr>
<td>NA x Chronic Illness</td>
<td>-.07</td>
<td>.15</td>
<td>.19</td>
<td>.12</td>
</tr>
<tr>
<td>SI x FSS</td>
<td>-.04</td>
<td>.16</td>
<td>.08</td>
<td>.13</td>
</tr>
<tr>
<td>NA x FSS</td>
<td>.08</td>
<td>.15</td>
<td>-.37*</td>
<td>.13</td>
</tr>
<tr>
<td>Adjusted (R^2)</td>
<td>.14*</td>
<td>.15</td>
<td>.35*</td>
<td>.37*</td>
</tr>
<tr>
<td>(F (df))</td>
<td>13.55 (5, 381)</td>
<td>8.60 (9, 377)</td>
<td>44.22 (5, 382)</td>
<td>26.71 (9, 378)</td>
</tr>
</tbody>
</table>

*Note.* Chronic illness was coded 0 = healthy, 1 = illnesses of known etiology or functional somatic syndrome. Functional somatic syndrome (FSS) was coded 0 = healthy or illnesses of known etiology, 1 = FSS. Negative affect (NA), social inhibition (SI), health behavior and social support were coded as z-scores. NA x SI was the product of NA and SI z-scores. *p* < .05
Also, in contrast to Type D theory, the sign of the interaction suggests that the combined effect of social inhibition and negative affectivity leads to an effect less than implied by the two main effects. Nonetheless, given the small size of the effect, and that this was the only significant NA by SI interaction across the four regressions, it is appropriate to treat the result with caution. Finally, there were the two significant group by Type D interactions discussed earlier.

To examine the combined effect of Type D and the health-related mechanisms of social support and health behaviours on symptom reporting, two regression models for both physical and psychological symptoms were fit (see Table 7.5). Model 1 included illness group indicators and Type D variables and Model 2 added social support and health behaviours as predictors. For both physical and psychological symptoms, the functional somatic syndrome group reported many more symptoms, yet the effect of chronic illness was only significant for physical symptoms. With regards to Type D, negative affectivity but not social inhibition predicted greater levels of symptom reporting; this was particularly true for psychological symptoms. Adding health behaviours and social support to the model resulted in a small increase in variance explained with both variables predicting lower levels of both psychological and physical symptoms.

**Table 7.5**

*Regression analysis for variables predicting physical symptoms and psychological symptoms*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Physical Symptoms</th>
<th>Psychological Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>Intercept</td>
<td>-.47*</td>
<td>.06</td>
</tr>
<tr>
<td>Gender</td>
<td>.17</td>
<td>.16</td>
</tr>
<tr>
<td>Education</td>
<td>-.03</td>
<td>.05</td>
</tr>
<tr>
<td>Chronic Illness</td>
<td>.49*</td>
<td>.09</td>
</tr>
</tbody>
</table>
FSS .92* .10 .90* .10 .62* .09 .60* .09
Negative Affectivity .33* .04 .26* .05 .69* .04 .63* .04
Social Inhibition -.03 .04 -.07 .05 .02 .04 -.01 .04
NAXSI -.05 .03 -.04 .03 -.03 .03 -.02 .03
Social Support -.11* .05 -.03 .03 -.08* .04
Health Behaviors -.10* .04 -.10* .03

Adjusted $R^2$ .47* .49* .61* .62*
$F (df)$ 70.16 (5,381) 53.48 (7,379) 120.03 (5,381) 90.72 (7,379)

Note. Chronic illness was coded 0 = healthy, 1 = illnesses of known etiology or functional somatic syndrome. Functional somatic syndrome (FSS) was coded 0 = healthy or illnesses of known etiology, 1 = FSS. Negative affect (NA), social inhibition (SI), health behavior, social support, physical symptoms, and psychological symptoms were coded as z-scores. NA x SI was the product of NA and SI z-scores.

* p<.05

7.12 Discussion

The current study had three primary aims: 1) to refine our understanding of how Type D personality should be represented, 2) to investigate whether there are Type D-related group differences between healthy versus chronically ill participants, and between functional somatic syndromes and illnesses of known etiology, and 3) to examine predictive models of Type D on perceived social support, health behaviours, and reported physical and psychological symptom severity. A discussion of the results as they relate to each of the three hypotheses is presented. Overall, the results supported Hypothesis 1, and partially supported Hypotheses 2 and 3.
7.13 Hypothesis 1: Representation of Type D

The first hypothesis predicted that Type D represented as negative affectivity and social inhibition main effects would be superior in predicting illness processes and symptom reporting over dichotomous or continuous representations. The results supported the hypothesis. Consistent with more parsimonious principles of personality trait theory, results from the representational analysis challenge the dichotomous and multiplicative representations of Type D. Continuous Type D predicted better than dichotomous, while the sum of negative affectivity and social inhibition predicted better than the product. However, treating negative affectivity and social inhibition as separate predictors (i.e. main effects) allowed for better prediction of health outcomes than either composite of negative affectivity and social inhibition. With the exception of health behaviours, the continuous forms of Type D did not provide incremental prediction, and even in the case of health behaviours, the interaction effect was in the opposite direction to that predicted by Type D theory.

These results are broadly consistent with findings from recent published research claiming that the interaction between negative affectivity and social inhibition rarely adds significant prediction over and above the main effects (Kelly-Hughes et al., 2014; Stevenson & Williams, 2014). Rather, a better interpretation is that the two subscales are important predictors that operate as separate main effects. Negative affectivity appeared to be a stronger predictor of health outcomes than social inhibition, although notable exceptions existed where the health related variable has a strong social component. Given the differential role of Type D predictors on health outcomes (e.g., social inhibition on social support), a Type D composite may hide these differential effects.

7.14 Hypothesis 2: The Rate of Type D in Healthy and Illness Groups

The second hypothesis predicted that the rate of Type D personality would be higher in chronic illness participants compared to healthy controls, and that the rate of Type D would
be higher in functional somatic syndromes participants compared to participants with illnesses of known etiology. The results supported the first part of the hypothesis, but not the second. Type D prevalence was significantly greater in chronic illness participants than in healthy controls. However, contrary to the prediction, there was no significant difference in the rate of Type D between functional somatic syndromes and illnesses of known etiology participants. The rate of Type D in the healthy controls in the present study was similar to the population estimate found in Study 2 (39.7%). The rate of Type D in the chronic illness group in the present study was similar to that reported in a previous study for hypertensive cardiac patients, who, in turn, had the highest rate of all cardiac patients (53%; Pedersen & Denollet, 2006).

A similar pattern emerged when looking at Type D subscales with both negative affectivity and social inhibition being generally higher in chronic illness groups. The data showed that the differences between healthy controls and functional somatic syndromes were greater than for healthy controls and participants with illnesses of known etiology, even though the two illness groups did not differ on the overall rate of dichotomous Type D. It may be that the continuous nature of the negative affectivity and social inhibition subscales provided a more nuanced estimate of the differences between groups than is provided by dichotomous estimates.

There are several possible explanations for the observed differences in the rate of Type D between health individuals and those with a chronic illness generally. First, it may be that merely having a chronic illness is sufficient to make people experience more negative emotions and reduce engagement in social interactions. Second, prior research (including Study 1) has shown that pre-morbid Type D individuals are likely to engage in fewer positive health behaviours than pre-morbid non-Type Ds. Thus Type D may contribute to acquiring a chronic illness via behavioural mechanisms. Third, the trend in the data may suggest that
Type D personality in people with a functional somatic syndrome amplifies, or may reflect, the psychological mechanisms of the condition. Finally, the differences also add weight to the proposal that Type D may have an indirect effect on symptoms via health behaviours and social support pathways.

A theme explored in the results was the extent to which symptoms could be explained by Type D personality versus process variables such as health behaviours and social support. The theory of Type D suggests that Type D leads to a general inability to cope with stress and seek help, which can, in turn, lead to avoidance behaviours followed by health problems. In contrast, the results of Study 3 showed that while Type D was associated with process variables that were related to symptoms, there was also support for a more direct role of negative affectivity. This was particularly evident when looking at the relationship between negative affectivity and psychological symptoms, where a very strong relationship was observed. This is broadly consistent with negative affectivity providing a general negative lens through which people experience both clinical and non-clinical health issues. It also made sense that this negative lens would be more relevant to psychological symptoms, which are arguably less constrained by the external world than physical symptoms. These results are also consistent with previous research that found Type D to be associated with higher rates of musculoskeletal pain and psychological symptom reporting (Condén et al., 2013). It may be that as the rate of negative affectivity and social inhibition increases, so does the subjective experience of illness and illness-related symptoms.

7.15 Hypothesis 3: Models of Type D on Health Outcomes

The third hypothesis predicted that Type D would differentially predict illness processes and symptom reporting between healthy controls and chronic illness sufferers, and between functional somatic syndromes and illnesses of known etiology. The results provided support for the hypothesis, though it was interpreted with some caution.
In the Type D prediction model analyses, social inhibition and negative affectivity had differential effects on the outcome variables. Negative affectivity generally had the stronger impact, except in the case of social support where the effects were of a similar magnitude. Including social support and negative affect as separate predictors led to a much better prediction of health outcomes and symptom reporting than using only dichotomous Type D or any continuous sum or product composite of Type D. While Type D predicted health behaviours, social support and physical symptoms, the effect of Type D on symptoms appeared to be more direct, as opposed to operating through these potential mediators. There were a few interactions between chronic illness group and Type D in predicting health behaviours, social support, and symptom severity.

The question of whether Type D had a differential effect on health outcomes between healthy and chronic illness groups, and between functional somatic syndromes and illnesses of known etiology, is tentatively answered by the results of Study 3. Given the overlap of mechanisms associated with both Type D and functional somatic syndromes (e.g. poor health behaviours, low perception of social support, adoption of poor coping mechanisms and greater reporting of somatic complaints), such interactions were expected. The results indicated two significant interactions at the .05 level, however they were not significant at the Bonferroni adjusted .002 level. The two .05 interactions showed that the effect of negative affect on social support was amplified in the functional somatic syndrome group and that the effect of social inhibition on health behaviours was reduced in the chronic illness group. On balance, there appears to be more evidence to suggest that the relationship between Type D personality and health outcomes is similar across illnesses rather than specific, or more influential, in specific illnesses. This suggests that models of Type D personality may generalise across different illnesses.
7.16 Summary, Implications and Limitations

7.16.1 Summary of the Findings

The results of Study 3 have contributed to the ongoing debate in the Type D literature regarding the most appropriate way to represent the construct: dichotomous, continuous, or main effects. The results have added support to recent claims that a continuous measure of personality is not only more consistent with personality theory generally, but may have greater predictive utility compared to a dichotomous measure. More importantly however, the results showed that the best model for predicting illness measures was where negative affectivity and social inhibition are entered as main effects, contrary to Type D theory. The results are not only contrary to the dichotomous representation of Type D, but also to the theory that Type D is the result of an interaction between negative affectivity and social inhibition.

The results of Study 3 failed to demonstrate any difference between functional somatic syndromes and illness of known etiology with regards to the rate of Type D, however the two illness groups do differ significantly on other health-related measures such as perceived symptom severity. The rate of Type D was significantly higher in participants with a chronic illness compared to healthy controls. Together, these results suggest that Type D may be a more general risk factor for chronic illness onset and maintenance, rather than having a more direct effect or influence in specific conditions.

Finally, prior research has presented evidence of a relationship between Type D personality, health behaviours, social support and symptom reporting in healthy and cardiac populations (e.g. Svansdottir, van den Broek, et al., 2013; Williams et al., 2008). The results of the present study offer some support to the proposed relationship, however it does appear that negative affectivity is the primary predictor in most cases. In predicting symptoms, health behaviour and social support had incremental prediction, suggesting that there may be
a cumulative effect of Type D with health behaviours and social support on reported symptom severity.

7.16.2 Implications

The results of Study 3 present several implications for Type D theory specifically, and for healthcare practices generally. First, the results have challenged the fundamental assumptions of how Type D personality should be represented. The finding that negative affectivity and social inhibition main effects provide superior prediction of health-related variables over both any Type D interaction term suggests that the theory of Type D should perhaps be revisited. The idea that Type D theory should be revised is further supported by the finding that dichotomous Type D was the least effective predictor in all representations tested.

Second, the findings have potential implications for healthcare practices. The results suggest that Type D may be a more general predictor of morbidity than first supposed. The majority of previous Type D research has focused on cardiac-related conditions, however Study 3 demonstrated that the mechanisms assumed to underpin Type D could easily be extrapolated to a range of chronic illnesses. For healthcare provision, this means that Type D personality could be considered a potential risk factor that can be easily screened for in a clinical setting. An awareness of Type D personality traits in a pre-morbid individuals could allow clinicians to factor in the likelihood of the individuals engaging in fewer health-promoting behaviours while adopting passive or maladaptive coping strategies during times of stress. These are points at which behavioural interventions could be introduced to an individual’s healthcare plan.

7.16.3 Limitations

This study contains several limitations that should be noted. First, the sample obtained had a large proportion of females. The possible impact of a gender bias in the results is
discussed in Chapter 8. Second, the cross-sectional nature of the research means that causal relationships between Type D, illness, and health outcomes could not be identified. As such, possible mechanisms of effect are speculative, however they may provide avenues of enquiry for future research. Third, the study had a limited ability to investigate Type D within specific illness groups. The data were combined across illnesses and across functional somatic syndrome status in order to ensure adequate power was achieved in the analyses. Further research could aim to develop a larger sample in order to look for more subtle effects of Type D and illness type. Finally, the data were obtained via self-report questionnaire, hence the degree to which a participant’s perceptions of social support or symptom severity are consistent with objective measures was unable to be obtained.

Further limitations include the possibility that a number of covariates were not accounted for in the analyses.

7.17 Conclusion

Overall, the current study contributes to a number of aspects of Type D research. While Type D may be a useful diagnostic heuristic for clinicians, predictive models clearly benefit more by treating the subscales of Type D as continuous additive effects. The greater importance of negative affectivity and the absence of interaction effects between Type D subscales may represent a further challenge to the novelty of the Type D construct.

More broadly, the present study expanded Type D research to previously untested chronic illnesses, finding that models of Type D developed in CHD patients appear to be more generally applicable. These findings not only help to better understand the construct, but may assist in developing better models of personality and health outcomes for use in clinical and applied health-care settings. Specific reference to personality variables is often absent in health determinant models, however increasing evidence from Type D research
suggests that particular traits, such as those that underpin Type D, represent important risk factors for health behaviours, illness perceptions and overall health status.
CHAPTER 8 - A METHODOLOGICAL CONSIDERATION OF THE POTENTIAL IMPACTS OF GENDER AND EDUCATION BIAS ACROSS THE THREE STUDIES

To avoid an unnecessary duplication of information, two methodical considerations that were common to each study are presented as a single, overarching investigation of their potential effects. The methodological considerations asked if the results of each study were impacted by a gender bias and an education bias.

8.1 Gender Bias

A disproportionate number of female respondents was a characteristic of all three studies. A review of the statistical and methodological literature pertaining to gender bias in health research was undertaken a posteriori, primarily as a means of determining whether a similar pattern of gender asymmetry had been reported by other researchers. The tendency for female participants to engage with survey-based health research more than males has been documented previously (Galea & Tracy, 2007). A review of 510 traditional data collection (i.e. paper and pencil) studies that were published in the Journal of Personality and Social Psychology during 2002, found that 71% of participants across the studies were female (Gosling et al., 2004). The same review also stated that an average of 77% of participants in correlational studies were female.

The way that the study is advertised to potential respondents seems to influence gender response rates. For example, a study that sought personality information of pet owners and their pets attracted a sample of 1,640 participants, 83% of whom were female (Gosling & Bonnenburg, 1998). Similarly, the presentation of the survey as either ‘masculine’ or ‘feminine’ has been shown to influence gender response rates. A survey invitation that was presented as either ‘feminine’ or ‘masculine’ (based on popular movies that were culturally considered to be either feminine or masculine) attracted the corresponding gender as roughly two-thirds of each sample. The ‘feminine’ version of the survey yielded a sample that was
66% female. The ‘masculine’ version of the same survey yielded a sample that was 39% female (Srivastava, John, Gosling, & Potter, 2003). Although the three studies in the present thesis were not designed to be more attractive to females than males, a gender bias occurred nevertheless. Research methodology literature generally supports the idea that females are more likely to participate in survey research than males, and for this reason the gender bias in the present study could be considered a likely product of the data collection method.

8.2 Gender Bias in the Present Studies

An examination of the differences between males and females in each of the three studies’ samples was conducted to determine if the bias translated into any real and meaningful effect. In each study, the presence of gender-related group differences for each variable was explored with a series of t-test analyses or chi square tests of independence analyses, depending on whether the data were continuous or categorical in nature. For each study, a table of means and standard deviations for the relevant variables is presented, as well as a summary of the results. At the conclusion of the individual study results, a discussion of the significant differences between the genders, and how the differences were assessed, is presented.

8.2.1 Study 1 – Facet-level Examination of Type D

The variables examined for gender differences in Study 1 are presented in Table 8.1. The proportion of Type D personality in the male sample was not statistically different to the proportion of Type D in the female sample, $\chi^2(1, n=262) = .428, p>.05$.

The only significant group difference between male and female participants in Study 1 was the Big 5 factor of agreeableness, $t(260) = 4.44, p<.001$ (2 tailed). An inspection of the group means in Table 8.1 showed that female participants were more agreeable than the male participants.
Table 8.1  
*Summary of descriptive statistics for male and female participants on rate of Type D, and Study 1 variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gender</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dichotomous</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type D</strong></td>
<td>Male</td>
<td>29</td>
<td>49.2</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>90</td>
<td>44.3</td>
</tr>
<tr>
<td><strong>M (SD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Negative Affectivity</strong></td>
<td>Male</td>
<td>59</td>
<td>12.30 (6.15)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>203</td>
<td>11.18 (6.26)</td>
</tr>
<tr>
<td><strong>Social Inhibition</strong></td>
<td>Male</td>
<td>59</td>
<td>12.65 (6.56)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>203</td>
<td>10.54 (6.10)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>Male</td>
<td>59</td>
<td>33.53 (16.04)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>203</td>
<td>32.48 (13.57)</td>
</tr>
<tr>
<td><strong>Agreeableness</strong></td>
<td>Male</td>
<td>59</td>
<td>3.36 (.41)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>203</td>
<td>3.62 (.39)</td>
</tr>
<tr>
<td><strong>Conscientiousness</strong></td>
<td>Male</td>
<td>59</td>
<td>3.32 (.40)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>203</td>
<td>3.42 (.46)</td>
</tr>
<tr>
<td><strong>Extraversion</strong></td>
<td>Male</td>
<td>59</td>
<td>3.14 (.50)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>203</td>
<td>3.27 (.47)</td>
</tr>
<tr>
<td><strong>Neuroticism</strong></td>
<td>Male</td>
<td>59</td>
<td>3.01 (.50)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>203</td>
<td>2.97 (.55)</td>
</tr>
<tr>
<td><strong>Openness</strong></td>
<td>Male</td>
<td>59</td>
<td>3.39 (.44)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>203</td>
<td>3.51 (.40)</td>
</tr>
</tbody>
</table>

*Note:* Significantly different group means are presented in bold.

8.2.2 Study 2 – Prevalence of Type D in the Australian Population

The variables examined for gender differences in Study 2 are presented in Table 8.2. The proportion of Type D personality in the male sample was not statistically different from the proportion of Type D in the female sample, $\chi^2(1, n=955) = 3.26, p>.05$. 
Table 8.2
Summary of descriptive statistics for male and female participants on rate of Type D, and Study 2 variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gender</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dichotomous Type D</td>
<td>Male</td>
<td>66</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>313</td>
<td>41.1</td>
</tr>
<tr>
<td><strong>M (SD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Affectivity</td>
<td>Male</td>
<td>168</td>
<td>10.1 (6.19)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>679</td>
<td>11.42 (6.05)</td>
</tr>
<tr>
<td>Social Inhibition</td>
<td>Male</td>
<td>168</td>
<td>11.14 (6.56)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>679</td>
<td>10.40 (6.31)</td>
</tr>
<tr>
<td>Social Support</td>
<td>Male</td>
<td>168</td>
<td>12.40 (3.41)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>679</td>
<td>12.38 (3.72)</td>
</tr>
<tr>
<td>Health Behaviours</td>
<td>Male</td>
<td>168</td>
<td><strong>8.85 (4.55)</strong></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>679</td>
<td><strong>9.98 (4.54)</strong></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>Male</td>
<td>114</td>
<td><strong>4.38 (3.65)</strong></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>518</td>
<td><strong>5.94 (3.66)</strong></td>
</tr>
</tbody>
</table>

*Note: Significantly different group means are presented in bold.*

There were two significant group differences between male and female participants in Study 2. On average, females carried out more positive health behaviors than males $t(845)=2.9, p<.005$ (two tailed). Females were also reported a higher rate of neuroticism, on average, than males $t(630)=4.16, p<.005$ (two tailed).

8.2.3 Study 3 – Type D as a General Risk Factor for Chronic Illness

The variables examined for gender differences in Study 3 are presented in Table 8.3 and 8.4. The proportion of Type D personality in the male sample was not statistically different to the proportion of Type D in the female sample, $\chi^2(1, n=205)=1.04, p>.05$.

Study 3 asked participants to indicate whether they were currently diagnosed with a chronic illness. A chi square test of independence analysis was used to determine if there were group differences in the rate of reported chronic illness between male and female.
participants. There was a significant group difference for reported chronic illness, $\chi^2(1, n=380) = 4.68, p<.05$, however the differences were within groups, rather than between groups. There was no significant difference between males and females on reporting of chronic illness. The subscript $a$ and subscript $b$ in Table 8.3 indicate that the proportions of cells with the same subscript letter are not significantly different from each other.

Of the variables presented in Table 8.4, only the variable of reported physical symptom severity differed significantly between genders $t(378) = 3.27, p<.005$ (two tailed). The mean scores show that females reported greater physical symptom severity than males.

**Table 8.3**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Did not report chronic illness</th>
<th>Did report chronic illness</th>
<th>Row Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>43$_a$ (35)</td>
<td>31$_b$ (39)</td>
<td>74</td>
</tr>
<tr>
<td>%</td>
<td>58.1</td>
<td>41.9</td>
<td>100</td>
</tr>
<tr>
<td>Female</td>
<td>135$_a$ (143)</td>
<td>171$_b$ (163)</td>
<td>306</td>
</tr>
<tr>
<td>%</td>
<td>44.1</td>
<td>55.9</td>
<td>100</td>
</tr>
<tr>
<td>Column Totals</td>
<td>178</td>
<td>202</td>
<td>380</td>
</tr>
<tr>
<td>%</td>
<td>46.8</td>
<td>53.2</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note:* Subscript letters denote a subset of reported chronic illness categories whose column proportions do not differ significantly from each other at the .05 level, two tailed. Expected values are in parentheses.

As a final step to ensure the gender bias in the data did not have an unexpected effect, gender was included as a predictor variable in the regression analyses in Study 3. The results showed that gender was not a significant predictor of health behaviours, social support, or symptom severity (Table 8.5 and Table 8.6).
**Table 8.4**
*Summary of descriptive statistics for male and female participants on rate of Type D, and Study 3 variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gender</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dichotomous</strong></td>
<td>Male</td>
<td>38</td>
<td>51.4</td>
</tr>
<tr>
<td><strong>Type D</strong></td>
<td>Female</td>
<td>137</td>
<td>44.8</td>
</tr>
<tr>
<td><strong>M (SD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Negative Affectivity</strong></td>
<td>Male</td>
<td>74</td>
<td>12.22 (6.67)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>306</td>
<td>11.75 (6.27)</td>
</tr>
<tr>
<td><strong>Social Inhibition</strong></td>
<td>Male</td>
<td>74</td>
<td>12.79 (6.50)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>306</td>
<td>11.22 (6.01)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>Male</td>
<td>71</td>
<td>37.54 (17.42)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>302</td>
<td>37.65 (14.39)</td>
</tr>
<tr>
<td><strong>Social Support</strong></td>
<td>Male</td>
<td>74</td>
<td>9.96 (2.25)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>306</td>
<td>10.31 (2.30)</td>
</tr>
<tr>
<td><strong>Health Behaviours</strong></td>
<td>Male</td>
<td>73</td>
<td>32.33 (9.68)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>306</td>
<td>34.18 (7.64)</td>
</tr>
<tr>
<td><strong>Physical Symptom Severity</strong></td>
<td>Male</td>
<td>74</td>
<td><strong>40.25 (11.14)</strong></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>306</td>
<td><strong>46.17 (14.56)</strong></td>
</tr>
<tr>
<td><strong>Psychological Symptom Severity</strong></td>
<td>Male</td>
<td>74</td>
<td>19.01 (6.68)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>306</td>
<td>19.41 (6.86)</td>
</tr>
</tbody>
</table>

*Note:* Significantly different group means are presented in bold.
## Table 8.5
Regression analysis of Type D predicting health behaviour and social support in Study 3

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Health Behavior</th>
<th></th>
<th>Social Support</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td></td>
<td>$B$</td>
<td>$SE$</td>
<td>$B$</td>
<td>$SE$</td>
</tr>
<tr>
<td>Intercept</td>
<td>-.30*</td>
<td>.07</td>
<td>-.32*</td>
<td>.07</td>
</tr>
<tr>
<td>Gender</td>
<td>.17</td>
<td>.12</td>
<td>.03</td>
<td>.18</td>
</tr>
<tr>
<td>Education</td>
<td>.07</td>
<td>.05</td>
<td>.12</td>
<td>.06</td>
</tr>
<tr>
<td>Chronic Illness</td>
<td>.52*</td>
<td>.11</td>
<td>.54*</td>
<td>.11</td>
</tr>
<tr>
<td>FSS</td>
<td>-.14</td>
<td>.13</td>
<td>-.17</td>
<td>.13</td>
</tr>
<tr>
<td>Negative Affectivity</td>
<td>-.32*</td>
<td>.06</td>
<td>-.31*</td>
<td>.09</td>
</tr>
<tr>
<td>Social Inhibition</td>
<td>-.03</td>
<td>.06</td>
<td>-.19*</td>
<td>.08</td>
</tr>
<tr>
<td>NA x SI</td>
<td>.10*</td>
<td>.04</td>
<td>.09*</td>
<td>.04</td>
</tr>
<tr>
<td>SI x Chronic Illness</td>
<td>.33*</td>
<td>.14</td>
<td></td>
<td>.10</td>
</tr>
<tr>
<td>NA x Chronic Illness</td>
<td>-.07</td>
<td>.15</td>
<td></td>
<td>.19</td>
</tr>
<tr>
<td>SI x FSS</td>
<td>-.04</td>
<td>.16</td>
<td></td>
<td>.08</td>
</tr>
<tr>
<td>NA x FSS</td>
<td>.08</td>
<td>.15</td>
<td></td>
<td>-.37*</td>
</tr>
</tbody>
</table>

Adjusted $R^2$  

- Health Behavior: .14*  
- Social Support: .15  

$F$ (df)  

- Health Behavior: 13.55 (5, 381)  
- Social Support: 8.60 (9, 377)  

Note. Chronic illness was coded 0 = healthy, 1 = illnesses of known etiology or functional somatic syndrome. Functional somatic syndrome (FSS) was coded 0 = healthy or illnesses of known etiology, 1 = FSS. Negative affect (NA), social inhibition (SI), health behavior and social support were coded as z-scores. NA x SI was the product of NA and SI z-scores.  
* $p<.05$
Table 8.6
Regression analysis for variables predicting physical symptoms and psychological symptoms in Study 3

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Physical Symptoms</th>
<th>Psychological Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>SE B</td>
</tr>
<tr>
<td>Intercept</td>
<td>-.47*</td>
<td>.06</td>
</tr>
<tr>
<td>Gender</td>
<td>.17</td>
<td>.16</td>
</tr>
<tr>
<td>Education</td>
<td>-.03</td>
<td>.05</td>
</tr>
<tr>
<td>Chronic Illness</td>
<td>.49*</td>
<td>.09</td>
</tr>
<tr>
<td>FSS</td>
<td>.92*</td>
<td>.10</td>
</tr>
<tr>
<td>Negative Affectivity</td>
<td>.33*</td>
<td>.04</td>
</tr>
<tr>
<td>Social Inhibition</td>
<td>-.03</td>
<td>.04</td>
</tr>
<tr>
<td>NAxSI</td>
<td>-.05</td>
<td>.03</td>
</tr>
<tr>
<td>Social Support</td>
<td>-.11*</td>
<td>.05</td>
</tr>
<tr>
<td>Health Behaviors</td>
<td>-.10*</td>
<td>.04</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>.47*</td>
<td>.49*</td>
</tr>
<tr>
<td>$F (df)$</td>
<td>70.16 (5,381)</td>
<td>53.48 (7,379)</td>
</tr>
</tbody>
</table>

Note. Chronic illness was coded 0 = healthy, 1 = illnesses of known etiology or functional somatic syndrome. Functional somatic syndrome (FSS) was coded 0 = healthy or illnesses of known etiology, 1 = FSS. Negative affect (NA), social inhibition (SI), health behavior, social support, physical symptoms, and psychological symptoms were coded as z-scores. NA x SI was the product of NA and SI z-scores.

* p<.05

8.3 Summary and Interpretation of Gender-related Group Differences

The three studies in the present thesis each had a disproportionate number of female participants. However, there were few significant differences between males and females on
the variables that were investigated. Arguably the most important comparison was the rate at which Type D occurred in each gender. In each of the three studies, there was no significant difference between males and females on the rate of Type D personality. The results are interesting as they do not support previous research which reported Type D to be significantly more common in women than men (25% men versus 31% women; Denollet, 2005). More importantly however, the results of the group comparisons allow the results of each study to be interpreted with confidence. If Type D was more prevalent in one gender over the other, the findings of each study may have had limited generalisability. Study 2, which assessed the prevalence of Type D in the Australian population, could have been particularly affected by a gender bias. Had the rate of Type D been much higher in one gender than the other, the prevalence estimate could have suffered inflation or suppression, depending on the direction of the bias.

Of the Big 5 factors in Study 1, only one group difference was found. The data indicated that females are significantly more agreeable than males, as measured by the NEO-PI-R. In Study 2, females were found to exhibit more neuroticism than males, as measured by the Neuroticism Subscale of the Eysenck Personality Questionnaire. The finding that females exhibited more agreeableness and neuroticism traits than males was not considered to be a threat to the integrity of the data. Past research indicates that both group differences could be expected. A meta-analysis of trait differences between genders in the personality literature from 1940 to 1992 found that women scored higher than men in extraversion, anxiety, trust, and tendermindedness (Feingold, 1994). The findings of the present thesis are largely consistent with the meta-analysis as anxiety is a facet of neuroticism, and both trust and tendermindedness are facets of agreeableness. The only discrepancy between the data in the present studies and the meta-analysis was that females were not higher than males in extraversion. Examination of the means for extraversion in Table 8.1 indicates a trend
towards females having more extraversion traits than males, however the trend did not reach significance.

Studies 2 and 3 both used measures of social support and health behaviours. There were no differences in perceived levels of social support between the genders in either Study 2 or Study 3. There was a significant difference in health behaviours in Study 2, although not in Study 3. In Study 2, the data showed that females engaged in more positive health behaviours than males. A difference in amount of positive health behaviour undertaken by males versus females has been reported in previous health literature. Published findings have indicated that relative to females, males are less likely to engage in positive health behaviours such as reduced alcohol intake and increased exercise (e.g. Von Bothmer & Fridlund, 2005). As such, the differences in reported positive health behaviours in the sample of Study 2 were not considered to be aberrant, and, therefore, unlikely to threaten the integrity of the data.

Finally, the data in Study 3 were derived from both healthy and chronically ill participants. Three variables in Study 3 were related to chronic illness: physical symptom severity, psychological symptom severity, and the presence of a chronic illness. There were no differences between the genders for psychological symptom severity. Physical symptom severity did differ between males and females. Females reported greater severity of their physical symptoms than males. The gender difference in physical symptom reporting in the present thesis is consistent with a sizeable body of research that shows that symptom reporting rates are typically higher in females than males (e.g. Almeida et al., 1999; Kroenke & Spitzer, 1998; Ladwig, Marten-Mittag, Formanek, & Dammann, 2000; Van Wijk & Kolk, 1997). In terms of reported presence of a chronic illness, the chi square test of independence results showed that females reported more chronic illness than would be expected if the groups were not different, while men reported less chronic illness than would have been expected (Table 8.4). From the perspective of an Australian sample, the differences are
consistent with data published by the Australian Bureau of Statistics (ABS, 1998), which data showed that Australian females reported more minor ailments than males, and held a more negative assessment of their own health. On the other hand, males reported more serious ailments and had higher death-rates at all ages than females. The question for the sample in Study 3 is whether CFS, fibromyalgia, type 2 diabetes, osteoarthritis, and rheumatoid arthritis are likely to be considered ‘serious’ or ‘minor’ under the ABS criteria. No definitions were available, however a speculative assumption could be that ‘serious’ may refer to life-threatening or terminal. The conditions in Study 3 are typically neither life-threatening nor terminal.

In summary, there appeared to be no significant differences between males and females in the samples of each study that could not be either expected or explained by the literature. As such, the effect of female gender bias on the results of the three studies was considered minimal to none. A positive outcome of the unexpected gender bias is that future research endeavours by the author can now expect to encounter a female gender bias. This greater awareness can assist to design future research that includes reasonable steps to try to minimise the impact of any bias.

8.4. Education Bias

Table 8.7 presents a comparison of national educational attainment rates with the rates observed in the three studies in this thesis. The percentages in Table 8.7 do not tally to 100% as the data do not include non-school qualifications such as vocational certificates. The secondary education percentages for the three studies are represented by two values. The value in parentheses represents the combined percentages of participants who indicated that they had achieved either a secondary school level of education or a trade level qualification. It was assumed by the researcher that prior to commencing a trade apprenticeship, a secondary education to at least year 10 was likely to have been obtained. The information in
Table 8.7 shows that the samples in each study under-represent individuals with secondary school attainment. Even with the addition of trade qualified participants, the secondary level in all three samples is less than the national average. Table 8.7 also shows that individuals with tertiary or postgraduate educational attainment are over-represented in all but one instance (postgraduate attainment in Study 1 appears representative).

**Table 8.7**

*Comparison of highest level of education proportion between the Australian population and each study*

<table>
<thead>
<tr>
<th></th>
<th>Australian Population</th>
<th>Study 1</th>
<th>Study 2</th>
<th>Study 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary</td>
<td>44</td>
<td>20 (24.5)</td>
<td>24 (31.2)</td>
<td>29 (35.2)</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>17</td>
<td>41</td>
<td>38</td>
<td>33</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>6</td>
<td>5</td>
<td>14</td>
<td>24</td>
</tr>
</tbody>
</table>

*Note:* Australian Bureau of Statistics data, current as of 15th May, 2015. Figures in parentheses represent percentage of sample that completed secondary level education followed by a trade qualification.

The disparity in the distribution of educational attainment in the studies compared with the Australian population shows that there is an education bias in the data. Hence, an inspection of the data was undertaken to determine whether there the bias may have impacted the results.

There is a well-documented relationship between health status and level of education. Generally, studies have repeatedly found that lower levels of education are related to poorer health outcomes (e.g. see Adler & Newman, 2002; Kunst et al., 2005; Mackenbach et al., 2008). Although the relationship between education and health has been established for some time, the mechanisms responsible for the relationship were not as clear. One mechanism that has been proposed to mediate the relationship between health status and education is health literacy. Health literacy has been defined as ‘the degree to which individuals have the
capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions’ (p 20; Parker & Ratzan, 2010). Low health literacy has been associated with both low education level and poor health status (Davis et al., 2006). Individuals with low health literacy have been found to not only have poorer health status, but also be less able to manage chronic illness effectively, to possess less health-related knowledge, and to have more difficulty reading and understanding health information (e.g. hospital forms or medication labels; van der Heide et al., 2013).

8.5 Education Bias in the Present Studies

It is difficult to determine whether the educational attainment levels of participants in the three studies may have affected the quality of the data obtained as, collectively, they have a higher level of education than the Australian population average. The higher level of education of the sample should correspond to higher health literacy, and, therefore, better overall health status. There is potentially a sizeable benefit to surveying a sample of participants with a high level of health literacy. The data from participants with high health literacy may be more reliable or more accurate than data from participants with low health literacy. A high level of health literacy may mean that participants were more likely to understand the meaning of scale items on health-related questionnaires. They may have been more apt at verbalising their health concerns, and may also have been more knowledgeable about the underlying causes of their health-related issues. On the other hand, high health literacy individuals are more likely to have better overall health compared to low health literacy individuals. Data obtained from a sample of people who have a tendency to have better overall health than the general population may reduce or inflate any effects that were under investigation. For this reason, it is important that the results of the studies in the present thesis be interpreted with some degree of caution.
Another factor that may have mediated the relationship between education and health is level of income. Educational attainment has been found to have a positive correlation with personal income level. Numerous economic studies have found that a higher individual level of education reliably predicts a higher individual level of income (e.g. Ashenfelter & Rouse, 1999). Low income could potentially reduce accessibility to healthcare services if the monetary costs of medical treatment or medications were greater than the disposable income of low wage earners. The potential for income level to affect access to healthcare in Australia has been addressed somewhat by two government-subsidised programs – Medicare and the Pharmaceutical Benefits Scheme (PBS). Since 2004, the primary health care network in Australia (Medicare) has gradually broadened the range of subsidised healthcare services to include out-of-hospital expenses (Department of Health, 2016b). For example, prior to 2004, the financial cost of accessing a mental health specialist, such as a psychologist, was borne by the individual. The fee per hour cost of consultation with a psychologist often effectively excluded low-income earners from accessing psychological services. The expansion of Medicare to incorporate psychological services may have begun to redress that particular healthcare disparity in Australia. Similarly, the PBS was implemented to provide access to heavily subsidised medications. The PBS was established in Australia in 1948, however the list of subsidised medications only totalled 139 (Department of Health, 2016a). In 2016, the PBS subsidises thousands of medications including high-cost newly developed therapeutic drugs and specialised treatments that would otherwise be unaffordable to low income earners.

Hence, for the participant samples in the present thesis, the influence of educational attainment on health status by way of income was thought to be minimal. Nevertheless, a series of one-way ANOVA analyses was carried out to determine whether there were any problematic group differences between the education levels in each study. The list of variables considered are the same as those in the gender analyses. To investigate the effect of
educational attainment within the three studies, only cases that indicated their highest level of education were included: secondary, undergraduate, or postgraduate were used. For each study, a table of means and standard deviations is presented, as well as a summary of the results. At the conclusion of the individual study results, a discussion of the significant differences between the educational attainment levels, and how the differences were assessed, is presented.

8.5.1 Study 1 – Facet-level Examination of Type D

The variables examined for educational attainment group differences in Study 1 are presented in Table 8.8. There was no difference between the educational attainment groups on the rate of Type D personality, $\chi^2(1, n=262) = .428, p>.05$.

<table>
<thead>
<tr>
<th>Table 8.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of descriptive statistics for level of education on rate of Type D, and Study 1 variables</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Secondary (A)</th>
<th>Tertiary (B)</th>
<th>Postgraduate (C)</th>
<th>Bonferroni</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dichotomous Type D (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=53</td>
<td>N=109</td>
<td>N=46</td>
<td></td>
</tr>
<tr>
<td>22 (41.5)</td>
<td>54 (46.8)</td>
<td>21 (45.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td></td>
</tr>
<tr>
<td>Negative Affectivity</td>
<td>10.15 (6.12)</td>
<td>12.57 (6.32)</td>
<td>10.58 (5.23)</td>
<td></td>
</tr>
<tr>
<td>Social Inhibition</td>
<td>10.68 (5.62)</td>
<td>12.07 (6.45)</td>
<td>10.17 (5.76)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>31.92 (16.05)</td>
<td>28.26 (12.45)</td>
<td>36.78 (13.35)</td>
<td>B&lt;C</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>3.47 (.41)</td>
<td>3.55 (.42)</td>
<td>3.67 (.41)</td>
<td></td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>3.30 (.39)</td>
<td>3.40 (.46)</td>
<td>3.50 (.40)</td>
<td></td>
</tr>
<tr>
<td>Extraversion</td>
<td>3.30 (.39)</td>
<td>3.20 (.52)</td>
<td>3.34 (.41)</td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>2.90 (.46)</td>
<td>3.12 (.55)</td>
<td>2.86 (.52)</td>
<td></td>
</tr>
<tr>
<td>Openness</td>
<td><strong>3.34 (.45)</strong></td>
<td><strong>3.56 (.40)</strong></td>
<td><strong>3.61 (.34)</strong></td>
<td>A&lt;B, A&lt;C</td>
</tr>
</tbody>
</table>

Note: p<.005, two tailed. Significant group differences are presented in bold.
8.5.2 Study 2 – Prevalence of Type D in the Australian Population

Mean scores for each of the three dependent variables by level of education are presented in Table 8.9. There was no difference between the educational attainment groups on the rate of Type D personality, $\chi^2(2, n=729) = 4.42, p>.05$.

Significant differences were found for social support $F(4,839) = 7.61, p<.001$ (two tailed), health behaviours $F(4,389) = 7.80, p<.001$ (two tailed), and neuroticism $F(4,625) = 3.98, p<.005$ (two tailed).

**Table 8.9**

*Summary of descriptive statistics for level of education on rate of Type D, and Study 2 variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Secondary (A)</th>
<th>Tertiary (B)</th>
<th>Postgraduate (C)</th>
<th>Bonferroni</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=229</td>
<td>N= 636</td>
<td>N=137</td>
<td></td>
</tr>
<tr>
<td>Dichotomous Type D (%)</td>
<td>98 (42.8)</td>
<td>140 (38.6)</td>
<td>48 (35)</td>
<td></td>
</tr>
<tr>
<td>Negative Affectivity</td>
<td>11.85 (6.50)</td>
<td>11.23 (5.97)</td>
<td>10.44 (5.33)</td>
<td></td>
</tr>
<tr>
<td>Social Inhibition</td>
<td>10.90 (6.45)</td>
<td>10.90 (6.35)</td>
<td>9.45 (6.10)</td>
<td></td>
</tr>
<tr>
<td>Social Support</td>
<td><strong>11.58 (3.67)</strong></td>
<td><strong>12.67 (3.77)</strong></td>
<td><strong>13.46 (3.05)</strong></td>
<td>A&lt;B, A&lt;C</td>
</tr>
<tr>
<td>Health Behaviours</td>
<td><strong>8.93 (4.71)</strong></td>
<td><strong>9.83 (4.0)</strong></td>
<td><strong>11.45 (4.82)</strong></td>
<td>A&lt;C,B&lt;C</td>
</tr>
<tr>
<td>Neuroticism</td>
<td><strong>6.39 (3.94)</strong></td>
<td>5.67 (3.58)</td>
<td><strong>4.60 (3.24)</strong></td>
<td>A&gt;C</td>
</tr>
</tbody>
</table>

*Note: p<.05, two tailed. Significant group differences are presented in bold.*

Post hoc tests with Bonferroni adjustment revealed that secondary level participants reported less perceived social support than both tertiary and postgraduate level participants. Postgraduate level participants reported more positive health behaviours than secondary and tertiary level participants. Finally, secondary level participants reported higher levels of neuroticism than postgraduate level participants.
8.5.3 Study 3 – Type D as a General Risk Factor for Chronic Illness

The chi square contingency table is presented as Table 8.10. There was no difference between the educational attainment groups on the rate of Type D personality, $\chi^2(2, n=336) = .123, p > .05$.

Study 3 asked participants to indicate whether they currently experienced a chronic illness. A chi square test of independence analysis was used to determine if there were group differences in the rate of reported chronic illness between the educational attainment groups. There was a significant group difference for reported chronic illness, $\chi^2(2, n=336) = 12.50, p < .05$. There was only one between groups difference, that of postgraduate participants who did not report a chronic illness. The subscript $a$ and subscript $b$ in Table 8.10 indicate that the proportions of cells with the same subscript letter are not significantly different from each other.

<table>
<thead>
<tr>
<th>Education level</th>
<th>Did not report chronic illness</th>
<th>Did report chronic illness</th>
<th>Row Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary</td>
<td>$47_a$ (55.8)</td>
<td>$66_b$ (57.2)</td>
<td>113</td>
</tr>
<tr>
<td>%</td>
<td>41.3</td>
<td>58.4</td>
<td>100</td>
</tr>
<tr>
<td>Tertiary</td>
<td>$80_a$ (64.2)</td>
<td>$50_b$ (65.8)</td>
<td>130</td>
</tr>
<tr>
<td>%</td>
<td>61.5</td>
<td>38.5</td>
<td>100</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>$39_a$ (45.9)</td>
<td>$54_a$ (47.1)</td>
<td>93</td>
</tr>
<tr>
<td>%</td>
<td>41.9</td>
<td>58.1</td>
<td>100</td>
</tr>
<tr>
<td>Column Totals</td>
<td>166</td>
<td>170</td>
<td>336</td>
</tr>
<tr>
<td>%</td>
<td>49.4</td>
<td>50.6</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: Subscript letters denote a subset of reported chronic illness categories whose column proportions do not differ significantly from each other at the .05 level, two tailed. Expected values are in parentheses.
Of the Study 3 variables presented in Table 8.11, health behaviours ($F(4, 373) = 5.12$, $p<.05$, two tailed) and psychological symptom severity ($F(4,384) = 3.42, p<.05$, two tailed) differed between the educational attainment groups.

**Table 8.11**

*Summary of descriptive statistics for level of education on rate of Type D, and Study 3 variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Secondary (A)</th>
<th>Tertiary (B)</th>
<th>Postgraduate (C)</th>
<th>Bonferroni</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dichotomous Type D (%)</strong></td>
<td>53 (47.7)</td>
<td>60 (46.2)</td>
<td>45 (48.4)</td>
<td></td>
</tr>
<tr>
<td><strong>M (SD)</strong></td>
<td>11.95 (6.70)</td>
<td>12.23 (6.20)</td>
<td>10.67 (5.70)</td>
<td></td>
</tr>
<tr>
<td>Negative Affectivity</td>
<td>11.77 (6.25)</td>
<td>11.89 (6.0)</td>
<td>10.83 (6.01)</td>
<td></td>
</tr>
<tr>
<td>Social Inhibition</td>
<td>40.03 (16.78)</td>
<td>31.39 (13.31)</td>
<td>42.09 (13.62)</td>
<td></td>
</tr>
<tr>
<td>Social Support</td>
<td>11.19 (3.75)</td>
<td>12.26 (3.77)</td>
<td>12.55 (3.20)</td>
<td></td>
</tr>
<tr>
<td>Health Behaviours</td>
<td><strong>10.68 (4.48)</strong></td>
<td><strong>10.72 (4.60)</strong></td>
<td><strong>13.17 (4.95)</strong></td>
<td>A&lt;C, B&lt;C</td>
</tr>
<tr>
<td>Physical Symptom Severity</td>
<td>47.51 (13.91)</td>
<td>43.06 (13.80)</td>
<td>43.06 (13.20)</td>
<td></td>
</tr>
<tr>
<td>Psychological Symptom Severity</td>
<td>19.59 (6.70)</td>
<td><strong>20.18 (7.08)</strong></td>
<td><strong>17.50 (5.80)</strong></td>
<td>B&gt;C</td>
</tr>
</tbody>
</table>

*Note:* $p<.05$, two tailed. Significant group differences are presented in bold.

Post hoc tests with Bonferroni adjustment revealed that participants with a postgraduate level of education carried out more health behaviours than both secondary and tertiary level participants. Furthermore, tertiary level participants reported greater severity of psychological symptoms than postgraduate level participants.

As a final step to ensure the education bias in the data did not have an unexpected effect, educational attainment was included as a predictor variable in the regression analyses in
Study 3. The results showed that educational attainment was not a significant predictor of health behaviours, social support, or symptom severity (See Tables 8.5 and 8.6).

8.6 Summary and Interpretation of Education-related Group Differences

The three studies in the present thesis all had samples where the educational attainment was, on average, higher than that of the Australian population. In the three samples, secondary school level of education was under-represented, while both tertiary and postgraduate were over represented. There were no group differences for the rate of Type D between the groups in any of the studies.

Overall there were a number of group differences on level of education, however most are consistent with expectations. With regards to the Big 5 factors, group differences occurred for neuroticism (Study 2) and openness to experience (Study 1). The mean scores indicated that neuroticism decreased as level of education increased. Additionally, openness to experience increased as education level increased. These results could perhaps reflect the influence of a broader educational experience on personality. It seems reasonable to consider education as a broadening of awareness and understanding of the world, which, in turn, may lead to a tendency to worry less and be more willing to consider or adopt new ideas.

The comparison of educational attainment groups on perceived social support and health behaviours does lend weight to the notion of education influencing health status. In the present samples, as education level increased, so did perceived levels of social supports and positive health behaviours. In study 2, tertiary and postgraduate participants reported significantly more perceived social support than did the secondary level participants. In Study 3, the means showed the same trend, however the differences did not reach significance. Social support is an important factor in managing health and coping with illness (Symister & Friend, 2003). As perceptions of social support decrease, ability to cope with the stressors
associated with illness also decreases. The results of Study 2, and, to a lesser extent, Study 3, demonstrate a possible relationship between education level and health status by way of perceived social support.

The same relationship was observed with health behaviours. As education level increased, so did the amount of positive health behaviours carried out by participants. In both Study 2 and Study 3, postgraduate participants carried out significantly more positive health behaviours than secondary and tertiary participants. The findings for both social support and health behaviours are consistent with the literature pertaining to health and education.

There were no group differences for physical symptom severity, however the tertiary level participants reported greater psychological severity than postgraduate, but not more than secondary level participants. These results are not as intuitive as the previous group differences, and an investigation of the other education level group comparisons did not offer any explanations for the difference. Tertiary level participants reported significantly less chronic illness than expected, so the psychological symptom severity does not appear to be a function of increased chronic illness within the tertiary group. Also, the tertiary group are not more neurotic than the postgraduate group, so excessive worry or anxiety does not account for the difference in psychological symptoms. There is, however, research evidence that indicates that undergraduate students are more psychologically distressed than the general population (Bore, Pittolo, Kirby, Dluzewska, & Marlin, 2016; Nerdrum, Rustøen, & Rønnestad, 2006). One possible explanation for the results of the present analyses could be that tertiary level participants may have been currently completing, or perhaps had recently completed, their undergraduate studies. If there were a high number of current or very recently completed tertiary participants, the elevated level of psychological symptom severity could be expected.
In summary, most of the educational attainment group differences observed were either expected or consistent with previous research. The group differences were considered unlikely to be a threat to the results of the present thesis, however the difference between the overall education level of the samples and the Australian population average is worth considering. The results of each study in the present thesis should be considered in light of the possibility that the sample were likely to have greater health literacy than the general population, and, therefore, be healthier. On the other hand, increased health literacy may have contributed to the robustness of the data. If the participants were better equipped to understand their health and the health-related information in the surveys, as well as more accurately verbalise their beliefs, behaviours and perceptions, the data may offer a clearer picture of the relationship between Type D personality and health.
CHAPTER 9 - SUMMARY, IMPLICATIONS, AND CONCLUSION

This thesis addressed four primary research questions. First, is Type D personality a new and valid construct in personality and health research, or simply a rebranding of known traits such as neuroticism and extraversion? Second, is Type D personality a typology that is present in the Australian general population, and, therefore, relevant to the Australian healthcare system? Third, which representation of Type D personality has the most valid and predictive utility for future health research? Finally, does Type D personality, and its reported health-related impacts, generalise to other high-impact chronic conditions beyond the well-established cardiac population? This chapter presents the findings of the three empirical studies relative to the research questions, along with the implications of the findings for Type D personality theory and research, and for the Australian healthcare system. The chapter also identifies the strengths and limitations of the studies, and concludes with recommendations for future research.

9.1 Summary of the Major Findings Relative to the Research Questions

The first research question asked whether Type D personality is a new and valid construct in personality and health research, or simply a rebranding of the well-known and widely-accepted Big 5 factors, neuroticism and extraversion. The NEO facet-level analysis in Chapter 5 provided modest evidence to suggest that Type D personality does represent particular characteristics beyond those which are accounted for by neuroticism and extraversion, and should be considered a novel and valid construct in personality and health research.

Participants from the Australian general public (n=273) completed the standard measure of Type D personality, the DS14, and the 240 item full scale NEO-PI-R. As predicted, and consistent with previous research, the factor level analysis revealed that the strongest correlations were between negative affectivity and neuroticism (.75), and social inhibition...
and extraversion (-.73). Negative affectivity correlated significantly with each of the Big 5 factors, except for openness. Social inhibition also correlated significantly with each of the Big 5 factors. These correlations may be interpreted as showing that negative affectivity and social inhibition were quite well represented by the Big 5, but were predominantly explained by neuroticism and extraversion.

With regards to the first research question, the zero-order correlations showed a number of expected relationships between the NEO facets and negative affectivity and social inhibition (e.g. gregariousness with social inhibition (-ve), positive emotions with negative affectivity (-ve)), as well as some that were unexpected (e.g. assertiveness with negative affectivity (+ve), self-consciousness with negative affectivity (-ve)). The semi-partial correlations indicated that five facets added significant incremental prediction over and above the Big 5 factors. The extraversion facets of assertiveness and positive emotion, and the neuroticism facet of self-consciousness provided incremental information about negative affectivity, while the extraversion facets of warmth and gregariousness provided incremental information about social inhibition.

The second research question asked whether Type D personality was a construct relevant to the Australian population, and, therefore, to the Australian healthcare system. Chapter 6 presented strong evidence to indicate that Type D personality is present in the Australian general population. Members of the general public (n=955) completed a series of health-related questionnaires. Type D personality was measured using the DS14, while the perception of social support was assessed with the Quality of Social Network and Social Support Scale. The frequencies of positive health behaviours were measured with the General Preventative Health Behaviours checklist, and neuroticism was measured with the neuroticism subscale of the Eysenck Personality Questionnaire. The rate of Type D personality was calculated using the standard dichotomous representation in order to facilitate
comparison to other population prevalence estimates. The results indicated that the prevalence rate in the Australian population was approximately 40%, irrespective of age or gender. The Australian prevalence rate was not significantly different from the rate reported in the United Kingdom and Ireland (38.5%; Williams et al., 2008).

The final study, presented in chapter 7, was designed to answer the third and fourth research questions. Research question 3 aimed to determine which representation of Type D personality had the highest predictive utility for future health research. Question 4 asked whether Type D personality, and its reported health-related impacts, can generalise to other high-prevalence, high-impact chronic conditions beyond the well-established cardiac population. Participants who self-identified as having one of the five chronic illnesses under consideration (type 2 diabetes, rheumatoid arthritis, osteoarthritis, CFS, fibromyalgia; N=208), as well as a sample of healthy controls (n=181), completed a series of health-related questionnaires assessing the presence of Type D personality, perceptions of social support, frequency of positive health behaviours, and perceptions of symptom severity (both physical and psychological).

Research question 3 was guided by the Type D literature regarding the various possible representations of Type D (e.g. see Denollet et al., 2013; Kelly-Hughes et al., 2014). In total, seven possible representations of Type D were established by the researcher. A series of linear regression analyses was employed to estimate the variance explained by each representation, in four health-related variables noted above; health behaviours, social support, and both physical and psychological symptom severity. The adjusted R² values were averaged across the four variables for each Type D representation. The representation that demonstrated the highest predictive utility was continuous negative affectivity and social inhibition main effects. The inclusion of the negative affectivity and social inhibition interaction term only added very minimal prediction to the average adjusted R² value overall,
and appeared to only demonstrate any real predictive utility, beyond the main effects, for health behaviours. The least effective representation of Type D was the traditional dichotomous representation.

The final research question asked whether Type D personality, and its reported health-related impacts, could generalise to other high-impact chronic conditions beyond the well-established cardiac population. Overall, the chronic illness participants had a significantly higher rate of Type D personality (53.6%) than the healthy controls (39.2%), however there was no difference between the functional somatic syndrome group (CFS, fibromyalgia) and the illnesses of known etiology group (type 2 diabetes, rheumatoid arthritis, osteoarthritis). Regression analyses revealed preliminary evidence of two significant interactions between Type D personality and illness group, however the effect was lost with the application of a Bonferroni adjustment to .002. At the .05 significance level, before alpha adjustment, the effect of negative affectivity on social support was amplified in the functional somatic syndrome group, and the effect of social inhibition on health behaviours was reduced in chronic illnesses compared to healthy controls. As these significant interactions were only two of a possible 24, the results, on balance, did not indicate that there was a differential effect of Type D personality on illness type. Instead, a more parsimonious explanation of the findings was that Type D personality appeared to be a generalised predictor of health behaviours, beliefs, and perceptions in a variety chronic illness groups.

9.2 Implications of the Research for Type D Personality Theory and Research

The research undertaken in this thesis aimed to contribute to debates in the Type D literature, as well as more fully investigate the construct and its potential applications. A principle criticism of Type D personality, and arguably the one that is the greatest threat to its integrity, is the claim that it is not a novel construct. The evidence provided in Study 1 goes some way to nullifying this criticism, by demonstrating that there are unique elements to the
Type D construct beyond basic neuroticism and extraversion.

The NEO-PI-R factor and facet-level investigation of Type D personality has particular implications for Type D theory, research, and clinical applications. Although the finding that negative affectivity and social inhibition have moderate to strong correlations with neuroticism and extraversion, respectively, is not new, the facet-level investigation of Type D is new. Both the zero-order and semi-partial correlation analyses offered new information about the specific personality characteristics (facets) that most effectively explain Type D personality. This research provided a more fine-grained understanding of Type D, and should allow future research to focus more closely on the psychological mechanisms of Type D personality.

The theory of Type D personality could be further developed and refined by examining the size of the zero-order correlations between the NEO-PI-R facets and negative affectivity and social inhibition. The three strongest facet correlations (+) with negative affectivity were, in descending order of size, depression, anxiety, and angry hostility. These correlations may be interpreted as showing that negative affectivity, as measured by the DS14, represents a tendency to experience emotions such as guilt, sadness, tension, frustration, and anger (Costa & McCrae, 2008), and this is consistent with Type D personality theory. However a further examination of the significant zero-order correlations showed that other NEO-PI-R facets contributed to the explanation of negative affectivity (e.g. vulnerability (+), trust (-), self-discipline (+), and impulsiveness (+)).

Similarly, the three highest facet correlations (-) with social inhibition were, in descending order of size, warmth, gregariousness, and positive emotion. These facet correlations show that the conceptualisation of social inhibition, as it relates to Type D personality, is less about self-consciousness or assertiveness than it is about a person’s need for, or willingness to seek personal intimacy and the company of others, as well as the
capacity to experience positive emotions such as joy, happiness, love, and excitement (Costa & McCrae, 2008). This information provided new clues as to the specific mechanisms at work in negative affectivity and social inhibition, which, in turn, could assist future research and intervention endeavors to take a more targeted approach to understanding how different aspects of Type D personality may influence health-related behaviours, beliefs, and perceptions.

The research in this thesis has several implications for the representation of Type D personality. The theory of Type D is based on two assumptions, that: 1) the construct should be represented as a dichotomous type, and 2) the type operates via an interaction of negative affectivity and social inhibition. The claim that Type D should be represented as a dichotomous construct has attracted growing criticism in the literature. The current research provided strong evidence that the dichotomisation of the two continuous Type D variables, negative affectivity and social inhibition, to form a type, reduced the predictive utility of Type D personality considerably. Of the seven possible representations of Type D, the traditional dichotomised approach provided the least predictive utility when predicting health-related variables. The most effective representation consisted of a continuous form of negative affectivity and social inhibition as main effects, which also challenges the second assumption of Type D personality theory, the interaction effect.

The evidence presented here indicated that representing Type D personality as an interaction between negative affectivity and social inhibition caused both traits to lose some of their uniqueness, and, possibly, some of their potential contribution to understanding the mechanisms of Type D. The evidence of this claim came from two studies. First, Study 1 demonstrated that the facet-level incremental prediction for negative affectivity and social inhibition disappeared when the traits were combined to form a continuous type. Second, the linear regression analyses in Study 3 demonstrated that combining negative affectivity and
social inhibition, as either dichotomous or continuous, or as a sum or product term, reduced their predictive utility, effectively ‘masking’ some of the unique contributions that each trait made to understanding the relationship between Type D personality and particular health-related variables. The implication for Type D theory, in light of these and other researchers’ results (e.g. Ferguson, Williams, O’Connor, et al., 2009; Kelly-Hughes et al., 2014), is that the dichotomisation and interaction assumptions may be limiting the functionality, sensitivity, and predicative utility of the Type D personality construct. 

Finally, this thesis has expanded Type D research to previously untested chronic illness groups. The research demonstrated that the associations between Type D personality and particular health outcomes identified in cardiac-related conditions appear to be applicable to a variety of chronic illnesses, including type 2 diabetes, CFS, fibromyalgia, rheumatoid arthritis and osteoarthritis. These findings not only help to better understand the construct, but may assist in developing better models of how personality might impact on health outcomes for use in clinical and applied healthcare settings.

9.2.1 Contribution to the Type D Literature

Overall, the present thesis offered evidence of four major contributions to the Type D personality theory and research. First, Type D personality is a construct that is sufficiently distinct from trait neuroticism and extraversion to be considered a novel and unique personality typology. Second, the representation of Type D personality that offers the highest predictive utility is negative affectivity and social inhibition main effects. Third, the inclusion of an interaction term in the representation of Type D appears to mask some of the contributions of negative affectivity and social inhibition. Finally, Type D personality has the capacity to reliably predict health-related behaviours, beliefs, and perceptions in a variety of chronic illnesses, highlighting its potential to be considered a generalised risk factor for poor health outcomes.
9.3 Implications of the Research for Healthcare in Australia

The current research provided strong evidence that Type D personality is a typology that is present in the Australian general population, and represents a potentially major challenge for healthcare services and resources. The prevalence rate of Type D in Australia was estimated at almost 40% (39.7%) of the population. This substantial portion of the population have an increased likelihood of carrying out fewer preventative health behaviours (e.g. regular exercise), and engaging in more deleterious health behaviours (e.g. excessive alcohol consumption). When coupled with other maladaptive health-related behaviours and beliefs that are associated with Type D personality, the almost 40% of Australians with Type D personality could be considered to be at a greatly increased risk of developing physically, socially, and economically costly chronic illnesses.

Another implication of this research is the potential to promote the use of the Type D personality measurement instrument, the DS14, to healthcare professionals. The 14 item DS14 can be administered and scored in approximately 10 minutes, and does not require any specialist psychometric skills or knowledge on the administrator’s behalf. Indeed a dedicated web-based calculator could be easily developed, and would reduce the administration and scoring time further. Given the generality of the effect of Type D on health, the use of the DS14 measure in primary and secondary care settings could offer clinicians an opportunity to assess whether their patient may be more likely to engage in maladaptive health behaviours or hold self-limiting perceptions about their available social supports. Such information could be utilised in the development of prevention or intervention plans, as well as provide a starting point for a behaviour change dialogue between clinician and patient.

At a governance level, healthcare policy in Australia could consider the potential for Type D personality to be included as a risk factor for chronic illness in health determinant models. Current Australian health determinant models (AIHW, 2014) have very limited
reference to psychological risk factors generally, and no direct references to any aspect of personality. The mounting evidence that at least one aspect of personality, Type D, can predict which individuals are at risk of engaging in health behaviours that are associated with the development of many high-impact chronic illnesses, may justify introducing personality factors into the development of future iterations of health determinant models in Australia.

9.4 Strengths and Limitations of the Research

The studies contained within this thesis have a number of noteworthy strengths. A considerable strength of Study 1 was the employment of the full-scale NEO-PI-R. To date, Type D validation studies have relied on the much shorter NEO Five Factor Inventory (NEO-FFI), which facilitates a factor-level analysis only (e.g. De Fruyt & Denollet, 2002; Đurka & Ruch, 2014; Sajadinejad et al., 2012). The use of a larger, well-validated and reliable scale is highly advantageous, and facilitated a more nuanced investigation of Type D personality than has been previously undertaken.

The findings of the population prevalence study were strengthened by the use of a sample derived from the broader Australian general population. A reliance on convenience samples, often university students, has been a limitation in quite a number of reported Type D studies (e.g. Grande, Glaesmer, et al., 2010; Howard & Hughes, 2012; Williams et al., 2008). The use of social media platforms and illness support agencies to recruit participants meant that advertisements were able to reach a diverse range of individuals, with a large age range, and from a variety of backgrounds.

A further strength of this thesis was the adoption of a statistical approach designed to assess the incremental prediction of personality facets over factors, that used adjusted r-squared values for both factor- and facet level regression analyses. This method addressed a number of issues with some previous approaches that led to biased parameter estimation, ill-defined population parameters, lack of confidence interval reporting, and a lack of parsimony.
in incremental facet assessment (e.g. see Anglim & Grant, 2014a). A criticism of previous Type D research was that regression models were over-fitted with similar predictors (e.g. see Ketterer et al., 2002; Ormel et al., 2004). The factor and facet-level analyses in this research address this limitation by focusing on the change in population variance that is explained from a regression with facets. Specifically, the analytical approach involved estimating the population incremental variance explained by facets over factors by subtracting adjusted r-squared values for a regression with five factor predictors from one with 30 facet predictors. The incremental value of particular facets was assessed by obtaining the semi-partial correlations between each facet and each Type D scale after adjusting each facet for overlap with the Big 5 factors.

The present research also had limitations that must be acknowledged. First, each of the studies attracted a high proportion of female respondents which may have introduced the potential for a gender bias. The limited generalisability of the results was somewhat tempered in Study 3 by the knowledge that females are typically over-represented in functional somatic syndrome diagnosis and research (Nacul et al., 2011). Each of the three studies had upwards of 75% female participants. A further exploration of the literature revealed a female gender bias is a common occurrence in health research, particularly in survey-based research. The sample from each study was further assessed for gender-related group differences that may have threatened the integrity of the data. No significant group differences between males and females were found that could not have been either expected or explained. The high rate of female respondents may simply be a reflection of a greater tendency for females to volunteer time and reveal personal health information, albeit anonymously, than males. It could also reflect a tendency for women to be more engaged with social media platforms, or to access services from illness support agencies.

A similar potential for bias in the data was the level of education of participants in each
sample. The same between-group analyses were carried out for education as were for gender in each of the three studies. No significant group differences between levels of education were found that could not have been either expected or explained.

A second limitation of the research was the difficulty experienced in recruiting participants with a diagnosed chronic illness. Although a number of recruitment drives were conducted with the assistance of various illness support agencies (e.g. Diabetes Australia, CFS/ME Australia), the final sample size for each illness group in Study 3 was below the optimal number. The issue of small sample size was overcome by combining like illnesses into two larger groups, however in doing so, illness specific information was no longer able to be extracted.

A third limitation of this thesis, although certainly not particular to this thesis, was the inability to establish cause and effect relationships due to the correlational and cross-sectional nature of the research.

Finally, as the data pertaining to health-related variables were obtained via self-report questionnaires, the degree to which the participants’ perceptions were an accurate reflection of their actual circumstances was unable to be established. It was unclear, for example, whether perceptions of low levels of social support were accurate in relation to the actual social support available to the participant. Similarly, it was not possible to determine whether perceptions of symptom severity were inflated or over-reported, or, indeed, downplayed, by participants.

9.5 Future Research Directions

First and foremost, the issue of how to represent Type D personality should be addressed. This thesis offered strong evidence to suggest that a negative affectivity and social inhibition main effects approach has the most predictive utility, however this assertion requires replication and adaption to other illness and healthy populations. For the Type D construct to
be most effective in research and in clinical applications, establishing the most appropriate representation is of utmost importance.

The accuracy of beliefs and perceptions of Type D individuals could be further explored. It would be advantageous to determine whether individuals with Type D personality tend to accurately assess their situation, or are susceptible to false beliefs or catastrophising. Achieving an understanding of the accuracy of the health-related beliefs and perceptions of Type D individuals could provide a clear target for intervention via psychological counselling (i.e. hypothesis testing if perceptions are unrealistic, or social skills training and behaviour change programs if perceptions are reasonably accurate).

Establishing whether a cause and effect relationship exists between Type D and illness onset or severity was not able to be achieved with the cross-sectional studies in this thesis. Future research could consider longitudinal designs that aim to investigate the stability of Type D personality over time, and in its relationship to ongoing health status.

In terms of the applied use of Type D personality in clinical settings, potential uptake of the DS14 measure as a screening tool could be maximised by the development of web-based application software that provides a user-friendly interface for patients to complete the 14 items (perhaps using a tablet). In addition, the application software could include a relatively simple formula for calculating the overall Type D diagnosis (i.e. present or not present). A more sophisticated approach would be to consider developing the application software to calculate the negative affectivity and social inhibition subscale scores and present the clinician with a more detailed breakdown of how the different aspects of Type D personality are manifest in any given patient.

Finally, in order to verify and extend the findings of Study 3, future research could investigate the role of Type D personality in a variety of distinct, high-prevalence, high-impact illness groups, such as obesity or lifestyle-related cancers (e.g. lung cancer,
melanoma). Should Type D be a truly general risk factor for the onset and maintenance of chronic illness, its usefulness in health policy and health research would broaden considerably.

9.6 Closing Remarks

In light of the findings in the present thesis, it would appear that the traditional dichotomous representation of Type D personality offers very little in terms of predictive utility when compared to all other possible representations considered herein. Although dichotomisation is a convenient diagnostic mechanism, treating personality in this manner represents an approach that is inconsistent with prevailing personality and trait theories. A more useful representation of Type D, at least from both research and health intervention perspectives, is that of continuous negative affectivity and social inhibition main effects.

In stating that Type D personality is most useful and relevant if represented as the main effects of two common personality traits, the question of the usefulness of Type D as a construct must be considered. If the conceptualisation of Type D as an interaction between negative affectivity and social inhibition is adopted, the construct as a novel representation of personality has merit. However, if the evidence suggests that the predictive utility of Type D is maximal when represented as trait main effects, perhaps there is little to be gained from grouping negative affectivity and social inhibition together under a single title. Furthermore, the findings in the present thesis demonstrate that negative affectivity is responsible for the majority of Type D’s predictive ability, with a relatively minimal (but still important) contribution from social inhibition. Given the preceding observations, it is easy to see why Type D has been labelled ‘old wine in new bottles’ by criticism of the construct. It may be premature however, to discard the concept and return to a variable-centred approach to studying personality. The idea that any single trait can operate in isolation from other traits that an individual may possess is an intuitively difficult concept to accept. It may be that we
have not yet developed adequate methodologies for investigating the interaction of multiple traits in personality typologies. It is, therefore, the view of the researcher that Type D personality can continue to improve our understanding of the complex role that personality plays in health and illness behaviors and beliefs. It is incumbent on researchers to continue to seek improvement to the approaches we take to untangle the personality-health relationships we observe.
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APPENDIX A: DS14 SCALE
DS14

Below are a number of statements that people often use to describe themselves. Please read each statement and then circle the appropriate number next to that statement to indicate your answer. There are no right or wrong answers. Your own impression is the only thing that matters.

0 = False  1 = Rather false  2 = Neutral  3 = Rather true  4 = True

1. I make contact easily when I meet people  0 1 2 3 4
2. I often make a fuss about unimportant things 0 1 2 3 4
3. I often talk to strangers 0 1 2 3 4
4. I often feel unhappy 0 1 2 3 4
5. I am often irritated 0 1 2 3 4
6. I often feel inhibited in social interactions 0 1 2 3 4
7. I take a gloomy view of things 0 1 2 3 4
8. I find it hard to start a conversation 0 1 2 3 4
9. I am often in a bad mood 0 1 2 3 4
10. I am a closed kind of person 0 1 2 3 4
11. I would rather keep other people at a distance 0 1 2 3 4
12. I often find myself worrying about something 0 1 2 3 4
13. I am often down in the dumps 0 1 2 3 4
14. When socializing, I don’t find the right things to talk about 0 1 2 3 4
APPENDIX B: NEO PERSONALITY INVENTORY REVISED
1. I am not a worrier

2. I really like most people I meet

3. I have a very active imagination

4. I tend to be cynical and sceptical of others' intentions

5. I'm known for my prudence and common sense

6. I often get angry at the way people treat me

7. I shy away from crowds of people

8. Aesthetic and artistic concerns aren't very important to me

9. I'm not crafty or sly

10. I would rather keep my options open than plan everything in advance

11. I rarely feel lonely or blue

12. I am dominant, forceful, and assertive

13. Without strong emotions, life would be uninteresting to me

14. Some people think I'm selfish and egotistical

15. I try to perform all the tasks assigned to me conscientiously

16. In dealing with other people, I always dread making a social blunder

17. I have a leisurely style in work and play

18. I'm pretty set in my ways

19. I would rather cooperate with others than compete with them
20. I am easy-going and lackadaisical

21. I rarely overindulge in anything

22. I often crave excitement

23. I often enjoy playing with theories or abstract ideas

24. I don't mind bragging about my talents and accomplishments

25. I'm pretty good about pacing myself so as to get things done on time

26. I often feel helpless and want someone else to solve my problems

27. I have never literally jumped for joy

28. I believe letting students hear controversial speakers can only confuse and mislead them

29. Political leaders need to be more aware of the human side of their policies

30. Over the years, I've said and done some pretty stupid things

31. I'm easily frightened

32. I don't get much pleasure from chatting with people

33. I try to keep all my thoughts directed along realistic lines and avoid flights of fancy

34. I believe that most people are basically well-intentioned

35. I don't take civic duties like voting very seriously

36. I'm an even tempered person

37. I like to have a lot of people around me

38. I am sometimes completely absorbed in music I am listening to

39. If necessary, I am willing to manipulate people to get what I want
40. I keep my belongings neat and clean

41. Sometimes I feel completely worthless

42. I sometimes fail to assert myself as much as I should

43. I rarely experience strong emotions

44. I try to be courteous to everyone I meet

45. Sometimes I'm not as dependable or reliable as I should be

46. I seldom feel self-conscious when I'm around people

47. When I do things, I do them vigorously

48. I think it's interesting to learn and develop new hobbies

49. I can be sarcastic and cutting when I need to be

50. I have a clear set of goals and work towards them in an orderly fashion

51. I have trouble resisting my cravings

52. I wouldn't enjoy vacationing in Las Vegas

53. I find philosophical arguments boring

54. I rather not talk about myself and my achievements

55. I waste a lot of time before settling down to work

56. I feel I am capable of coping with most of my problems

57. I have sometimes experienced intense joy or ecstasy

58. I believe that laws and social policies should change to reflect the needs of a changing world
59. I'm hard-headed and tough-minded in my attitudes

60. I think things through before coming to a decision

61. I rarely feel fearful or anxious

62. I'm known as a warm and friendly person

63. I have an active fantasy life

64. I believe that most people will take advantage of you if you let them

65. I keep myself informed and usually make intelligent decisions

66. I am known as hot-blooded and quick-tempered

67. I usually prefer to do things alone

68. Watching ballet or modern dance bores me

69. I couldn't deceive anyone even if I wanted to

70. I'm not a very methodical person

71. I am seldom sad or depressed

72. I have often been a leader of groups I have belonged to

73. How I feel about things is important to me

74. Some people think of me as cold and calculating

75. I pay my debts promptly and in full

76. At times I have been so ashamed I just want to hide

77. My work is likely to be slow but steady

78. Once I find the right way to do something, I stick to it
79. I hesitate to express my anger, even when it's justified

80. When I start a self-improvement program, I usually let it slide after a few days

81. I have little difficulty resisting temptation

82. I have sometimes done things just for "kicks" or "thrills"

83. I enjoy solving problems or puzzles

84. I am better than most people and I know it

85. I am a productive person who always gets the job done

86. When I'm under a great deal of stress, sometimes I feel like I'm going to pieces

87. I am not a cheerful optimist

88. I believe we should look to our religious authorities for decisions on moral issues

89. We can never do too much for the poor and elderly

90. Occasionally I act first and think later

91. I often feel tense and jittery

92. Many people think of me as somewhat cold and distant

93. I don't like to waste my time daydreaming

94. I think most of the people I deal with are honest and trustworthy

95. I often come into situations without being fully prepared

96. I am not considered a touchy or temperamental person

97. I really feel the need for other people if I am by myself for long

98. I am intrigued by the patterns I find in art and nature
99. Being perfectly honest is a bad way to do business

100. I like to keep everything in its place so I know just where it is

101. I have sometimes experienced a deep sense of guilt or sinfulness

102. In meetings, I usually let others do the talking

103. I seldom pay much attention to my feelings of the moment

104. I generally try to be thoughtful and considerate

105. Sometimes I cheat when I play solitaire

106. It doesn't embarrass me too much if people ridicule me and tease me

107. I often feel as if I'm bursting with energy

108. I often try new and foreign foods

109. If I don't like people, I let them know it

110. I work hard to accomplish my goals

111. When I am having my favourite foods, I tend to eat too much

112. I tend to avoid movies that are shocking or scary

113. I sometimes lose interest when people talk about very abstract, theoretical matters

114. I try to be humble

115. I have trouble making myself do what I should

116. I keep a cool head in emergencies

117. Sometimes I bubble with happiness
118. I believe that the different ideas of right and wrong that people in other societies have may be valid for them

119. I have no sympathy for panhandlers

120. I always consider the consequences before I take action

121. I'm seldom apprehensive about the future

122. I really enjoy talking to people

123. I enjoy concentrating on a fantasy or daydream and exploring all its possibilities, letting it grow and develop

124. I'm suspicious when someone does something nice for me

125. I pride myself on my sound judgment

126. I often get disgusted with people I have to deal with

127. I prefer jobs that let me work alone without being bothered by other people

128. Poetry has little or no effect on me

129. I would hate to be thought of as a hypocrite

130. I never seem to be able to get organised

131. I tend to blame myself when anything goes wrong

132. Other people often look at me to make decisions

133. I experience a wide range of emotions or feelings

134. I'm not known for my generosity

135. When I make a commitment, I can always be counted on to follow through
136. I often feel inferior to others
137. I'm not as quick and lively as other people
138. I prefer to spend my time in familiar surroundings
139. When I've been insulted, I just try to forgive and forget
140. I don't feel like I'm driven to get ahead
141. I seldom give in to my impulses
142. I like to be where the action is
143. I enjoy working on "mind-twister"-type puzzles
144. I have a very high opinion of myself
145. Once I start a project, I almost always finish it
146. It's often hard for me to make up my mind
147. I don't consider myself especially "light-hearted"
148. I believe that loyalty to one's ideals and principles is more important than "open-mindedness"
149. Human need should always take priority over economic considerations
150. I often do things on the spur of the moment
151. I often worry about things that might go wrong
152. I find it easy to smile and be outgoing with strangers
153. If I feel my mind starting to drift off into daydreams, I usually get busy and start concentrating on some work or activity instead
154. My first reaction is to trust people

155. I don't seem to be completely successful at anything

156. It takes a lot to get me mad

157. I'd rather vacation at a popular beach than an isolated cabin in the woods

158. Certain kinds of music have an endless fascination for me

159. Sometimes I trick people into doing what I want

160. I tend to be somewhat fastidious or exciting

161. I have a low opinion of myself

162. I would rather go my own way than be a leader of others

163. I seldom notice the moods or feelings that different environments produce

164. Most people I know like me

165. I adhere strictly to my ethical principles

166. I feel comfortable in the presence of my bosses or other authorities

167. I usually seem to be in a hurry

168. Sometimes I make changes around the house just to try something different

169. If someone starts a fight, I'm ready to fight back

170. I strive to achieve all I can

171. I sometimes eat myself sick

172. I love the excitement of roller coasters

173. I have little interest in speculating on the nature of the universe or the human condition
174. I feel that I am no better than others, no matter what their condition

175. When a project gets too difficult, I'm inclined to start a new one

176. I can handle myself pretty well in a crisis

177. I am a cheerful, high-spirited person

178. I consider myself broad-minded and tolerant of other people's lifestyles

179. I believe all human beings are worthy of respect

180. I rarely make hasty decisions

181. I have fewer fears than most people

182. I have strong emotional attachments to my friends

183. As a child I rarely enjoyed games of make believe

184. I tend to assume the best about people

185. I'm a very competent person

186. At times I have felt bitter and resentful

187. Social gatherings are usually boring to me

188. Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement

189. At times I bully or flatter people into doing what I want them to

190. I'm not compulsive about cleaning

191. Sometimes things look pretty bleak and hopeless to me

192. In conversations, I tend to do most of the talking
193. I find it easy to empathise - to feel myself what others are feeling

194. I think of myself as a charitable person

195. I try to do jobs carefully, so they won't have to be done again

196. If I have said or done the wrong thing to someone, I can hardly bear to face them again

197. My life is fast-paced

198. On a vacation, I prefer going back to a tried and true spot

199. I'm hard-headed and stubborn

200. I strive for excellence in everything I do

201. Sometimes I do things on impulse that I later regret

202. I'm attracted to bright colours and flashy styles

203. I have a lot of intellectual curiosity

204. I would rather praise others than praise myself

205. There are so many little jobs that need to be done that I sometimes just ignore them all

206. When everything seems to be going wrong, I can still make good decisions

207. I rarely use words like "fantastic!" or "sensational!" to describe my experiences

208. I think that if people don't know what they believe in by the time they're 25, there's something wrong with them

209. I have sympathy for others less fortunate than me

210. I plan ahead carefully when I go on a trip

211. Frightening thoughts often come into my head
212. I take a personal interest in the people I work with

213. I would have difficulty just letting my mind wander without control or guidance

214. I have a good deal of faith in human nature

215. I am efficient and effective at my work

216. Even minor annoyances can be frustrating to me

217. I enjoy parties with lots of people

218. I enjoy reading poetry that emphasises feelings and images more than story lines

219. I pride myself on my shrewdness in handling people

220. I spend a lot of time looking for things I've misplaced

221. Too often, when things go wrong, I get discouraged and feel like giving up

222. I don't find it easy to take charge of a situation

223. Odd things - like certain scents or the names of distant places - can evoke strong moods in me

224. I go out of my way to help others if I can

225. I'd really like to be sick before I'd miss a day of work

226. When people I know do foolish things, I get embarrassed for them

227. I am a very active person

228. I follow the same route when I go someplace

229. I often get into arguments with my family and co-workers

230. I'm something of a "workaholic"
231. I am always able to keep my feelings under control

232. I like being part of the crowd at sporting events

233. I have a wide range of intellectual interests

234. I'm a superior person

235. I have a lot of self-discipline

236. I'm pretty stable emotionally

237. I laugh easily

238. I believe that the "new morality" of permissiveness is no morality at all

239. I would rather be known as "merciful" than as "just"

240. I think twice before I answer a question
APPENDIX C: ROTTERDAM SYMPTOM CHECKLIST
# ROTTERDAM SYMPTOM CHECKLIST

**Name:**

**Date:**

**Trial Number:**

In this questionnaire you will be asked about your symptoms. Against each item place a firm tick under the heading that best describes how you have been feeling during the past week.

<table>
<thead>
<tr>
<th>Lack of appetite</th>
<th>Decreased sexual interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritability</td>
<td>Restlessness or agitation</td>
</tr>
<tr>
<td>Tiredness</td>
<td>Feeling tense</td>
</tr>
<tr>
<td>Worrying</td>
<td>Anxious feelings</td>
</tr>
<tr>
<td>Sore muscles</td>
<td>Constipation</td>
</tr>
<tr>
<td>Depressed mood</td>
<td>Diarrhoea</td>
</tr>
<tr>
<td>Chest pain</td>
<td>Heartburn/acidity</td>
</tr>
<tr>
<td>General pain</td>
<td>Coughing up blood</td>
</tr>
<tr>
<td>Nervousness</td>
<td>Tingling of hands and feet</td>
</tr>
<tr>
<td>Nausea</td>
<td>Difficulty concentrating</td>
</tr>
<tr>
<td>Despondent feelings about the future</td>
<td>Sore mouth</td>
</tr>
<tr>
<td>Difficulty sleeping</td>
<td>Loss of hair</td>
</tr>
<tr>
<td>Headaches</td>
<td>Lack of energy</td>
</tr>
<tr>
<td>Vomiting</td>
<td>Shortness of breath</td>
</tr>
<tr>
<td>Dizziness</td>
<td>Dry mouth</td>
</tr>
<tr>
<td>Cough</td>
<td>Shivering</td>
</tr>
<tr>
<td>Difficulty swallowing</td>
<td>Hearseness</td>
</tr>
<tr>
<td></td>
<td>Burning eyes</td>
</tr>
</tbody>
</table>

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APPENDIX D: QUALITY OF SOCIAL NETWORK AND SOCIAL SUPPORT SCALE
Quality of Social Network and Social Support Scale

Please answer each question by circling the response that most closely applies to you:

1. How strongly do you feel attached to your close family?
   Very Strongly    Quite Strongly    Quite loosely    Not at all

2. Do you find it difficult to know where you are with your close family, with respect to their points of view and opinions?
   Often    Sometimes    Never

3. Do you feel that you, by and large, can be yourself in relation to your close family?
   Always    Usually    Seldom or never

4. Do you feel that your close family puts reasonable weight upon your opinions?
   Always    Usually    Seldom or never

5. Do you feel that you can count on your friends in the future?
   Very sure    Quite sure    Not sure

6. Do you think you would be disappointed if you knew what your friends really thought about you?
   Yes    Maybe    No

7. Do you feel closely attached to your friends?
   Always    Usually    Seldom or never

8. Do you feel that your friends put reasonable weight upon your opinions?
   Always    Usually    Seldom or never

9. Do you feel apart even among friends?
   Often    Sometimes    Never
APPENDIX E: GENERAL PREVENTATIVE HEALTH BEHAVIOURS

CHECKLIST
GENERAL PREVENTIVE HEALTH BEHAVIOURS CHECKLIST

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Always or almost always</th>
<th>Sometimes</th>
<th>do not do</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Avoid drinking and driving.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2)</td>
<td>Wear a seat belt when in the car.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3)</td>
<td>Do things in moderation.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4)</td>
<td>Get enough relaxation.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5)</td>
<td>Check safety of electrical appliances.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6)</td>
<td>Avoid overworking.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7)</td>
<td>Fix broken things around the home.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8)</td>
<td>Eat sensibly.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9)</td>
<td>Maintain contact with friends and relatives.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10)</td>
<td>Destroy old or unused medicines.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>11)</td>
<td>Regularly eat breakfast.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>12)</td>
<td>Avoid getting chilled.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13)</td>
<td>Avoid crossing the street against the traffic lights.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>14)</td>
<td>Keep a first-aid kit in the home.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>15)</td>
<td>Get enough sleep.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>16)</td>
<td>Keep emergency phone numbers.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>17)</td>
<td>Avoid over-the-counter medicines.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>18)</td>
<td>Spend time out of doors every day.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>19)</td>
<td>Do not smoke.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>20)</td>
<td>Get enough exercise.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>21)</td>
<td>Pray or live by the principles of religion.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>22)</td>
<td>Avoid letting things get me down.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>23)</td>
<td>Avoid eating snacks.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>24)</td>
<td>Limit alcohol intake.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>25)</td>
<td>Limit certain foods e.g. fat, sugar.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>26)</td>
<td>Control weight.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>27)</td>
<td>Get a regular medical checkup.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>28)</td>
<td>Get a regular dental checkup.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>29)</td>
<td>Take dietary supplements or vitamin.</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>


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APPENDIX F: EYSENCK PERSONALITY QUESTIONNAIRE - NEUROTICISM

SUBSCALE
1. Does your mood often go up and down? YES/NO
2. Do you ever feel ‘just miserable’ for no reason? YES/NO
3. Are you an irritable person? YES/NO
4. Are your feelings easily hurt? YES/NO
5. Do you often feel ‘fed up’? YES/NO
6. Would you call yourself a nervous person? YES/NO
7. Are you a worrier? YES/NO
8. Would you call yourself tense or ‘highly-strung’? YES/NO
9. Do you worry too long after an embarrassing experience? YES/NO
10. Do you suffer from ‘nerves’? YES/NO
11. Do you often feel lonely? YES/NO
12. Are you often troubled about feelings of guilt? YES/NO
APPENDIX G: ETHICS APPROVAL – STUDY 1