Traditional and emerging lifestyle behaviours and mental distress: A cross-sectional analysis

Lisette van der Leden

MSc Health Psychology, BSc (Hons) Psychology

This research report is submitted in partial fulfillment of the requirement for the degree of Master of Clinical Psychology, School of Psychology, University of Newcastle, Australia.

The University of Newcastle

June, 2017

Declarations

Statement of Originality

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library **, being made available for loan and photocopying subject to the conditions of the Copyright Act 1968.

**Unless an Embargo has been approved for a determined period.

Acknowledgement of Authorship

I hereby certify that the work embodied in this thesis contains scholarly work of which I am a joint author. I have included as part of the thesis a written statement, endorsed by my supervisors, attesting to my contribution to the joint scholarly work.

Lisette van der Leden, Dr Tanya Hanstock and Associate Professor Mitch Duncan conceived the original study, designed and coordinated the study. Lisette van der Leden and Associate Professor Mitch Duncan conducted the statistical analysis and interpretation of the data. Lisette van der Leden drafted the manuscript. Dr Tanya Hanstock and Associate Professor Mitch Duncan were involved in the supervision of the project and evaluation and editing of the final manuscript. All authors read and approved the final manuscript.

Signed:

16th June, 2017

_____ _____

Lisette van der Leden Date

19th June, 2017

_____ _____

Dr Tanya Hanstock Date

19th June, 2017

_____ _____

Associate Professor Mitch Duncan Date

Acknowledgements

Firstly, I would like to acknowledge Dr Tanya Hanstock and Associate Professor Mitch Duncan who were responsible for the supervision of this project. This work would not have been possible without your continuous support, guidance and encouragement.

I am very grateful for the support, patience and understanding shown by my family and friends throughout this project. Sam, I would not have been able to do this without your support, encouragement and belief in me. Finley, Sascha and Reuben, thank you for your patience with my absence. Mike, Naidene, Tully and Charlotte, thank you for your support and spending time with our family. Sara, Ollie, Owen and Alex, thank you for being our Australian family. Papa and mama, thank you for all the support you have given me.

Structured Abstract

Scope

Unhealthy lifestyle behaviours have a profound negative effect on physical and mental health. These behaviours are prevalent among people with poor mental health. There is extensive evidence supporting the negative effects of unhealthy lifestyle risk behaviours, smoking, inadequate nutrition, alcohol consumption and physical inactivity (SNAP). These behaviours have been found to co-occur, rather than occur in isolation. Evidence is emerging supporting the negative impact of prolonged sitting time and sleep insufficiency on physical health and mental distress. However there is relatively little evidence regarding the influence of these emerging lifestyle behaviours on mental distress or how they may influence mental distress above and beyond the influence of traditional lifestyle factors.

Purpose

The purpose of the study was to investigate the association between engaging in multiple unhealthy lifestyle risk behaviours and frequent mental distress in a group of Australian adults. Furthermore, the study aims to examine whether emerging lifestyle behaviours, insufficient sleep and sitting time, are associated with frequent mental distress even when accounting for the influence of SNAP behaviours.

Methodology

The study is a data analysis of baseline data of the 2015 National Social Survey, a survey that collects data on various topics including health, well-being and socio-demographics of participants. Participants were men and women aged 18 years

and over, who were randomly selected from a national electronic database of landline and mobile telephone numbers. A total of 1,318 respondents completed the National Social Survey. This study reports on variables directly related to the aims of the study. The current study is an analysis of 1,201 participants (640 women, 561 men, M_{age} = 52.2 years, age range: 18-100 years) who provided complete data for the survey items relating to lifestyle behaviours, frequent mental distress (FMD) and demographics. A total SNAP score was created by summing the number of unhealthy traditional lifestyle behaviours an individual engaged in, higher scores represent a greater number of unhealthy lifestyle behaviours engaged in.

Results

Results showed a positive relationship between the number of SNAP behaviours a person engaged in and FMD. In addition, the emerging lifestyle risk behaviour, sitting time, was associated with increased levels of FMD when accounting for SNAP behaviours. Furthermore, insufficient sleep was positively associated with FMD when accounting for SNAP behaviours. Both sitting time and insufficient sleep were associated with FMD when accounting for all other variables. Lastly, results showed that the association between SNAP behaviours and FMD was no longer significant when accounting for either sitting time, sleep or both sitting time and sleep.

Conclusions and Implications

A significant association was found between the number of SNAP behaviours a person engages in and FMD. However, this association was no longer significant when emerging lifestyle risk factors, sitting time, insufficient sleep or both sitting time and insufficient sleep were accounted for. These findings highlight the importance of

including emerging lifestyle behaviours in preventive interventions for mental health. Prospective longitudinal research is required to ascertain causality of lifestyle risk behaviours on mental health outcomes.

Table of Contents

List of Tables

Critical Literature Review

Life expectancy is a common measure of the general health of a population. Australians have one of the highest life expectancies worldwide. Boys born in Australia in 2012 had a life expectancy of 79.9 years, and girls 84.3 years (Australian Institute of Health and Welfare (AIHW), 2014). In 2014, Australia ranked third amongst 34 Organisation for Economic Co-operation and Development (OECD) countries for the life expectancy at birth for males, and seventh for females (OECD, 2015). However, it is not clear if a longer life expectancy does equate to the population being healthy. The World Health Organization (WHO) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1948).

Compared with previous generations current generations are less active, eat more processed foods, and spend more time in front of electronic screens (Australian Bureau of Statistics [ABS], 2015). According to the ABS Australian Health Survey, in 2014-2015 only 5.1% of the population consumed the recommended number of serves of fruit and vegetables. Furthermore, only 55.5% of adults were sufficiently active (ABS, 2015). In addition, adults spent 13 hours per week watching television and 6 hours on computers and phones (ABS, 2013). These lifestyle behaviours are considered to have a profound negative effect on our health.

There is now a wealth of research supporting the impact of lifestyle behaviours on physical and mental health (Ding, Rogers, van der Ploeg, Stamatakis, & Bauman, 2015; Loef & Walach, 2012; Saneei et al., 2016). Most of this research focuses on the impact of traditional lifestyle behaviours. Traditional lifestyle behaviours include smoking, nutrition, alcohol consumptions and physical activity and are often referred to as SNAP behaviours (Poortinga, 2007). More recently research has documented the ill health effects of other lifestyle behaviours on health, including sitting times and sleep

(Ding et al., 2014). A number of these studies examined the individual impact of emerging lifestyle behaviours on health outcomes. For example sedentary behaviour, also measured as sitting time, is associated with health risks including all-cause mortality (Chau et al., 2013) and psychological distress (Sloan et al., 2013). The risks associated with prolonged sitting times are independent from physical activity (Bauman et al., 2011). Furthermore adults who report frequent insufficient sleep are significantly more likely to report poor general health, frequent physical distress and frequent mental distress (Strine & Chapman, 2005).

Previously researchers have investigated the impact of individual traditional lifestyle SNAP behaviours on health. However in recent years the focus has shifted to assessing the association between the combined effects of SNAP lifestyle behaviours on health (Loef & Walach, 2012; Poortinga, 2007; Schuit, van Loon, Tijhuis, & Ocke, 2002). This is because lifestyle risk behaviours do not occur in isolation, as they frequently co-occur (Fine, Philogene, Gramling, Coups, & Sinha, 2004). Whilst much research has focused on the combined effects of lifestyle behaviours on physical health, research investigating the effect of traditional and emerging lifestyle behaviours on frequent mental distress is sparse (Ding et al., 2014). Furthermore, no research has examined the role of emerging lifestyle behaviours on frequent mental distress when accounting for traditional SNAP behaviours.

This literature review will commence with a description of the term mental distress, its prevalence, how it is measured and its effects on physical and mental health. Next will be an overview of evidence of the impact of each of the traditional SNAP lifestyle behaviours. Following this, an overview of research into each of the emerging lifestyle behaviours, sleep and sitting time will be outlined. Additionally, evidence of the

combined impact of traditional and emerging SNAP lifestyle behaviours will be examined.

Mental Distress

Mental distress has been described as a state of emotional suffering, characterised by symptoms of depression (e.g., feelings of sadness, hopelessness and a loss of interest) and anxiety (e.g., feeling tense and restless) (Drapeau, Marchand, & Beaulieu-Prévost, 2012). There is debate in the literature on the definition of mental distress. Horwitz (2007) distinguishes psychological distress from psychological disorders by proposing that mental distress is a normal human emotion, which would subside if the stressor disappeared or one's circumstances changed. In contrast, he argues that a mental disorder is an internal psychological dysfunction, which may be caused by stressful situations or may be idiopathic. However, Kessler et al. (2010) proposed that mental distress is a term used to indicate the perceived presence of symptoms of mental health disorders such as anxiety and depression (Kessler et al., 2010). Further research supports a direct link between levels of mental distress and the presence of mental disorders (Slade, Grove, & Burgess, 2011), particularly for affective disorders and anxiety disorders (ABS, 2008). In research, participants are commonly defined as having FMD if they respond $\geq$ 14 days to the question "Now thinking about your mental health, which includes stress, depression and problems with emotions, for how many days during the past 30 days was your mental health not good?". The period of 14 days or more to define FMD is frequently used by researchers and clinicians as an indicator of mental illness (CDC, 2000). The association between mental distress and mental disorders is also applied in clinical practice to the diagnosis and treatment of mental health disorders. For example, DSM 5 criteria for Acute Stress Disorder and Adjustment Disorders state that these

disorders are characterised by an emotional response to a stressful event (American Psychiatric Association, 2013).

Mental distress is prevalent with approximately 11% of the US population reporting experiencing frequent mental distress (Bruning, Arif, & Rohrer, 2014). In 2014-2015, 11.7% of the Australian population reported experiencing high or very high levels of psychological distress. More women than men reported high or very high rates of mental distress in 2014-2015 (13.5% and 9.9% respectively) (Australian Bureau of Statistics, 2015). In rural Australian communities the prevalence of psychological distress has been found to be as high as 31.3% (Kilkkinen et al., 2007). Nationally, psychological distress was most prevalent amongst women aged 18-24 years, with 20% of Australian women aged 18-24 years reported high or very high levels of psychological distress (ABS, 2015). In contrast, in a rural Australian population sample high levels of mental distress were most prevalent in women and men aged between 45 and 54 (13.4% and 13.8% respectively) (Kilkkinen et al., 2007).

Similarly to mental distress, both anxiety related disorders and depression are more common in women than in men. In 2014-2015, 13% of women reported having an anxiety related disorder, compared with 9.4% of men. The highest prevalence was observed in females aged 15-24 years: 18.9% of females in this age group reported having an anxiety related disorder. Depression was prevalent in 8.9% of Australians, with more women than men reporting having depression or feelings of depression (10.4% and 7.4% respectively). Prevalence rates increased for both men and women until age 55-64, when rates peaked at 13.7% (ABS, 2015).

Mental distress is a burden for both the individual suffering and society. In 2010, depression and anxiety were amongst the leading causes of disability in Australia (Institute for Health Metrics and Evaluation, 2013). Mental disorders were the largest

non-fatal burden of disease in Australia for both men and women in 2011 (Australian Institute of Health and Welfare, 2016). Furthermore, depression and anxiety were the leading causes of total burden amongst females aged between 15 and 44 years.

Mental distress can be measured in a number of ways including self-report measures such as the Kessler-10 (K-10; (Kessler et al., 2002) and the Depression Anxiety and Stress Scale (DASS; (Lovibond & Lovibond, 1995). In research frequent mental distress (FMD) is often measured by asking people how many days in the past month their mental health was not good (Strine et al., 2005). FMD is defined as a self-report of 14 or more mentally unhealthy days (Moriarty, Zack, & Kobau, 2003). This measure has most commonly been used for large population health surveys conducted by telephone (Moriarty et al., 2003).

Mental distress has been found to have an impact on physical health and vice versa (Prince et al., 2007). Depression has been found to be an independent risk factor for the onset of a range of chronic diseases, including cardiovascular diseases (Van der Kooy et al., 2007), cancer (Currier & Nemeroff, 2014), type 2 diabetes (Arroyo et al., 2004; Golden et al., 2004) and Alzheimer disease (Green et al., 2003). In addition, anxiety disorders are significantly associated with cardiovascular mortality, coronary heart disease, stroke, heart failure (Emdin et al., 2016) and asthma (Del Giacco et al., 2016). The impact of mental distress on physical health can be partly explained by the association between mental health and lifestyle risk factors such as smoking, poor nutrition, obesity and reduced activity (Bartlem et al, 2015). Furthermore, depression has biological effects on cortisol metabolism (elevated cortisol resulting in inflammation, excessive clotting and metabolic syndrome), serotonin metabolism (which alters cardiac function, platelet aggregation and vasoconstriction) and cell mediated immunity (Prince et al., 2007).

Conversely, chronic physical diseases are often comorbid with depression and anxiety. Patients with a chronic diseases are significantly more likely to suffer depression than those without chronic disease (Moussavi et al., 2007). Major depression was strongly correlated with having a physical medical condition in an Australian population sample (Wilhelm, Mitchell, Slade, Brownhill, & Andrews, 2003). In addition, anxiety disorders are highly prevalent among patients with chronic diseases. For example, anxiety disorders are highly prevalent among patients with Multiple Sclerosis (MS) (Korostil & Feinstein, 2007). Korostil & Feinstein (2007) reported the lifetime prevalence of any anxiety disorder was 35.7% in patients with MS. Moreover, in a critical review Fleet et al. (2000) reported that panic disorder is prevalent among patients with coronary artery disease (Fleet, Lavoie, & Beitman, 2000), with some studies reporting prevalence rates of 53% (Beitman, Basha, & Flaker, 1987).

Traditional Healthy Lifestyle Behaviours

There is now a wealth of research supporting a bidirectional relationship between lifestyle behaviours and health (Loef & Walach, 2012; Ding et al., 2015; Saneei et al., 2016). Much of this research focuses on traditional SNAP risk behaviours (Poortinga, 2007), and their impact on all cause mortality (Krokstad et al., 2017; Loef & Walach, 2012) and physical health (Petersen et al., 2015) in particular. Research on the relationship between SNAP lifestyle risk behaviours and mental distress is more limited, but is increasing. Strine et al. (2004) found that people who reported experiencing frequent mental distress were more likely to smoke, drink excessively and be physically inactive. These findings were supported by McGuire et al (2007) who reported that adults with frequent mental distress were less likely to be non-smokers, to consume the recommended daily amount of fruit and vegetables and to engage in moderate or

vigorous physical activity (McGuire, Strine, Okoro, Ahluwalia, & Ford, 2007). Bartlem et al. (2015) reported high prevalence rates of smoking, inadequate fruit and vegetable consumption, alcohol consumption and physical inactivity in an Australian community mental health population (Bartlem et al., 2015). Furthermore, results from a recent meta-analysis showed that physical activity significantly reduced depression and anxiety in non-clinical adult populations (Rebar et al., 2015).

Smoking. Smoking is one of the largest preventable causes of death and disease in Australia. The social, health and economic costs of tobacco smoking in Australia were estimated to be $31.5 billion in 2004-2005. Smoking is associated with an increased risk of a wide range of health conditions, including cancer, lung diseases, coronary heart disease, stroke, heart attack, diabetes, renal disease and eye disease (Australian Bureau of Statistics, 2015). Moreover, research has consistently confirmed an association between smoking and poor mental health. Lawrence et al. (Lawrence, Mitrou, & Zubrick, 2009) reported that the smoking prevalence among adults with a mental illness is almost double the smoking prevalence of adults without a mental illness. In addition, they found smoking levels increased with increasing levels of mental distress in an almost linear fashion. These findings suggest that smoking is highly prevalent among adults with a mental illness, and that a significant proportion of smokers have a mental illness.

Rates of tobacco smoking have significantly decreased in recent years. In Australia, 14.5% of people aged 18 years and over reported smoking daily in 2014-2015, compared with 22.4% of adults in 2001 (Australian Bureau of Statistics, 2015). Despite this decrease, smoking continues to be one of the largest preventable causes of death and disease in Australia (ABS, 2015).

Whilst overall rates of tobacco smoking have decreased over time, research shows that rates of smoking remained stable amongst people with serious psychological distress (Forman-Hoffman et al., 2017). Moreover, research has consistently found a positive relationship between smoking and frequent mental distress. Current smokers were significantly more likely than former smokers or non-smokers to report frequent mental distress (Strine & Chapman, 2005). In addition, research using a large Australian population sample found a strong association between current smoking status and psychological distress (Leung, Gartner, Dobson, Lucke, & Hall, 2011).

Nutrition. The Australian dietary guidelines recommend adults consume at least 5 serves of vegetables and 2 serves of fruit per day. Measuring fruit and vegetable intake is frequently selected by researchers as a measure of dietary quality (e.g., Ding, Do, Schmidt, & Bauman, 2015). In 2014-2015, only 7% of Australian adults met the guidelines for recommended daily serves of vegetables, and 49.8% of Australians met the guidelines for daily serves of fruit. Both guidelines were met by a mere 5.1% of the Australian population (Australian Bureau of Statistics, 2015).

To maintain a healthy weight the 2013 Australian Dietary guidelines recommend eating a variety of 5 food groups (vegetables, fruit, grains, lean meats or other proteins and dairy), and limiting the intake of food high in saturated fats, added sugar, added salt and alcohol. A healthy diet is associated with a reduced risk of developing chronic diseases, such as cardiovascular disease, type 2 diabetes and cancer. A healthy weight is defined as a Body Mass Index (BMI) between 18.5 and 24.99kg / m^2. (Australian Government Department of Health and Aging, 2013).

Fruit and vegetable intake has been shown to reduce the risks of chronic diseases, either directly or indirectly by reducing obesity (Boeing et al., 2012). For example,

increasing fruit and vegetable intake has been shown to reduce the risk of coronary heart disease (Joshipura et al., 2001). Joshipura et al. (2001) found the CHD risk was reduced by way of a dose-response: Each daily serve of fruit and vegetables reduced risk by 4%. In a literature review Boeing et al. (2012) found evidence that increased fruit and vegetable intake directly reduces the risk of chronic diseases such as hypertension, CHD, stroke, asthma, COPD and rheumatoid arthritis. Furthermore, they suggested that increased fruit and vegetable intake may prevent weight gain, thereby reducing the incidence of type 2 diabetes mellitus.

Whilst fruit and vegetable intake has been shown to reduce risks of chronic diseases, the impact of fruit and vegetable intake alone on mental health remains unclear. Kingsbury et al. (2016) found a significant inverse association between fruit and vegetable intake and mental distress and depression. However, this association was not significant when adjusting for other health related factors such as smoking and physical activity. In addition, Richard et al. (Richard, Rohrmann, Vandeleur, Mohler-Kuo, & Eichholzer, 2015) reported an inverse association between fruit and vegetable consumption and mental distress. They found that consuming 5 servings of fruit and vegetables was associated with lower levels of mental distress.

Alcohol consumption. To reduce the lifetime risk of harm from alcohol related injury or disease, the 2009 Australian Guidelines for reducing health risks from drinking alcohol recommend that adults drink no more than 2 standard drinks per day (National Health and Medical Research Council, 2009). The most recent figures showed that 17.4% of adults in Australia consumed more than the recommended guidelines between 2014-2015. More men than women exceeded the lifetime risk guideline between 2014-2015 (25.8% and 9.3% respectively) (Australian Bureau of Statistics, 2015).

Excessive alcohol consumption is a well-documented risk factor for a number of chronic diseases. Excessive alcohol consumption is associated with increased risk for a number of cancers, diabetes, Alzheimers disease, cardiovascular disease and stroke (Shield, Parry, & Rehm, 2013) as well as all-cause mortality (Di Castelnuovo et al., 2006).

Studies have shown that high volume drinking, binge drinking and hazardous drinking are associated with higher levels of mental distress (Makela, Raitasalo, & Wahlbeck, 2015). However, the relationship between alcohol consumption and mental health is not linear: Moderate drinking was associated with positive self-reports of mental health, and lower reports of sub optimal health (El-Guebaly, 2007).

Physical activity. Australian guidelines recommend that adults engage in moderate or vigorous intensity exercise for a minimum of 150 minutes per week. It is recommended that adults are active on most days every week, including at least two muscle strengthening activities each week (Department of Health, 2014). In 2014-2015, only 55.5% of Australian adults were sufficiently active in the past week. Moreover, 29.7% of Australian adults were insufficiently active, whilst 14.8% were inactive. These rates have remained stable throughout this decade (ABS, 2015). Evidence has shown that engaging in physical activity significantly reduces the risks of all cause mortality, cardiovascular disease, diabetes, some cancers, musculoskeletal disorders and poor mental health (Brown, Bauman, Bull, & Burton, 2012).

The benefits of physical activity on mental health are well established (Fox, 1999). Research has shown benefits of moderate physical activity in the treatment of depression, in reducing anxiety symptoms, and in improving the mood in non-clinical population

samples (Brown et al., 2012; Paluska & Schwenk, 2000). Moreover, a recent Cochrane review concluded that exercise is an effective treatment to reduce symptoms of depression (Cooney et al., 2013).

Emerging Lifestyle Behaviours: Sitting Time and Sleep

More recently, research is increasing for the role of new emerging unhealthy lifestyle behaviours such as prolonged sitting and insufficient sleep (Duncan, Kline, Rebar, Vandelanotte, & Short, 2016; van der Ploeg, Chey, & Korda, 2012). These have individually been associated with a negative impact on physical health (Strine & Chapman, 2005; Ding et al., 2015).

Sitting time. Sitting time, or sedentary behaviour, "refers to any waking activity characterized by an energy expenditure ≤ 1.5 metabolic equivalents *and* a sitting or reclining posture. In general this means that any time a person is sitting or lying down, they are engaging in sedentary behavior". Common sedentary behaviours include TV viewing, video game playing, computer use (collectively termed "screen time"), driving automobiles, and reading (Sedentary Behaviour Research, 2012). Sitting time is a health risk behaviour, which is distinct from physical inactivity (Bauman et al., 2011). It appears separately from physical activity in Australian health guidelines (Australian Government Department of Health and Aging, 2014).

In 2011-2012, Australian adults spent an average of 39 hours per week sitting, including 10 hours at work and 29 hours in leisure time. The most prevalent sedentary activity was watching TV, with an average of 13 hours per week. Amongst workers, professionals and administrative occupations reported the highest rates of time spent sitting at work (Australian Bureau of Statistics, 2013).

Research has found a non-linear relationship between sitting time and all-cause mortality. In a meta-analysis examining daily sitting time and all-cause mortality, Chau et al. (2013) found that high rates of sitting time (> 7 hours) were associated with a significant increased risk of all-cause mortality, even when accounting for physical activity (Chau et al., 2013). Furthermore, Biddle et al. (2016) conducted a systematic review of sedentary behaviour and all-cause mortality. They concluded that there is evidence for a causal relationship between sitting time and all-cause mortality (Biddle et al., 2016)

High sitting time has also been associated with an increased risk of poor mental health. Sloan et al. (2013) examined the association between high sedentary behaviour and mental distress, even when accounting for physical activity (Sloan et al., 2013). In addition, Teychenne et al. (Teychenne, Costigan, & Parker, 2015) reported a positive association between sitting time and anxiety risk, that is higher sitting times increase the risk of anxiety.

Sleep. Sufficient sleep is important for health. Sufficient sleep consists of sufficient sleep duration as well as sufficient sleep quality. Buysse (2014) proposed the following definition of sleep health: “Sleep health is a multidimensional pattern of sleep-wakefulness, adapted to individual, social, and environmental demands, that promotes physical and mental well-being. Good sleep health is characterised by subjective satisfaction, appropriate timing, adequate duration, high efficiency, and sustained alertness during waking hours.” (Buysse, 2014, p.12).

The National Sleep Foundation recommends a sleep duration of 7-9 hours for adults (Hirshkowitz et al., 2015). In 2008, the mean sleep duration amongst adults in New South Wales was 7.25 hours on weekdays and 7.53 hours in the weekends. The

prevalence of sleeping less than 6.5 hours per weeknight was 18.4%. The prevalence of insufficient quantity of sleep was 13.0%, and poor quality sleep was 10.6% (Bartlett, Marshall, Williams, & Grunstein, 2008).

Insufficient sleep has been linked with increased mortality risk (Grandner, Hale, Moore, & Patel, 2010), cardiovascular disease, coronary heart disease, stroke, diabetes and obesity (Shankar, Syamala, & Kalidindi, 2010) and high blood pressure, asthma and arthritis (Liu et al., 2013). Moreover research has supported an association between sleep and levels of mental health. Strine and Chapman (2005) examined the association between sleep insufficiency, health related quality of life and health behaviours. They found that adults who reported frequent insufficient sleep were significantly more likely to report frequent mental distress, depressive symptoms and anxiety symptoms. They also examined the association between unhealthy behaviours and sleep insufficiency, and found that sleep insufficiency was more prevalent among people who were smokers, obese, inactive and heavy drinkers. However the authors did not examine the role of sleep on health outcomes when accounting for these traditional lifestyle behaviours (Strine & Chapman, 2005).

Co-occurrence of Lifestyle Risk Behaviours

Traditionally researchers have investigated the impact of health risk behaviours in isolation. However, clear evidence exists that these lifestyle behaviours co-occur (Loef & Walach, 2012; Poortinga, 2007; Schuit et al., 2002; Fine et al., 2004). Furthermore engaging in multiple lifestyle risk behaviours is associated with an increased risk of chronic disease (Spring, Moller, & Coons, 2012).

Whilst traditionally research has focused on examining the impact of individual lifestyle risk behaviours on health, evidence is emerging of trends of the clustering of lifestyle risk behaviours (e.g., (Morris, D'Este, Sargent-Cox, & Anstey, 2016; Poortinga, 2007). Multiple SNAP lifestyle risk behaviours are associated with an increased risk of physical diseases, such as cancer and cardiovascular disease (Ford, Bergmann, Boeing, Li, & Capewell, 2012; Mokdad, Marks, & Stroup, 2004). Moreover, these multiple lifestyle risk behaviours have a cumulative adverse impact on health (Spring et al., 2012). Compared with people who do not engage in SNAP behaviours, people who engage in all 4 SNAP risk behaviours had a 3-fold increased risk of cardiovascular disease and cancer mortality, and a 4-fold increased risk of dying from other causes (Kvaavik, Batty, Ursin, Huxley, & Gale, 2010).

Whilst research on the association of SNAP lifestyle behaviours with mental health disorders is more limited, the evidence supporting a link between lifestyle and mental health is growing (Vermeulen-Smit, Ten Have, Van Laar, & De Graaf, 2015; Walsh, 2011). In Australia, prevalence of SNAP lifestyle risk behaviours among people with a mental illness is high, with over 75% of people reporting 2 or more SNAP lifestyle risk behaviours (Bartlem et al., 2015). Vermeulen-Smith et al. (2015) found that people who engaged in unhealthy lifestyle behaviours were twice as likely to suffer from depression than those engaged in healthy lifestyle behaviours, suggesting a strong association between health lifestyle behaviour clusters and mental health. Indeed, targeting one or more lifestyle behaviours can have therapeutic benefits for people with mental health disorders (Walsh, 2011), and can reduce depression and anxiety in non-clinical populations (Rebar et al., 2015).

Inclusion of Sitting and Sleep Insufficiency as Risk Factors

Recently researchers have proposed the inclusion of sitting time and sleep insufficiency in future studies on multiple health behaviours. Ding et al. (2014) investigated whether adding sleep and sitting to traditional SNAP lifestyle risk behaviours improved the prediction of a number of health outcomes, including psychological distress. Using data from an Australian cohort aged 45 years and over, they developed four lifestyle indices (SNAP, SNAP + sleep, SNAP + sitting and SNAP + sleep + sitting) and examined the association between the number of SNAP risk behaviours and the odds of at-risk sitting time and sleep duration. In addition, they examined how well each lifestyle index predicted four health outcomes (self-rated health, quality of life, psychological distress and physical function). They found a positive association between the number of SNAP behaviours a person engaged in and sitting-time and sleep duration: The more SNAP lifestyle behaviours a person engaged in, the more likely a person was to being at risk for sitting time and sleep. This finding confirmed previous suggestions that health risk behaviours tend to cluster. In addition, the authors found that adding sleep duration as a risk factor significantly improved the prediction of all health outcomes, including psychological distress. However, adding at-risk sitting time did not affect the predictability of health outcomes in this study (Ding et al., 2014).

In contrast, a more recent study by Ding et al. (2015) supported the inclusion of prolonged sitting time as a predictor for health outcomes. In this study, data from a large Australian cohort of middle and old-aged adults was used to examine lifestyle risk indices, including sleep and sitting time, on all-cause mortality. They found that prolonged sitting was the most common single risk factor. The most common combination of two risk factors was physical inactivity and prolonged sitting time. This

combination was strongly associated with all-cause mortality. In addition, an association was found between the number of lifestyle risk factors and all-cause mortality. Furthermore they found further evidence that risk behaviours tend to cluster, and that these behavior clusters increased health risk exponentially rather than equaling the sum of each individual risk (Ding, Rogers, et al., 2015).

Martínez-Gómez et al. (2013) reported a cumulative impact of engaging in both traditional and emerging lifestyle behaviours on mortality. They found an inverse dose-response relationship between the number of positive health behaviours a person engaged in and mortality risk (Martínez-Gómez, Guallar-Castillón, León-Muñoz, López-García, & Rodríguez-Artalejo, 2013). A more recent study supported the importance of including emerging lifestyle risk behaviours sleep and sitting time to predict health outcomes. Krokstad et al. (2017) investigated the impact of SNAP lifestyle risk behaviours and 3 emerging lifestyle risk behaviours (sleep, sitting time and social connectivity) (Krokstad et al., 2017). This large Norwegian population study examined the association between traditional and emerging health risk behaviours and all-cause and cardio-metabolic mortality. In contrast to Ding et al. (2014), this study found that both sleep and sitting time were associated with an increased risk of all-cause mortality and cardio-metabolic mortality. Moreover, they found that clustering of behaviours was associated with an incremental effect on mortality, i.e. the more lifestyle risk behaviours one engaged in the higher the mortality risk. They concluded that excessive sitting time in isolation was not a significant risk factor, however in combination with physical inactivity there is a significant risk for all-cause mortality and cardio-metabolic mortality.

SNAP, Emerging Lifestyle Behaviours and Mental Health

To date, one other study examined the combined effects of SNAP behaviours and emerging lifestyle risk behaviours on mental distress. Ding et al. (2014) examined whether adding emerging lifestyle risk behaviors to SNAP behaviors improved the prediction of a number of health outcomes in an Australian population sample aged 45 years and over. One of the health outcomes was psychological distress, which they measured using the Kessler 10 (Andrews & Slade, 2010). Sitting time and sleep were assessed, measured by asking participants a single question about the total number of hours spent sitting and sleeping during the past 24 hours. They found that adding sleep, but not sitting time, to SNAP behaviours was a significant predictor of psychological distress in participants aged 45 years and over. Limitations of this study are the age of participants, and measurements used to assess the independent variables. For example, sitting time and sleep were only assessed by duration in the last 24 hours. Other dimensions, such as sleep sufficiency and breaks in sitting, were not assessed. These finding suggest the need for further research into the combined effects of SNAP and sleep and sitting behaviours on mental health.

Health Promotion Campaigns

Findings on the risks associated with individual lifestyle behaviours have contributed to the development of health promotion campaigns (Centers for Disease Control and Prevention, 2017).. There are a number of campaigns in Australia designed to promote individual health behaviours. The focus of these campaigns has been on traditional lifestyle behaviours. The 10,000 Steps Project is a health promotion program that encourages the use of a pedometer to increase daily physical activity and reduce sedentary behaviour (Queensland Government, 2017). The Go for 2 & 5 campaign

promotes healthy eating behaviour by encouraging a daily intake of 2 servings of fruit and 5 servings of vegetables per day (Australian Government Department of Health and Aging, 2005). The Australian Government's National Binge Drinking Strategy (NBDS) (Australian Government Department of Health and Aging, 2008) raises awareness of the harmful impacts of binge drinking in order to address the binge drinking culture in Australia and develop a more responsible drinking culture. The Australian National Tobacco Campaign (NTC) was initiated in 1997 by the federal government to reduce the prevalence of tobacco smoking in Australia by helping smokers to quit. As part of its strategy, the NTC has developed advertising materials and the Quit Now website and helpline (Hill & Carroll, 2003).

Summary

Recent studies on the individual effects of sleep and sitting time have demonstrated their impact on health outcomes. Furthermore research suggests that adding these emerging lifestyle risk factors to traditional SNAP lifestyle risk behaviours to predict health outcomes is important, as health risk lifestyle behaviours have been shown to co-occur.

There have been a large number of studies that have investigated the combined impact of traditional and emerging lifestyle behaviours on general health (Ding et al, 2014, Ding et al, 2015), cardiovascular disease (Hoevenaar-Blom, Spijkerman, Kromhout, & Verschuren, 2014) and mortality (Martínez-Gómez et al., 2013). However, to date only one research study has investigated the combined impact of traditional and emerging lifestyle behaviours on mental distress (Ding et al., 2014). There is a need to examine whether sleep and sitting time can have an impact on mental distress in addition to the traditional SNAP behaviours.

References

Andrews, G., & Slade, T. (2001). Interpreting scores on the Kessler Psychological Distress Scale (K10). *Australian and New Zealand Journal of Public Health, 25*, 494-497.

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Arlington, VA, American Psychiatric Association.

Arroyo, C., Hu, F. B., Ryan, L. M., Kawachi, I., Colditz, G. A., Speizer, F. E., & Manson, J. (2004). Depressive symptoms and risk of type 2 diabetes in women. *Diabetes Care, 27*(1), 129-133. doi:https://doi.org/10.2337/diacare.27.1.129

Australian Bureau of Statistics. (2008). National Survey of Health an Wellbeing: Summary of Results, 2007. *4326.0*.

Australian Bureau of Statistics. (2013). Australian Health Survey: Physical Activity, 2011-2012Australian Health Survey 2011-2012. Canberra: ABS. doi:http://www.abs.gov.au/ausstats/abs@.nsf/lookup/7838D948C8549693CA257BAC0015F644?opendocument

Australian Bureau of Statistics. (2015). National Health Survey: First Results, 2014-15. *4364.0.55.001*.

Australian Government Department of Health and Aging. (2005). Go for 2 and 5. Retrieved from http://www.healthyactive.gov.au/internet/healthyactive/publishing.nsf/Content/2and5

Australian Government Department of Health and Aging. (2008). National Binge Drinking Strategy. Retrieved from http://www.alcohol.gov.au/internet/alcohol/publishing.nsf/Content/cli

Australian Government Department of Health and Aging. (2013). *Eat for Health: Australian Dietary Guidelines*. Canberra, Australia.

Australian Government Department of Health and Aging. (2014). Australia's phsyical activity and sedentary behaviour guidelines.

Australian Institute of Health and Welfare. (2016). Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2011 - summary report. *Australian Burden of Disease Study series no. 4. BOD 5.*

Bartlem, K. M., Bowman, J. A., Bailey, J. M., Freund, M., Wye, P. M., Lecathelinais, C., McElwaine, K. M., Campbell, E. M., Gillham, K. E., & Wiggers, J. H. (2015). Chronic disease health risk behaviours amongst people with a mental illness. *Australian and New Zealand Journal of Psychiatry, 49*(8), 731-741. doi:10.1177/0004867415569798

Bartlett, D. J., Marshall, N. S., Williams, A., & Grunstein, R. R. (2008). Sleep health New South Wales: chronic sleep restriction and daytime sleepiness. *Internal Medicine Journal, 38*(1), 24-31. doi:10.1111/j.1445-5994.2007.01395.x

Bauman, A., Ainsworth, B. E., Sallis, J. F., Hagstromer, M., Craig, C. L., Bull, F. C., Pratt, M., Venugopal, K., Chau, J., Sjostrom, M., & Group, I. P. S. (2011). The descriptive epidemiology of sitting. A 20-country comparison using the International Physical Activity Questionnaire (IPAQ). *American Journal of Preventive Medicine, 41*(2), 228-235. doi:10.1016/j.amepre.2011.05.003

Biddle, S. J. H., Bennie, J. A., Bauman, A. E., Chau, J. Y., Dunstan, D., Owen, N., Stamatakis, E., & van Uffelen, J. G. Z. (2016). Too much sitting and all-cause mortality: is there a causal link? *BMC Public Health, 16*, 635. doi:0.1186/s12889-016-3307-3

Boeing, H., Bechthold, A., Bub, A., Ellinger, S., Haller, D., Kroke, A., Leschik-Bonnet, E., Muller, M. J., Oberritter, H., Schulze, M., Stehle, P., & Watzl, B. (2012). Critical review: vegetables and fruit in the prevention of chronic diseases. *European Journal of Nutrition, 51*(6), 637-663. doi:10.1007/s00394-012-0380-y

Brown, W. J., Bauman, A., Bull, F. C., & Burton, N. W. (2012). Development of evidence-based physical activity recommendations for adults (18-64 years). *Report prepared for the Australian Government Department of Health*. doi:http://www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-phys-act-guidelines/$File/DEB-PAR-Adults-18-64years.pdf

Bruning, J., Arif, A. A., & Rohrer, J. E. (2014). Medical cost and frequent mental distress among the non-elderly US adult population. *Journal Public Health (Oxford Academic), 36*(1), 134-139. doi:10.1093/pubmed/fdt029

Buysse, D. J. (2014). Sleep health: can we define it? Does it matter? *Sleep, 37*(1), 9-17. doi:10.5665/sleep.3298

Centers for Disease Control and Prevention. (2017). Chronic Disease Prevention and Health Promotion. Retrieved from doi:https://www.cdc.gov/chronicdisease/about/infographic.htm

Chau, J. Y., Grunseit, A. C., Chey, T., Stamatakis, E., Brown, W. J., Matthews, C. E., Bauman, A. E., & van der Ploeg, H. P. (2013). Daily sitting time and all-cause mortality: a meta-analysis. *Public Library of Science One, 8*(11), e80000. doi:10.1371/journal.pone.0080000

Cooney, G. M., Dwan, K., Greig, C. A., Lawlor, D. A., Rimer, J., Waugh, F. R., McMurdo, M., & Mead, G. E. (2013). Exercise for depression. *Cochrane*

Database of Systematic Reviews(9), CD004366. doi:0.1002/14651858.CD004366.pub6

Currier, M. B., & Nemeroff, C. B. (2014). Depression as a risk factor for cancer: from pathophysiological advances to treatment implications. *Annual Review of Medicine, 65*, 203-221. doi:10.1146/annurev-med-061212-171507

Del Giacco, S. R., Cappai, A., Gambula, L., Cabras, S., Perra, S., Manconi, P. E., Carpiniello, B., & Pinna, F. (2016). The asthma-anxiety connection. *Respiratory Medicine, 120*, 44-53. doi:10.1016/j.rmed.2016.09.014

Department of Health. (2014). Australia's physical activity and sedentary behaviour guidelines. doi:http://www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-phys-act-guidelines - apaadult

Di Castelnuovo, A., Costanzo, S., Bagnardi, V., Donati, M. B., Iacoviello, L., & de Gaetano, G. (2006). Alcohol dosing and total mortality in men and women: An updated meta-analysis of 34 prospective studies. *Archives of Internal Medicine, 166*(22), 2437-2445. doi:10.1001/archinte.166.22.2437

Ding, D., Do, A., Schmidt, H. M., & Bauman, A. E. (2015). A Widening Gap? Changes in Multiple Lifestyle Risk Behaviours by Socioeconomic Status in New South Wales, Australia, 2002-2012. *Public Library of Science One, 10*(8), e0135338. doi:10.1371/journal.pone.0135338

Ding, D., Rogers, K., Macniven, R., Kamalesh, V., Kritharides, L., Chalmers, J., & Bauman, A. (2014). Revisiting lifestyle risk index assessment in a large Australian sample: should sedentary behavior and sleep be included as additional risk factors? *Preventive Medicine, 60*, 102-106. doi:10.1016/j.ypmed.2013.12.021

Ding, D., Rogers, K., van der Ploeg, H., Stamatakis, E., & Bauman, A. E. (2015). Traditional and Emerging Lifestyle Risk Behaviors and All-Cause Mortality in Middle-Aged and Older Adults: Evidence from a Large Population-Based Australian Cohort. *Public Library of Science Medicine, 12*(12), e1001917. doi:10.1371/journal.pmed.1001917

Drapeau, A., Marchand, A., & Beaulieu-Prévost, D. (2012). Epidemiology of Psychological Distress. *Mental Illness - Understanding Prediction and Control:* Prof. Luciano LAbate. Retrieved from http://www.intechopen.com/books/mental-illnesses-understanding-prediction-and- control/epidemiology-of-psychological-distress.

Duncan, M. J., Kline, C. E., Rebar, A. L., Vandelanotte, C., & Short, C. E. (2016). Greater bed- and wake-time variability is associated with less healthy lifestyle behaviors: a cross-sectional study. *Journal of Public Health, 24*(1), 31-40. doi:10.1007/s10389-015-0693-4

El-Guebaly, N. (2007). Investigating the Association Between Moderate Drinking and Mental Health. *Annals of Epidemiology, 17*(5), S55-S62. doi:10.1016/j.annepidem.2007.01.013

Emdin, C. A., Odutayo, A., Wong, C. X., Tran, J., Hsiao, A. J., & Hunn, B. H. (2016). Meta-Analysis of Anxiety as a Risk Factor for Cardiovascular Disease. *The American Journal of Cardiology, 118*(4), 511-519. doi:10.1016/j.amjcard.2016.05.041

Fine, L. J., Philogene, G. S., Gramling, R., Coups, E. J., & Sinha, S. (2004). Prevalence of multiple chronic disease risk factors. 2001 National Health Interview Survey. *American Journal of Preventive Medicine, 27*(2 Suppl), 18-24. doi:10.1016/j.amepre.2004.04.017

Fleet, R., Lavoie, K., & Beitman, B. D. (2000). Is panic disorder associated with coronary artery disease? A critical review of the literature. *Journal of Psychosomatic Research, 48*(4-5), 347-356. doi:10.1016/S0022-3999(99)00101-4

Ford, E. S., Bergmann, M. M., Boeing, H., Li, C., & Capewell, S. (2012). Healthy lifestyle behaviors and all-cause mortality among adults in the United States. *Preventive Medicine, 55*, 23-27. doi:0.1016/j.ypmed.2012.04.016

Forman-Hoffman, V. L., Hedden, S. L., Miller, G. K., Brown, K., Teich, J., & Gfroerer, J. (2017). Trends in cigarette use, by serious psychological distress status in the United States, 1998-2013. *Addictive Behaviours, 64*, 223-228. doi:10.1016/j.addbeh.2016.09.003

Fox, K. R. (1999). The influence of physical activity on mental well-being. *Public Health Nutrition, 2*(3a), 411-418. doi:https://doi.org/10.1017/S1368980099000567

Golden, S. H., Williams, J. E., Ford, D. E., Yeh, H., Sanford, C. P., Nieto, F. J., & Brancati, F. L. (2004). Depressive Symptoms and the Risk of Type 2 Diabetes. *Diabetes Care, 27*(2), 429-435. doi:https://doi.org/10.2337/diacare.27.2.429

Grandner, M. A., Hale, L., Moore, M., & Patel, N. P. (2010). Mortality associated with short sleep duration: The evidence, the possible mechanisms, and the future. *Sleep Medicine Review, 14*(3), 191-203. doi:10.1016/j.smrv.2009.07.006

Green, R. C., Cupples, L. A., Kurz, A., Auerbach, S., Go, R., Sadovnick, D., Duara, R., Kukull, W. A., Chui, H., Edeki, T., Griffith, P. A., Friedland, R. P., Bachman, D., & Farrer, L. (2003). Depression as a risk factor for Alzheimer

disease: The MIRAGE study. *Archives of Neurology, 60*(5), 753-759. doi:10.1001/archneur.60.5.753

Hill, D., & Carroll, T. (2003). Australia's National Tobacco Campaign. *Tobacco Control, 12*(Supplement II), ii9-ii14. doi:http://tobaccocontrol.bmj.com/content/tobaccocontrol/12/suppl_2/ii9.full.pdf

Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., Hazen, N., Herman, J., Katz, E. S., Kheirandish-Gozal, L., Neubauer, D. N., O'Donnell, A. E., Ohayon, M., Peever, J., Rawding, R., Sachdeva, R. C., Setters, B., Vitiello, M. V., Ware, J. C., & Adams Hillard, P. J. (2015). National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health, 1*(1), 40-43. doi:10.1016/j.sleh.2014.12.010

Hoevenaar-Blom, M. P., Spijkerman, A. M., Kromhout, D., & Verschuren, W. M. (2014). Sufficient sleep duration contributes to lower cardiovascular disease risk in addition to four traditional lifestyle factors: the MORGEN study. *European Journal of Preventive Cardiology, 21*(11), 1367-1375. doi:10.1177/2047487313493057

Horwitz, A. V. (2007). Distinguishing distress from disorder as psychological outcomes of stressful social arrangements. *Health (London), 11*(3), 273-289. doi:10.1177/1363459307077541

Institute for Health Metrics and Evaluation. (2013). The global burden of disease: Generating Evidence, Guiding Policy (pp. 27-29). Seattle, WA: IHME, 2013. doi: http://www.healthmetricsandevaluation.org/gbd/visualizations/country

Joshipura, K. J., Hu, F. B., Manson, J. E., Stampfer, M. J., Rimm, E. B., Speizer, F. E., Colditz, G. A., Ascherio, A., Rosner, B., Spiegelman, D., & Willett, W. C. (2001). The effect of fruit and vegetable intake on risk of coronary heart disease. *Annals of Internal Medicine, 134*(12), 1106-1114. doi:10.7326/0003-4819-134-12-200106190-00010

Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S.-L., T., Walters, E. E., & Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine, 32*, 959-976. doi:10.1017/S003329170200607

Kessler, R. C., Green, J. G., Gruber, M. J., Sampson, N. A., Bromet, E., Cuitan, M., Furukawa, T. A., Gureje, O., Hinkov, H., Hu, C. Y., Lara, C., Lee, S., Mneimneh, Z., Myer, L., Oakley-Browne, M., Posada-Villa, J., Sagar, R., Viana, M. C., & Zaslavsky, A. M. (2010). Screening for serious mental illness in the general population with the K6 screening scale: results from the WHO World Mental Health (WMH) survey initiative. *International Journal of Methods in Psychiatric Research, 19 Suppl 1*, 4-22. doi:10.1002/mpr.310

Kilkkinen, A., Kao-Philpot, A., O'Neil, A., Philpot, B., Reddy, P., Bunker, S., & Dunbar, J. (2007). Prevalence of psychological distress, anxiety and depression in rural communities in Australia. *Australian Journal of Rural Health, 15*(2), 114-119. doi:10.1111/j.1440-1584.2007.00863.x

Kingsbury, M., Dupuis, G., Jacka, F., Roy-Gagnon, M. H., McMartin, S. E., & Colman, I. (2016). Associations between fruit and vegetable consumption and depressive symptoms: evidence from a national Canadian longitudinal survey.

Journal of Epidemiology and Community Health, 70(2), 155-161. doi:10.1136/jech-2015-205858

Korostil, M., & Feinstein, A. (2007). Anxiety disorders and their clinical correlates in multiple sclerosis patients. *Multiple Sclerosis, 13*, 67-72. doi:10.1177/1352458506071161

Krokstad, S., Ding, D., Grunseit, A. C., Sund, E. R., Holmen, T. L., Rangul, V., & Bauman, A. (2017). Multiple lifestyle behaviours and mortality, findings from a large population-based Norwegian cohort study - The HUNT Study. *BMC Public Health, 17*(1), 58. doi:10.1186/s12889-016-3993-x

Kvaavik, E., Batty, D., Ursin, G., Huxley, R., & Gale, C. R. (2010). Influence of individual and combined health behaviors on total and cause-specific mortality in men and women. *Archives of Internal Medicine, 170*(8), 711-718. doi:https://dx-doi-org.ezproxy.newcastle.edu.au/10.1001/archinternmed.2010.76

Lawrence, D., Mitrou, F., & Zubrick, S. R. (2009). Smoking and mental illness: results from population surveys in Australia and the United States. *BMC Public Health, 9*, 285. doi:10.1186/1471-2458-9-285

Leung, J., Gartner, C., Dobson, A., Lucke, J., & Hall, W. (2011). Psychological distress is associated with tobacco smoking and quitting behaviour in the Australian population: evidence from national cross-sectional surveys. *Australian and New Zealand Journal of Psychiatry, 45*(2), 170-178. doi:http://dx.doi.org.ezproxy.newcastle.edu.au/10.3109/00048674.2010.534070

Liu, Y., Croft, J. B., Wheaton, A. G., Perry, G. S., Chapman, D. P., Strine, T. W., McKnight-Eily, L. R., & Presley-Cantrell, L. (2013). Association between

perceived insufficient sleep, frequent mental distress, obesity and chronic diseases among US adults, 2009 behavioural risk factor surveillance system. *BMC Public Health, 13:84*. doi:10.1186/1471-2458-13-84

Loef, M., & Walach, H. (2012). The combined effects of healthy lifestyle behaviors on all cause mortality: a systematic review and meta-analysis. *Preventive Medicine, 55*(3), 163-170. doi:10.1016/j.ypmed.2012.06.017

Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the Depression Anxiety Stress Scales* (2 ed.). Sydney: Psychology Foundation.

Makela, P., Raitasalo, K., & Wahlbeck, K. (2015). Mental health and alcohol use: a cross-sectional study of the Finnish general population. *European Journal of Public Health, 25*(2), 225-231. doi:10.1093/eurpub/cku133

Martínez-Gómez, D., Guallar-Castillón, P., León-Muñoz, L. M., López-García, E., & Rodríguez-Artalejo, F. (2013). Combined impact of traditional and non-traditional health behaviors on mortality: a national prospective cohort study in Spanish older adults. *BMC Medicine, 11*, 47. doi:http://www.biomedcentral.com/1741-7015/11/47

McGuire, L. C., Strine, T. W., Okoro, C. A., Ahluwalia, I. B., & Ford, E. S. (2007). Modifiable Characteristics of a healthy lifestyle in U.S. older adults with or without Frequent Mental Distress: 2003 Behavioral Risk Factor Surveillance System. *American Journal of Geriatric Psychiatry, 15*(9). doi:http://dx.doi.org.ezproxy.newcastle.edu.au/10.1097/JGP.0b...

Mokdad, A. H., Marks, J. S., & Stroup, D. F. (2004). Actual; causes of death in the Uinted States, 2000. *JAMA, 291*(10), 1238-1245. doi:10.1001/jama.291.10.1238

Moriarty, D. G., Zack, M. M., & Kobau, R. (2003). The Centers for Disease Control and Prevention's Healthy Days Measure - Population tracking of perceived physical and mental health over time. *Health and Quality of Life Outcomes, 1*(1), 37. doi:10.1186/1477-7525-1-37

Morris, L. J., D'Este, C., Sargent-Cox, K., & Anstey, K. J. (2016). Concurrent lifestyle risk factors: Clusters and determinants in an Australian sample. *Preventive Medicine, 84*, 1-5. doi:10.1016/j.ypmed.2015.12.009

Moussavi, S., Chatterji, S., Verdes, E., Tandon, A., Patel, V., & Ustun, B. (2007). Depression, chronic diseases, and decrements in health: results from the World Health Surveys. *The Lancet, 370*, 851-858. doi:10.1016/s0140-6736(07)61415-9

National Health and Medical Research Council. (2009). Australian Guidelines to Reduce Health Risks from Drinking Alcohol. doi:https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/ds10-alcohol.pdf

Organisation for Economic Co-operation and Development. (2015). Life expectancy at birthHealth at a Glance 2015: OECD Indicators. Paris: OECD Publishing. doi: http://dx.doi.org/10.1787/health_glance-2015-6-en

Paluska, S. A., & Schwenk, T. L. (2000). Physical activity and mental health. *Sports Medicine, 29*(3), 167-180. doi:10.2165/00007256-200029030-00003

Petersen, K. E., Johnsen, N. F., Olsen, A., Albieri, V., Olsen, L. K., Dragsted, L. O., Overvad, K., Tjonneland, A., & Egeberg, R. (2015). The combined impact of adherence to five lifestyle factors on all-cause, cancer and cardiovascular mortality: a prospective cohort study among Danish men and women. *British Journal of Nutrition, 113*(5), 849-858. doi:10.1017/S0007114515000070

Poortinga, W. (2007). The prevalence and clustering of four major lifestyle risk factors in an English adult population. *Preventive Medicine, 44*(2), 124-128. doi:10.1016/j.ypmed.2006.10.006

Prince, M., Patel, V., Saxena, S., Maj, M., Maselko, J., Philips, M. R., & Rahman, A. (2007). No health without mental health. *The Lancet, 370*(9580), 859-877. doi:10.1016/S0140-6736(07)61238-0

Queensland Government. (2017). Workplace Health and Wellbeing. 10,000 Steps challenge. Retrieved from https://workplaces.healthier.qld.gov.au/public-resources/10000-steps-challenge/

Rebar, A. L., Stanton, R., Geard, D., Short, C., Duncan, M. J., & Vandelanotte, C. (2015). A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. *Health Psychology Review, 9*(3), 366-378. doi:10.1080/17437199.2015.1022901

Richard, A., Rohrmann, S., Vandeleur, C. L., Mohler-Kuo, M., & Eichholzer, M. (2015). Associations between fruit and vegetable consumption and psychological distress: results from a population-based study. *BMC Psychiatry, 15*, 213. doi:10.1186/s12888-015-0597-4

Saneei, P., Esmaillzadeh, A., Keshteli, A. H., Reza Roohafza, H., Afshar, H., Feizi, A., & Adibi, P. (2016). Combined Healthy Lifestyle Is Inversely Associated with Psychological Disorders among Adults. *Public Llbrary of Science One, 11*(1), e0146888. doi:10.1371/journal.pone.0146888

Schuit, A. J., van Loon, A. J. M., Tijhuis, M., & Ocke, M. C. (2002). Clustering of Lifestyle Risk Factors in a General Adult Population. *Preventive Medicine, 35*(3), 219-224. doi:10.1006/pmed.2002.1064

Sedentary Behaviour Research, N. (2012). Letter to the editor: standardized use of the terms "sedentary" and "sedentary behaviours". *Applied Physiology Nutrition Metabolism, 37*(3), 540-542. doi:10.1139/h2012-024

Shankar, A., Syamala, S., & Kalidindi, S. (2010). Insufficient rest or sleep and its relation to cardiovascular disease, diabetes and obesity in a national, multiethnic sample. *Public Library of Science One, 5*(11), e14189. doi:10.1371/journal.pone.0014189

Shield, K. D., Parry, C., & Rehm, J. (2013). Chronic diseases and conditions related to alcohol use. *Alcohol Research: Current Reviews, 35*(2), 155-173.

Slade, T., Grove, R., & Burgess, P. (2011). Kessler Psychological Distress Scale: normative data from the 2007 Australian National Survey of Mental Health and Wellbeing. *Australian and New Zealand Journal of Psychiatry, 45*(4), 308-316. doi:10.3109/00048674.2010.543653

Sloan, R. A., Sawada, S. S., Girdano, D., Liu, Y. T., Biddle, S. J. H., & Blair, S. N. (2013). Associations of sedentary behavior and physical activity with psychological distress: a cross-sectional study from Singapore. *BMC Public Health, 13*, 885. doi:http://www.biomedcentral.com/1471-2458/13/885

Spring, B., Moller, A. C., & Coons, M. J. (2012). Multiple health behaviours: overview and implications. *Journal of Public Health (Oxford), 34 Supplement 1*, i3-i10. doi:10.1093/pubmed/fdr111

Strine, T. W., Balluz, L., Chapman, D. P., Moriarty, D. G., Owens, M., & Mokdad, A. H. (2004). Risk behaviors and healthcare coverage among adults by frequent mental distress status, 2001. *American Journal of Preventive Medicine, 26*(3), 213-216. doi:10.1016/j.amepre.2003.11.002

Strine, T. W., & Chapman, D. P. (2005). Associations of frequent sleep insufficiency with health-related quality of life and health behaviors. *Sleep Medicine, 6*(1), 23-27. doi:10.1016/j.sleep.2004.06.003

Strine, T. W., Okoro, C. A., Chapman, D. P., Balluz, L. S., Ford, E. S., Ajani, U. A., & Mokdad, A. H. (2005). Health-related quality of life and health risk behaviors among smokers. *American Journal of Preventive Medicine, 28*(2), 182-187. doi:10.1016/j.amepre.2004.10.002

Teychenne, M., Costigan, S. A., & Parker, K. (2015). The association between sedentary behaviour and risk of anxiety: a systematic review. *BMC Public Health, 15*, 513. doi:10.1186/s12889-015-1843-x

Van der Kooy, K., van Hout, H., Marwijk, H., Marten, H., Stehouwer, C., & Beekman, A. (2007). Depression and the risk for cardiovascular diseases: systematic review and meta analysis. *International Journal of Geriatric Psychiatry, 22*(7), 613-626. doi:10.1002/gps.1723

van der Ploeg, H. P., Chey, T., & Korda, R. J. (2012). Sitting time and all-cause mortality risk in 222 497 Australian adults. *Archives of Internal Medicine, 172*(6), 494-500. doi:10.1001/archinternmed.2011.2174

Vermeulen-Smit, E., Ten Have, M., Van Laar, M., & De Graaf, R. (2015). Clustering of health risk behaviours and the relationship with mental disorders. *Journal of Affective Disorders, 171*, 111-119. doi:10.1016/j.jad.2014.09.031

Walsh, R. (2011). Lifestyle and mental health. *American Psychologist, 66*(7), 579-592. doi:10.1037/a0021769

Wilhelm, K., Mitchell, P., Slade, T., Brownhill, S., & Andrews, G. (2003). Prevalence and correlates of DSM-IV major depression in an Australian national survey.

Journal of Affective Disorders, 75(2), 155-162. doi:0.1016/S0165-0327(02)00040-X

Manuscript formatted for submission to Health Psychology

Traditional and emerging lifestyle behaviors and mental distress: A cross-sectional analysis

van der Leden, L.H.[1], Hanstock, T.L.[1], & Duncan, M.J[2]*.

1. School of Psychology, Faculty of Science, University of Newcastle, Callaghan, NSW, 2308.

2. School of Medicine & Public Health; Priority Research Centre for Physical Activity and Nutrition, Faculty of Health and Medicine, The University of Newcastle, Callaghan NSW 2308, Australia

*Contact Author: A/Prof. Mitch Duncan, School of Medicine & Public Health; Priority Research Centre for Physical Activity and Nutrition, Faculty of Health and Medicine, University Drive, University of Newcastle, Australia. E-mail: Mitch.Duncan@newcastle.edu.au; Phone: +61 2 4921 7805; Fax: +61 2 4921 2084

Word Count: 5163 (excludes title page, tables and references)

Abstract

Objective: Previous research on multiple lifestyle risk behaviors has largely focused on physical health outcomes compared to mental distress. We examined the association of traditional lifestyle risk behaviors (smoking, poor nutrition, higher risk alcohol consumption and reduced physical activity [SNAP]) and emerging lifestyle risk behaviors (increased sitting time and frequent insufficient sleep) with frequent mental distress (FMD).

Methods: A randomly selected sample of Australian adults (N = 1,201) aged between 18 and 100 years (M = 52.23, SD = 17.18) completed a telephone survey regarding lifestyle risk behaviors and FMD as part of the National Social Survey. Data was collected between July-August 2015. Each lifestyle risk behavior was classified into either higher or lower risk. The total number of higher risk SNAP behaviors engaged in was summed to create a SNAP behavior score. Logistic regression was used to examine the association between FMD, SNAP behavior score, and to examine the additional influence of higher risk sitting and frequent insufficient sleep when adjusting for SNAP behavior score.

Results: Higher SNAP behavior scores were associated with FMD (OR = 1.26, 95% CI [1.01 – 1.56]). Both higher sitting (OR = 1.72, 95% CI [1.10 – 2.69]) and frequent insufficient sleep (OR = 3.36, 95% CI [2.26 – 5.01]) were associated with FMD when adjusting for SNAP behavior scores, which were no longer significantly associated with FMD.

Conclusion: While SNAP behaviors are associated with FMD, results indicate the importance of considering the role of sitting time and insufficient sleep as emerging risk factors for mental distress.

Keywords: Insufficient sleep, sitting, mental distress, lifestyle behaviors

Introduction

The impact of lifestyle behaviors on physical and mental health is well established (Ding, Rogers, van der Ploeg, Stamatakis, & Bauman, 2015; Ford, Bergmann, Boeing, Li, & Capewell, 2011; Loef & Walach, 2012; Saneei et al., 2016). Most of this research focuses on the impact of traditional lifestyle behaviors. Traditional lifestyle behaviors include smoking, nutrition, alcohol consumption and physical activity, which are often referred to as SNAP behaviors (Poortinga, 2007). These SNAP behaviors are well established as risk factors for both physical and mental health issues (Buttery, Mensink, & Busch, 2015; Loef & Walach, 2012).

In recent years the focus has shifted from assessing lifestyle risk behaviors individually to assessing the association between engaging in multiple lifestyle behaviors and health (Loef & Walach, 2012; Poortinga, 2007; Schuit, van Loon, Tijhuis, & Ocke, 2002). This is because lifestyle risk behaviors often do not occur in isolation (Prochaska, Spring, & Nigg, 2008). Considerable evidence shows that SNAP behaviors co-occur (Tobias et al., 2007) and engaging in multiple SNAP behaviors has been shown to have a cumulative effect on physical health (Krokstad et al., 2017). For example, compared with people who do not engage in any SNAP behaviors, people who engage in all four SNAP behaviors had a 3-fold increased risk of cardiovascular disease and cancer mortality (McCullough et al., 2011) and a 4-fold risk of dying from other causes (Kvaavik, Batty, Ursin, Huxley, & Gale, 2010).

More recently there is growing awareness of the need to examine the role of ‘emerging’ risk factors, such as sitting time and sleep, as risk factors for both poorer physical and mental health (Ding et al., 2014; St-Onge et al., 2016). Higher levels of sitting time have been suggested to increase the risk of anxiety and mental distress, however there is limited understanding of the way in which sitting time is associated

with mental health (Teychenne Costigan, & Parker, 2015). Poorer quality sleep, sleep durations longer and shorter than recommended and frequent insufficient sleep are also associated with increased risk of mental distress (Cunningham et al. 2015; Liu et al., 2013;Ohayon, Reynolds, Dauviliers, 2013; Seun-Fadipe & Mosaku, 2017).

Furthermore, recent evidence suggests that SNAP behaviors and emerging lifestyle risk behaviors co-occur (Ding et al., 2015). For example, when examining the clustering of physical activity and sleep in adults, it was found that different levels of physical activity, sleep duration and sleep quality clustered in four different ways and that the group with the poorest sleep behaviors also had the highest level of mental distress (Rayward, Duncan, Brown, Plotnikoff, & Burton, 2017).

Some researchers have examined the impact of multiple SNAP and emerging lifestyle behaviors on health (Ding et al., 2014; Duncan et al., 2014). Most of this research focuses on physical health outcomes or quality of life. Little research has examined the effects of multiple SNAP and emerging lifestyle behaviors on mental distress (Ding et al., 2014; Krokstad et al., 2017).

Mental distress has been described as a state of emotional suffering, which is characterized by symptoms of depression (e.g., feelings of sadness and hopelessness) and anxiety (feeling tense and restless) (Drapeau, Marchand, & Beaulieu-Prévost, 2012). Mental distress is prevalent, with 11.7% of the Australian population reporting experiencing high or very high levels of psychological distress in 2014-2015 (Australian Bureau of Statistics, 2015).

Mental distress has been found to negatively influence physical health, which can be partly explained by the association between mental health and lifestyle risk factors such as smoking, poor nutrition, obesity and reduced activity (Bartlem et al., 2015). Although research on the relationship between SNAP behaviors and mental

distress is more limited compared to physical health, evidence supporting an association is increasing (e.g., Strine et al., 2004). For example, empirical evidence has supported a relationship between mental distress and smoking (e.g., Lawrence, Mitrou, & Zubrick, 2009), poor nutrition (e.g., Kingsbury et al., 2016), alcohol consumption (e.g., Makela, Raitasalo, & Wahlbeck, 2015), physical inactivity (e.g., Fox 1999). There is also growing evidence for the role higher sitting time (e.g. Sloan et al., 2013) and sleep insufficiency (e.g., Strine & Chapman, 2005) as risk factors for mental distress.

A number of studies have examined the combined effects of SNAP and emerging lifestyle risk behaviors in relation to physical disease or mortality (Ding et al., 2015; Krokstad et al., 2017; Martínez-Gómez, Guallar-Castillón, León-Muñoz, López-García, & Rodríguez-Artalejo, 2013). To date only one study examining the combined impact of multiple lifestyle risk behaviors included psychological distress as an outcome (Ding et al., 2014). Ding et al. (2014) examined whether adding emerging lifestyle risk behaviors to SNAP behaviors improved the prediction of health outcomes in an Australian population sample aged 45 years and over. They found that adding short sleep duration, but not sitting time, to SNAP behaviors significantly improved the prediction of all health outcomes, including psychological distress. Higher daily sitting time and sleep were assessed by using single item questions regarding the total number of hours spent sitting and sleeping in the last 24 hours. However it is important to confirm these observations, including in populations with more diverse age ranges.

Findings on the association between sitting time and mental health are conflicting: Studies on the association between sitting time alone and mental health has found a significant association (e.g. Teychenne et al., 2015), however Ding et al. (2014) found that adding sitting time to SNAP behaviors did not improve the prediction of

psychological distress. As such there is a need to provide further insight into the combined effects of SNAP and sleep and sitting behaviors on mental health.

The Current Study

The goals of this study were firstly to examine whether engaging in multiple SNAP behaviors was associated with frequent mental distress (FMD) in a sample of Australian adults. Secondly, the goal was to investigate whether emerging lifestyle risk behaviors (high sitting time and frequent insufficient sleep) are independently associated with mental distress levels, when accounting for the influence of SNAP behaviors. The current study contributes to existing research by examining the impact of both SNAP behaviors and new emerging lifestyle behaviors on FMD specifically. Furthermore, it examines the association between emerging lifestyle behaviors on FMD when accounting for SNAP behaviors, to ascertain their independent role in FMD.

The following hypotheses were tested. Firstly, that engagement in a higher number of SNAP behaviors is associated with higher levels of FMD. Secondly, that engagement in increased sitting time is associated with higher levels of FMD, even when accounting for the effects of SNAP behaviors. Thirdly, that engagement in insufficient sleep is associated with higher levels of FMD, even when accounting for the effects of SNAP behaviors. Finally, that high sitting and insufficient sleep are significantly associated with higher levels of FMD, even when accounting for the influence of SNAP behaviors.

Method

Ethics

Ethics approval for this study was obtained from Human Ethics Research Review Panel at Central Queensland (CQ) University (H14/09-203). Verbal consent was obtained from all participants prior to commencing the telephone survey.

Participants and Procedures

The National Social Survey is an annual cost shared telephone survey conducted by the Population Research Laboratory, CQ University, Australia. The National Social Survey collects data on various topics including health, well-being and socio-demographics of participants. This study only reports on variables directly related to the aims of the current study and uses data collected from the 2015 survey, which was conducted between July and August 2015. Data analysis was conducted in April and May 2017. Eligible participants were adults aged 18 years and over who were living in a dwelling that could be contacted by direct dialed landline telephone or direct dialed mobile telephone service.

Landline samples were drawn to cover all Australian states and territories. Mobile telephone numbers were randomly generated and pre-validated. Approximately 48% of the sample was contacted on a mobile phone. Using a computer program, the sample was drawn from the database using simple random selection of telephone numbers. For each selected record, one eligible person was selected.

A total of 1,318 participants completed the 2015 National Social Survey. The response rate was 33%, which is comparable to other recently conducted telephone surveys (Alley Duncan, Schoeppe, Rebar, Vandelanotte, 2017; Curtin, Presser, &

Singer, 2005). The current study is an analysis of 1,201 participants who provided complete data for the survey items relating to lifestyle behaviors, frequent mental distress (FMD) and demographics.

Measures

Demographics. Participants reported their age (years), gender (male or female), height, weight, years of education, employment status, occupational level, and if they lived in a city, town or rural area as an indicator of urbanization. Self-reported height and weight were reported and used to calculate body mass index (BMI). Participants also reported if they had any of the following chronic diseases: Heart disease, high blood pressure, stroke, cancer, depression/anxiety, diabetes type 1, diabetes type 2, arthritis, chronic back/neck pain, asthma, chronic obstructive pulmonary disease (COPD), chronic kidney disease. The total number of chronic diseases reported by participants was used to create a variable indicating the number of chronic diseases a participant had.

Lifestyle Behavior Measures.

Smoking. Smoking status was assessed by using a single item to classify participants as either a smoker or a non-smoker. A smoker was defined as smoking at least one cigarette per day for the last month.

Nutrition. Dietary behaviors were assessed by participants' indication of the number of serves of fruit and vegetables consumed on a daily basis using two items. Based on Australian Dietary Guidelines (Australian Government Department of Health and Aging, 2013), participants were subsequently classified as higher risk dietary behavior if they consumed < 5 serves of vegetables and < 2 serves of fruit daily.

Alcohol consumption. The Alcohol Use Disorders Identification Test (AUDIT-C) was used to assess alcohol consumption. AUDIT-C is a three–item instrument, which assesses the volume and frequency of alcohol consumption (Bush et al., 1998). The AUDIT-C instrument has been reported to have a test-retest reliability of .65, and performs better compared to the entire AUDIT instrument regarding detection of heavy drinking (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). Participants were classified as low risk (≤ 2 alcoholic drinks per day) or high risk (> 2 drinks per day), based on the Australian Guideline to reduce the risk of alcohol-related harm over a lifetime (National Health and Medical Research Council (NHMRC), 2009).

Physical activity. The Active Australia Survey (Australian Institute of Health and Welfare (AIHW), 2003) was used to assess physical activity during the previous seven days. It measures the duration and frequency of walking, moderate intensity exercise and vigorous intensity exercise undertaken for recreational, domestic, occupational, or transport purposes. It has adequate reliability and validity, with a test-retest ICC of .59 and κ = .24 to .47 (Brown, Bauman, Chey, Trost, & Mummery, 2004; Brown, Trost, Bauman, Mummery, & Owen, 2004). Physical activity was calculated by adding the total minutes spent walking, doing moderate and vigorous intensity physical activity during the previous seven days, with vigorous intensity weighted by two. Participants were classified as higher risk physical activity if they reported being physically active for less than 150 minutes per week.

Sitting time. Sitting time during the previous seven days was measured using the two sitting items from the International Physical Activity Questionnaire – Long Form (IPAQ-LF). These items assessed the duration of sitting at work, home, doing course work, non-television based leisure time and time in a motor vehicle on a week

and weekend day. The IPAQ sitting questions have demonstrated good test-retest reliability (r > .6) and validity against accelerometer counts (r = .24 to .43) (Rosenberg, Bull, Marshall, Sallis, & Bauman, 2008). Using established scoring protocols, average daily sitting time was calculated by averaging the time spent sitting on weekdays and weekend days {e.g. [(weekday sitting x 5) + (weekend sitting x 2) / 7]}. Higher sitting time was defined as ≥ 8 hours per day. Evidence suggests that people who sit for 8 hours or more per day have a significantly higher mortality risk (Chau et al., 2013).

Sleep. Frequency of sleep insufficiency was measured using a single question from the Behavioral Risk Surveillance Screening Sleep Module (Centers for Disease Control and Prevention (CDC), 2009). Participants were defined as having frequent insufficient sleep if they responded ≥ 14 days to the following question: "During the past 30 days, for about how many days have you felt you did not get enough rest or sleep?". This question is one of five items in the BRSSSM and is a reliable instrument (Jungquist, C. R. et al. 2016). The remaining four items were not included.

Outcome Measure.

Frequent mental distress (FMD). FMD was measured by using an item from the Centers for Disease Control and Prevention Health-Related Quality of Life (CDC HRQOL) instrument (Centers for Disease Control and Prevention, 2000). It has been shown to be a valid instrument (r = .58) (Newschaffer, 1998). Participants were defined as having FMD if they responded ≥ 14 days to the question "Now thinking about your mental health, which includes stress, depression and problems with emotions, for how many days during the past 30 days was your mental health not good?". The period of 14 days or more to define FMD was selected, because this period is frequently used by researchers and clinicians as an indicator of mental illness

(CDC, 2000). Therefore using the period of 14 days allows interpretation on the effects on mental health.

Statistical Analyses

Data analyses were carried out using the Statistical Package for the Social Sciences, version 23 (IBM SPSS Statistics version 23). A chi-square test of independence was applied to determine whether there was an association between self reported mental health disorders (depression and anxiety) and FMD. To examine the association between lifestyle behaviors and the dependent variable, frequent mental distress, logistic regression analyses were performed. Assumptions of logistic regression were met and multicollinearity between the lifestyle factors were tested. Variables were dichotomized using cut-off points associated with poorer health status, to assist in the interpretability of the results and enable comparison to prior studies (Alley et al., 2017; Ding et al., 2014; Duncan et al., 2014). The number of higher risk SNAP behaviors reported by participants was summed to create a SNAP behavior risk score ranging from zero to four. Four separate logistic regression analyses were performed to test study hypotheses. Socio-demographic variables included in analyses were selected a priori based on evidence regarding their influence on either the outcome or lifestyle behaviors examined. To test hypothesis one, the association between FMD and SNAP behavior risk score was examined when adjusting for socio-demographic characteristics (Model 1). Socio-demographic characteristics included in the analysis were gender, age (continuous), BMI (continuous), occupational category (Professional/White Collar, Blue Collar, Not Employed) and years of education (continuous). To examine hypothesis two, the association between FMD and higher sitting time was examined including all variables included in model 1 (Model 2). To

examine hypothesis three, the association between FMD and frequent insufficient sleep was examined including all variables included in model 1 (Model 3). To examine hypothesis four, the association between FMD, higher sitting time and frequent insufficient sleep was examined including all variables included in model 1 (Model 4). All analyses were conducted using an alpha of .05.

Results

Participant Characteristics

Descriptive statistics are presented in Table 1. Overall, 53.3% of participants were women and 66.7% of participants were aged over 44 years. A total of 62.7% of participants had at least 13 years of education, and 59.8% were employed. The total proportion of participants living in urban and rural areas was 73.9% and 26.1% respectively.

Frequent Mental Distress, Depression and Anxiety

A chi-square test of independence was applied to examine the association between FMD and self-reported depression and anxiety. There was a significant association between FMD and self-reported depression and anxiety, X^2 (1, N = 1,201) = 161.17, $p < .001$. A higher proportion of participants reporting depression and anxiety also reported FMD (34.9%) compared to those not reporting depression and anxiety (5.4%).

Association Between SNAP Behaviors and FMD

The first hypothesis stated that engaging in multiple traditional lifestyle risk behaviors (SNAP behaviors) would increase the likelihood of participants to report

experiencing FMD. To test the association between SNAP behaviors and FMD, a logistic regression analysis was used. In Model 1, the number of SNAP behaviors was entered into the model to examine the association between SNAP behaviors and FMD when adjusted for socio-demographics. The results revealed a positive relationship between the number of higher risk lifestyle behaviors engaged in and FMD (OR = 1.26, 95% CI [1.01, 1.56], p = .039) (Table 2).

Association Between Sitting Time and FMD

The second hypothesis predicted that high sitting time was associated with higher FMD, even when accounting for the influence of SNAP behaviors. To test the hypothesis a logistic regression analysis was conducted. Model 2 included all variables from Model 1, and included sitting time to examine the association between sitting time and FMD after adjusting for socio-demographics and SNAP behaviors. Results revealed a positive relationship between high sitting time and FMD (OR = 1.72, 95% CI [1.10, 2.69], p = .018). In Model 2 the relationship between the number of SNAP behaviors and FMD was non-significant when accounting for high sitting time (OR = 1.23, 95% CI [0.99, 1.53], p = .062) (Table 2).

Association Between Sleep Insufficiency and FMD

The third hypothesis predicted that insufficient sleep was associated with higher FMD, when accounting for the influence of SNAP behaviors. To examine the association between insufficient sleep and FMD, Model 3 included all Model 1 variables, and insufficient sleep after adjusting for socio-demographic variables and SNAP behaviors. Results revealed a positive relationship between insufficient sleep and FMD (OR = 3.36, 95% CI [2.26, 5.01], p < .001). . The relationship between the

number of SNAP behaviors and FMD was not significant when accounting for insufficient sleep (OR = 1.22, 95% CI [0.98, 1.51], p = .082) (Table 2).

Association Between Sitting Time, Sleep Insufficiency and FMD

The fourth hypothesis predicted that high sitting and insufficient sleep are positively associated with FMD, even when adjusting for engagement in SNAP behaviors, high sitting, and sleep insufficiency. Results revealed a positive relationship between high sitting time and FMD (OR = 1.64, 95% CI [1.03, 2.61], p = .036), even when accounting for socio-demographics, SNAP behaviors and sleep insufficiency. In addition there was a positive relationship between insufficient sleep and FMD (OR = 3.32, 95% CI [2.23, 4.95], p < .001). The relationship between SNAP behaviors and FMD was not significant when accounting for emerging lifestyle factors, high sitting time and sleep insufficiency (OR = 1.19, 95% CI [0.96, 1.49], p = .118) (Table 2).

Table 1

Socio-demographics and lifestyle characteristics of participants

Characteristics	N (1,201)	**% of sample**
Age		
18-34 years	226	18.8
35-44 years	173	14.4
45-64 years	476	39.6
≥65 years	326	27.1
Gender		
Female	640	53.3
Male	561	46.7
Education		
≤ 12 years	448	37.3
13-14 years	178	14.8
≥ 15 years	575	47.9
Employment		
Not working	483	40.2
Blue Collar	123	10.2
White Collar / white collar	595	49.5
BMI		
Normal (< 25)	478	39.8
Overweight (25.0-29.9)	437	36.4
Obese (≥ 30)	286	23.8
FMD		
No Frequent Mental Distress (< 14 days)	1074	89.4
Frequent Mental Distress (≥ 14 days)	127	10.6
Smoking		
Smoker	170	85.8
Non-Smoker	1031	14.2
Diet		
Lower Risk Diet	150	12.5
Higher Risk Diet	1051	87.5
Alcohol		
Lower Risk Alcohol Consumption	593	49.4
Higher Risk Alcohol Consumption	608	50.6
Physical Activity		
Lower Risk Physical Activity	608	50.6
Higher Risk Physical Activity	593	49.4
Sitting Time		
Lower sitting time (< 8 hrs / day)	987	82.2
Higher sitting time (≥ 8 hrs / day)	214	17.8
Sleep Sufficiency		
No Frequent Insufficient Sleep(< 14 days)	907	75.5
Frequent Insufficient Sleep (≥ 14 days)	294	24.5

Table 2

Models of correlations of traditional and emerging lifestyle behaviors with frequent mental distress

	Frequent mental distress[a]	
	OR (95 % CI)	*p*
Model 1[b]		
Number of SNAP behaviors	1.26 (1.01-1.56)	.039
Model 2[c]		
Number of SNAP behaviors	1.23 (0.99-1.53)	.062
Sitting Time ≥8hrs / day	1.72 (1.10-2.69)	.018
Model 3[d]		
Number of SNAP behaviors	1.22 (0.98-1.51)	.082
Frequent Insufficient Sleep (≥14 days)	3.36 (2.26-5.01)	< .001
Model 4[e]		
Number of SNAP behaviors	1.19 (0.96-1.49)	.118
Sitting Time ≥8hrs / day	1.64 (1.03-2.61)	.036
Frequent Insufficient Sleep (≥14 days)	3.32 (2.23-4.95)	< .001

Note. [a] FMD is classified as participants who report ≥14 days of mental distress. [b] Model 1 is adjusted for gender, age (continuous), BMI (continuous), occupational category (Professional/White Collar, Blue Collar, Not Employed), years of education (continuous) and includes snap score (range 0-4) as covariates. N = 1,201. [c] Model 2 is adjusted for gender, age (continuous), BMI (continuous), occupational category (Professional/White Collar, Blue Collar, Not Employed), years of education (continuous) and includes snap score (range 0-4) and sitting time. N = 1,201. [d] Model 3 is adjusted for gender, age (continuous), BMI (continuous), occupational category (Professional/White Collar, Blue Collar, Not Employed), years of education (continuous) and includes snap score (range 0-4) and sleep sufficiency. N = 1,201.[e] Model 4 is adjusted for gender, age (continuous), BMI (continuous), occupational category (Professional/White Collar, Blue Collar, Not Employed), years of education

(continuous) and includes snap score (range 0-4), sitting time and sleep sufficiency. N = 1,201.

Discussion

The aim of this study was to examine whether engaging in multiple SNAP behaviors increased the risk of mental distress. It also aimed to examine whether emerging lifestyle risk behaviors, sitting time and sleep, were associated with mental distress levels, even when accounting for the influence of SNAP behaviors.

Firstly, this study hypothesized that the greater number of SNAP behaviors a person engaged in was positively associated with mental distress. That is, mental distress levels increase with each additional behavior a person engages in. The findings of this study were consistent with this hypothesis. The results showed a positive relationship between the number of SNAP behaviors engaged in and frequent mental distress. Few studies have examined the cumulative impact of SNAP behaviors on mental distress. Vermeulen-Smit et al. (2015) reported that participants who engaged in three SNAP behaviors had a 2-fold risk of depression compared to participants who did not engage in SNAP behaviors (Vermeulen-Smit, Ten Have, Van Laar, & De Graaf, 2015). This relationship is consistent with evidence concerning the dose-response relationships between the number of risky SNAP behaviors engaged and poorer physical health status and mortality (Kvaavik et al., 2010; McCullough et al., 2011).

Secondly, this study hypothesized that the emerging lifestyle risk behavior, sitting time, was associated with increased levels of mental distress when accounting for SNAP behaviors. As predicted, a significant positive association was found between both sitting time and mental distress. These findings are consistent with a review by Teychenne et al. (2010), which suggested a positive association between

sedentary behavior and increased risk of depression in adults (Teychenne, Ball, & Salmon, 2010). The observation in the current study that higher sitting time was positively associated with FMD is consistent with the results reported by Asztalos et al. (2015), who observed that sitting time was positively associated with psychological distress in a sample of Belgian adults (Asztalos, Cardon, De Boudeaudhuij, & De Cocker, 2015). Demographics, physical activity and sleeping problems were controlled for in their study, however they did not account for other SNAP behaviors of smoking, nutrition and alcohol consumption. However, Ding et al. (2014) found that adding sitting time as a lifestyle risk factor to SNAP behaviors did not improve the prediction of health outcomes, including psychological distress. They suggested that future research on the association between sitting and health outcomes should include measures across different domains of sedentary behaviors, such as non-occupational sitting, TV viewing and Internet use. Whilst the current study did not examine different domains of sedentary behaviors, results showed that sitting time was associated with FMD when adjusting for SNAP behaviors. These different results may be explained by the use of different measures of lifestyle behaviors as Ding et al. (2014) used a single item to assess total sitting time and the current study used two items to assess sitting time in multiple domains on week and weekend days. Furthermore, it may be due to different population groups. This suggests the need for future studies to examine the association between sedentary behavior and mental distress.

Thirdly, it was hypothesized that insufficient sleep was positively associated with mental distress, when accounting for SNAP behaviors. The results of this study supported this prediction: The strongest association in this study was found between insufficient sleep and mental distress. This result supports previous research by Strine

& Chapman (2005), who found that people with frequent sleep insufficiency were significantly more likely than people without frequent sleep insufficiency to report FMD (24.7% vs 5.7%). Indeed research suggests that a causal link between sleep insufficiency and FMD is biologically plausible. Research examining the biological implications of sleep insufficiency suggests that sleep has effects on a number of dysregulated pathways implicated in depression, including inflammation, neurotransmitter processes, disturbances to the hypothalamic-pituitary-adrenal axis (HPA) axis and oxidative stress (Lopresti, Hood, & Drummond, 2013). The findings in this study were partially consistent with the findings of Ding et al. (2014).They found that including sleep duration as a lifestyle risk factor in addition to traditional lifestyle factors significantly improved the prediction of psychological distress. However, in their study adding sitting time as a lifestyle risk factor did not improve the prediction of health outcomes. Moreover, combining both sitting and sleep with traditional risk factors did not improve the prediction of health outcomes in their study.

Collectively, these studies have demonstrated that sleep duration and sleep insufficiency are associated with mental distress. Sleep duration, sleep quality and sleep sufficiency are all components of sleep health (Buysse, 2014). In future, it may be important to consider the multicomponent nature of sleep (e.g. duration, quality, timing, variability, daytime fatigue) when examining its effect on health, rather than examining individual components of sleep health.

Finally, this study hypothesized that both sitting time and sleep were significantly associated with mental distress, even when accounting for all other variables. Results supported this hypothesis, as a significant association was found between sitting time and mental distress, and between sleep and mental distress.

A surprising finding was that the association between traditional SNAP behaviors and mental distress was no longer significant when the influence of emerging lifestyle risk behaviors was accounted for. Results showed that the association between SNAP behaviors and mental distress was no longer significant when accounting for either sitting time, sleep, or both sitting time and sleep. This finding suggests the importance of emerging lifestyle risk behaviors on mental health, as the association between sitting time and insufficient sleep on FMD was greater than the other SNAP behaviors. However the design of this study does not allow causation to be determined. Sitting time and insufficient sleep may influence FMD more than SNAP behaviors, or FMD influences sitting time and insufficient sleep. This finding does not discount decades of research supporting the adverse impact of SNAP behaviors on health (e.g., Ford et al., 2012), but rather suggest the importance of including emerging lifestyle behaviors in public health strategies or considering them as clinical indicators of FMD. Lifestyle behaviors change over time, therefore a holistic approach to public health that targets both traditional and emerging lifestyle factors is needed.

Strengths of the Study

To date literature on the effects of SNAP behaviors and emerging lifestyle behaviors sitting time and insufficient sleep on mental distress is sparse. This study is one of few to examine the association of traditional and emerging lifestyle behaviors with mental distress. Secondly, this study was randomly selected from all States and Territories of Australia.

Limitations of the Study

This study has several limitations. The main limitation is that it is not possible to infer a causal relationship between lifestyle behaviors and FDM, due to the cross-sectional design of this study. In this study the most significant association was found for sleep insufficiency and FMD. There are many potential biological pathways linking poor sleep health and sleep disorders to mental health conditions (Lopresti et al., 2013) and sleep disturbance is one of the diagnostic criteria for depressive and anxiety related disorders (American Psychiatric Association [APA], 2013). Although the relationship between sleep and mental health remains inconclusive (Alvaro, Roberts, & Harris, 2013), the current study sought to account for this by statistically adjusting for the self-reported presence of anxiety or depression in all analyses.

A second limitation of this study is the use of self-report measures, which are subject to biases. Research suggests that participants may be more likely to overestimate desirable behaviors and underestimate undesirable behaviors (van de Mortel, 2008).

Third, the majority of the sample was aged 45 years or above (66.7%) and more than 40% of participants were not working. Although the current study accounted for these demographic factors, further research is encouraged to examine the role of multiple lifestyle behaviors on mental distress in broader population groups.

Clinical Implications

As causality could not be ascertained in the current study, several clinical implications are possible. Firstly, if FMD influences emerging lifestyle risk behaviors, sitting time and sleep may be important clinical indicators of mental health. Secondly,

if emerging lifestyle risk factors influence FMD, the findings in this study could highlight the importance of including emerging lifestyle behaviors in preventive interventions for mental health. Australian health guidelines already include sitting time as a component of physical activity guidelines. Early intervention in sleep and the promotion of sleep hygiene as a public health strategy could be helpful in reducing the public health burden of poor sleep health (Irish, Kline, Gunn, Buysse, & Hall, 2015; Hillman & Lack, 2013). Some countries have already begun to integrate sleep into public health activity guidelines. For example, New Zealand recently integrated sleep in their physical activity guidelines to improve mental and physical health for children/youth (New Zealand Government Ministry of Health, 2017). Furthermore, Canada released 24 Hour Movement Guidelines for Children and Youth, which integrate sleep, moderate and vigorous physical activity and sitting time into a holistic guideline for movement behavior (Tremblay et al., 2016).

Further Research

To ascertain causality of lifestyle risk behaviors on mental health outcomes, further research is required. A prospective longitudinal cohort study is needed to ascertain whether engaging in lifestyle risk behaviors adversely impacts mental health outcomes.

Future research should include more specific measures. For example, mental health could be assessed with a more detailed measure of psychological distress, such as the K-10 (Kessler et al., 2002). Furthermore examining sitting time across different domains of sitting would advance understanding of this complex lifestyle risk behavior. Physical activity and diet could assess other components, such as strength training and High Intensity Interval Training (HIIT), and fast food and soft drink

consumption. Finally, future research investigating the effects of sleep on mental distress should measure multiple components of sleep rather than examining individual components of sleep health.

Conclusions

Emerging lifestyle risk behaviors were strongly associated with FMD. The strongest association was found for frequent insufficient sleep. People who engage in high sitting time and who have frequent insufficient sleep are more likely to report FMD, even when accounting for engagement in other traditional lifestyle risk behaviors and socio-demographics. Prospective longitudinal research is needed to confirm a causal link between lifestyle risk behaviors and mental distress and health issues.

Funding Acknowledgments: MJD is supported by a Future Leader Fellowship (ID 100029) from the National Heart Foundation of Australia.

References

Alley, S. J., Duncan, M. J., Schoeppe, S., Rebar, A. L., & Vandelanotte, C. (2017). 8-year trends in physical activity, nutrition, TV viewing time, smoking, alcohol and BMI: A comparison of younger and older Queensland adults. *Public Library of Science One, 12*(3), e0172510. doi:10.1371/journal.pone.0172510

Alvaro, P. K., Roberts, R. M., & Harris, J. K. (2013). A systematic review assessing bidirectionality between sleep disturbances, anxiety and depression. *Sleep, 36*(7), 1059-1068. doi:0.5665/sleep.2810

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Washington, DC.

Asztalos, M., Cardon, G., De Bourdeaudhuij, I., & De Cocker, K. (2015). Cross-Sectional Associations Between Sitting Time and Several Aspects of Mental Health in Belgian Adults. *Journal of Physical Activity and Health, 12*(8), 1112-1118. doi:10.1123/jpah.2013-0513

Australian Bureau of Statistics. (2015). National Health Survey: First Results, 2014-15. *4364.0.55.001*.

Australian Government Department of Health and Aging. (2013). *Eat for Health: Australian Dietary Guidelines*. Canberra, Australia.

Australian Institute of Health and Welfare (AIHW). (2003). *The Active Australia Survey: A guide and manula for implementation, analysis and reporting* (C. AIHW Ed.).

Bartlem, K. M., Bowman, J. A., Bailey, J. M., Freund, M., Wye, P. M., Lecathelinais, … Wiggers, J. H. (2015). Chronic disease health risk behaviours amongst people with a mental illness. *Australian and New Zealand Journal of Psychiatry, 49*(8), 731-741. doi:10.1177/0004867415569798

Beitman, B.D., Basha, I., & Flaker, G. (1987). Atypical or nonanginal chest pain. Panic disorder or coronary artery disease? *Archives of Internal Medicine, 147.* 1548-1552.

Brown, W. J., Bauman, A., Chey, T., Trost, S., & Mummery, K. (2004). Method: Comparison of surveys used to measure physical activity. *Austrailan and New Zealand Journal of Public Health, 28*(2), 128-134. doi:10.1111/j.1467-842X.2004.tb00925.x

Brown, W. J., Trost, S., Bauman, A., Mummery, K., & Owen, N. (2004). Test-retest reliablity of four physical activity measures used in population surveys. *Journal of Science and Medicine in Sport, 7*(2), 205-215. doi:10.1016/S1440-2440(04)80010-0

Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., & Bradley, K. A. (1998). The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. *Archives of Internal Medicine, 158*(16), 1789-1795. doi:10.1001/archinte.158.16.1789

Buttery, A. K., Mensink, G. B., & Busch, M. A. (2015). Healthy behaviours and mental health: findings from the German Health Update (GEDA). *European Journal of Public Health, 25*(2), 219-225. doi:10.1093/eurpub/cku094

Buysse, D. J. (2014). Sleep health: can we define it? Does it matter? *Sleep, 37*(1), 9-17. doi:10.5665/sleep.3298

Centers for Disease Control and Prevention (CDC). (2009). *Behavioral Risk Factor Surveillance System* (A. Centers for Disease Control and Prevention, GA Ed.): US Department of Health and Human Services.

Centers for Disease Control and Prevention. (2000). *Measuring healthy days: Population assessment of health-related quality of life* (A. Centers for Disease Control and Prevention, Georgia 2000 Ed.).

Chau, J. Y., Grunseit, A. C., Chey, T., Stamatakis, E., Brown, W. J., Matthews, C. E., … van der Ploeg, H. P. (2013). Daily sitting time and all-cause mortality: a meta-analysis. *Public Library of Science One, 8*(11), e80000. doi:10.1371/journal.pone.0080000

Cunningham, T. J., Wheaton, A. G., & Giles, W. H. (2015). The association between psychological distress and self-reported sleep duration in a population-based sample of women and men. *Sleep Disorders, 2015*, 172064. doi:10.1155/2015/172064

Curtin, R., Presser, S., & Singer, E. (2005). Changes in telephone survey nonresponse over the past quarter century. *Public Opinion Quarterly, 69*(1), 87-98. doi:10.1093/poq/nfi002

Ding, D., Rogers, K., Macniven, R., Kamalesh, V., Kritharides, L., Chalmers, J., & Bauman, A. (2014). Revisiting lifestyle risk index assessment in a large Australian sample: should sedentary behavior and sleep be included as additional risk factors? *Preventive Medicine, 60*, 102-106. doi:10.1016/j.ypmed.2013.12.021

Ding, D., Rogers, K., van der Ploeg, H., Stamatakis, E., & Bauman, A. E. (2015). Traditional and Emerging Lifestyle Risk Behaviors and All-Cause Mortality in Middle-Aged and Older Adults: Evidence from a Large Population-Based Australian Cohort. *Public Library of Science Medicine, 12*(12), e1001917. doi:10.1371/journal.pmed.1001917

Drapeau, A., Marchand, A., & Beaulieu-Prévost, D. (2012). Epidemiology of Psychological DistressMental Illness - Understanding Prediction and Control: Prof. Luciano LAbate. Retrieved from http://www.intechopen.com/books/mental-illnesses-understanding-prediction-and- control/epidemiology-of-psychological-distress

Duncan, M. J., Kline, C. E., Vandelanotte, C., Sargent, C., Rogers, N. L., & Di Milia, L. (2014). Cross-sectional associations between multiple lifestyle behaviors and health-related quality of life in the 10,000 Steps cohort. *Public Library of Science One, 9*(4), e94184. doi:10.1371/journal.pone.0094184

Ford, E. S., Bergmann, M. M., Boeing, H., Li, C., & Capewell, S. (2012). Healthy lifestyle behaviors and all-cause mortality among adults in the United States. *Preventive Medicine, 55*, 23-27. doi:0.1016/j.ypmed.2012.04.016

Fox, K. R. (1999). The influence of physical activity on mental well-being. *Public Health Nutrition, 2*(3a), 411-418. doi:https://doi.org/10.1017/S1368980099000567

Hillman, D. R., & Lack, L. C. (2013). Public health implications of sleep loss: the community burden. *Medical Journal of Australia, 199*(8), 7-10. doi:10.5694/mja13.10620

Irish, L. A., Kline, C. E., Gunn, H. E., Buysse, D. J., & Hall, M. H. (2015). The role of sleep hygiene in promoting public health: A review of empirical evidence. *Sleep Medicine Review, 22*, 23-36. doi:10.1016/j.smrv.2014.10.001

Jungquist, C. R., Mund, J., Aquilina, A. T., Klingman, K., Pender, J., Ochs-Balcom, H., van Wijngaarden, E., & Dickerson, S. S. (2016). Validation of the Behavioral Risk Factor Surveillance System Sleep Questions. *Journal of Clinical Sleep Medicine, 12*(3), 301-310. doi:0.5664/jcsm.5570

Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S.-L., T., … Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine, 32*, 959-976. doi:10.1017/S003329170200607

Kingsbury, M., Dupuis, G., Jacka, F., Roy-Gagnon, M. H., McMartin, S. E., & Colman, I. (2016). Associations between fruit and vegetable consumption and depressive symptoms: evidence from a national Canadian longitudinal survey. *Journal of Epidemiology and Community Health, 70*(2), 155-161. doi:10.1136/jech-2015-205858

Krokstad, S., Ding, D., Grunseit, A. C., Sund, E. R., Holmen, T. L., Rangul, V., & Bauman, A. (2017). Multiple lifestyle behaviours and mortality, findings from a large population-based Norwegian cohort study - The HUNT Study. *BMC Public Health, 17*(1), 58. doi:10.1186/s12889-016-3993-x

Kvaavik, E., Batty, D., Ursin, G., Huxley, R., & Gale, C. R. (2010). Influence of individual and combined health behaviors on total and cause-specific mortality in men and women. *Archives of Internal Medicine, 170*(8), 711-718. doi:https://dx-doi-org.ezproxy.newcastle.edu.au/10.1001/archinternmed.2010.76

Lawrence, D., Mitrou, F., & Zubrick, S. R. (2009). Smoking and mental illness: results from population surveys in Australia and the United States. *BMC Public Health, 9*, 285. doi:10.1186/1471-2458-9-285

Liu, Y., Croft, J. B., Wheaton, A. G., Perry, G. S., Chapman, D. P., Strine, T. W., … Presley-Cantrell, L. (2013). Association between perceived insufficient sleep, frequent mental distress, obesity and chronic diseases among US adults, 2009

behavioural risk factor surveillance system. *BMC Public Health, 13:84*. doi:10.1186/1471-2458-13-84

Loef, M., & Walach, H. (2012). The combined effects of healthy lifestyle behaviors on all cause mortality: a systematic review and meta-analysis. *Preventive Medicine, 55*(3), 163-170. doi:10.1016/j.ypmed.2012.06.017

Lopresti, A. L., Hood, S. D., & Drummond, P. D. (2013). A review of lifestyle factors that contribute to important pathways associated with major depression: diet, sleep and exercise. *Journal of Affective Disorders, 148*(1), 12-27. doi:10.1016/j.jad.2013.01.014

Makela, P., Raitasalo, K., & Wahlbeck, K. (2015). Mental health and alcohol use: a cross-sectional study of the Finnish general population. *European Journal of Public Health, 25*(2), 225-231. doi:10.1093/eurpub/cku133

Martínez-Gómez, D., Guallar-Castillón, P., León-Muñoz, L. M., López-García, E., & Rodríguez-Artalejo, F. (2013). Combined impact of traditional and non-traditional health behaviors on mortality: a national prospective cohort study in Spanish older adults. *BMC Medicine, 11*, 47. doi:http://www.biomedcentral.com/1741-7015/11/47

McCullough, M. L., Patel, A. V., Kushi, L. H., Patel, R., Willett, W. C., Doyle, C., … & Gapstur, S. M. (2011). Following cancer prevention guidelines reduces risk of cancer, cardiovascular disease, and all-cause mortality. *Cancer, Epidemiology, Biomarkers & Prevention, 20*(6), 1089-1097. doi:10.1158/1055-9965.EPI-10-1173

National Health and Medical Research Council. (2009). Australian Guidelines to Reduce Health Risks from Drinking Alcohol.

doi:https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/ds10-alcohol.pdf

Newschaffer C. J. (1998). *Validation of BRFSS HRQOL measures in a statewide sample.* Atlanta, Georgia: US Department of Health and Human Services, CDC, National Center for Chronic Disease Prevention and Health Promotion.

New Zealand Government (2017). *Sit less, move more, sleep well. Physical Activity guidelines for children and young people.* doi: http://www.health.govt.nz/system/files/documents/pages/physical-activity-guidelines-for-children-and-young-people-may17.pdf

Ohayon, M. M., Reynolds, C. F., & Dauviliers, Y. (2013). Excessive sleep duration and quality of life. *Annals of Neurology, 73*(6), 785-794. doi:10.1002/ana.23818

Poortinga, W. (2007). The prevalence and clustering of four major lifestyle risk factors in an English adult population. *Preventive Medicine, 44*(2), 124-128. doi:10.1016/j.ypmed.2006.10.006

Prochaska, J., J., Spring, B., & Nigg, C. R. (2008). Multiple health behavior change research: an introduction and overview. *Preventive Medicine, 46*(3), 181-188. doi:10.1016/j.ypmed.2008.02.001

Rayward, A. T., Duncan, M. J., Brown, W. J., Plotnikoff, R. C., & Burton, N. W. (2017). A cross-sectional cluster analysis of the combined association of physical activity and sleep with sociodemographic and health characteristics in mid-aged and older adults. *Maturitas, 102,* 56-61. doi: http://dx.doi.org/10.1016/j.maturitas.2017.05.013

Rosenberg, D. E., Bull, F. C., Marshall, A. L., Sallis, J. F., & Bauman, A. E. (2008). Assessment of sedentary behavior with the International Physical Activity

QUestionnaire. *Journal of Physical Activity and Health, 5*(Suppl 1), S30-S44. doi:PMID: 18364524

Saneei, P., Esmaillzadeh, A., Keshteli, A. H., Reza Roohafza, H., Afshar, H., Feizi, A., & Adibi, P. (2016). Combined Healthy Lifestyle Is Inversely Associated with Psychological Disorders among Adults. *Public Llbrary of Science One, 11*(1), e0146888. doi:10.1371/journal.pone.0146888

Schuit, A. J., van Loon, A. J. M., Tijhuis, M., & Ocke, M. C. (2002). Clustering of Lifestyle Risk Factors in a General Adult Population. *Preventive Medicine, 35*(3), 219-224. doi:10.1006/pmed.2002.1064

Seun-Fadipe, C. T., & Mosaku, K. S. (2017). Sleep quality and psychological distress among undergraduate students of a Nigerian university. *Sleep Health, 3*(3), 190-194. doi:0.1016/j.sleh.2017.02.004

Sloan, R. A., Sawada, S. S., Girdano, D., Liu, Y. T., Biddle, S. J. H., & Blair, S. N. (2013). Associations of sedentary behavior and physical activity with psychological distress: a cross-sectional study from Singapore. *BMC Public Health, 13*, 885. doi:http://www.biomedcentral.com/1471-2458/13/885

Spring, B., Moller, A. C., & Coons, M. J. (2012). Multiple health behaviours: overview and implications. *Journal of Public Health (Oxford), 34 Supplement 1*, i3-i10. doi:10.1093/pubmed/fdr111

St-Onge, M. P., Grandner, M. A., Brown, D., Conroy, M. B., Jean-Louis, G., Coons, M., Bhatt, D. L., American Heart Association Obesity, Behavior Change, Diabetes, and Nutrition Committees of the Council on Lifestyle and Cardiometabolic Health, Council on Cardiovascular Disease in the Young, Council on Clinical Cardiology, & Stroke Council (2016). Sleep Duration and Quality: Impact on Lifestyle Behaviors and Cardiometabolic Health: A

Scientific Statement From the American Heart Association. *Circulation, 134*(18), e367-e386. doi:10.1161/CIR.0000000000000444

Strine, T. W., Balluz, L., Chapman, D. P., Moriarty, D. G., Owens, M., & Mokdad, A. H. (2004). Risk behaviors and healthcare coverage among adults by frequent mental distress status, 2001. *American Journal of Preventive Medicine, 26*(3), 213-216. doi:10.1016/j.amepre.2003.11.002

Strine, T. W., & Chapman, D. P. (2005). Associations of frequent sleep insufficiency with health-related quality of life and health behaviors. *Sleep Medicine, 6*(1), 23-27. doi:10.1016/j.sleep.2004.06.003

Teychenne, M., Ball, K., & Salmon, J. (2010). Sedentary behavior and depression among adults: a review. *International Journal of Behavioral Medicine, 17*(4), 246-254. doi:10.1007/s12529-010-9075-z

Teychenne, M., Costigan, S. A., & Parker, K. (2015). The association between sedentary behaviour and risk of anxiety: a systematic review. *BMC Public Health, 15*, 513. doi:10.1186/s12889-015-1843-x

Tobias, M., Jackson, G., Yeh, L.-C., & Huang, K. (2007). Do healthy and unhealthy behaviours cluster in New Zealand? *Australian and New Zealand Journal of Public Health, 31*(2), 155-163. doi:10.1111/j.1753-6405.2007.00034.x

Tremblay, M. S., Carson, V., Chaput, J. P., Connor Gorber, S., Dinh, T., Duggan, M., … Zehr, L. (2016). Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep. *Appl Physiol Nutr Metab, 41*(6 Suppl 3), S311-327. doi:10.1139/apnm-2016-0151

van de Mortel, T. F. (2008). Faking it: social desirability response bias in self-report research. *Australian Journal of Advanced Nursing, 25*(4), 40-48. doi:http://www.ajan.com.au/ajan_25.4.html

Vermeulen-Smit, E., Ten Have, M., Van Laar, M., & De Graaf, R. (2015). Clustering of health risk behaviours and the relationship with mental disorders. *Journal of Affective Disorders, 171*, 111-119. doi:10.1016/j.jad.2014.09.031

Appendix A

Human Research Ethics Approval

Office of Research

CQUniversity AUSTRALIA

Secretary, Human Research Ethics Committee
Ph: 07 4923 2603
Fax: 07 4923 2600
Email: ethics@cqu.edu.au

A/Prof Matthew Rockloff and
Ms Christine Hanley
School of Human Health and Social sciences
Bundaberg Campus

1 October 2014

Dear A/Prof Rockloff and Ms Hanley

HUMAN RESEARCH ETHICS COMMITTEE ETHICAL APPROVAL PROJECT: H14/09-203 *2014 NATIONAL SOCIAL SURVEY (NSS-2014)*

The Human Research Ethics Committee is an approved institutional ethics committee constituted in accord with guidelines formulated by the National Health and Medical Research Council (NHMRC) and governed by policies and procedures consistent with principles as contained in publications such as the joint Universities Australia and NHMRC *Australian Code for the Responsible Conduct of Research.* This is available at http://www.nhmrc.gov.au/publications/synopses/_files/r39.pdf.

On 30 September 2014, the Chair of the Human Research Ethics Committee considered your application under the Low Risk Review Process. This letter confirms that your project has been granted approval under this process, pending ratification by the full committee at its October 2014 meeting.

Please note that this approval is conditional upon forwarding the final survey for each year it is implemented to the secretary before it is distributed.

The period of ethics approval will be from 30 September July 2014 to 31 December 2016. The approval number is H14/09-203; please quote this number in all dealings with the Committee. HREC wishes you well with the undertaking of the project and looks forward to receiving the final report.

The standard conditions of approval for this research project are that:

(a) you conduct the research project strictly in accordance with the proposal submitted and granted ethics approval, including any amendments required to be made to the proposal by the Human Research Ethics Committee;

(b) you advise the Human Research Ethics Committee (email ethics@cqu.edu.au) immediately if any complaints are made, or expressions of concern are raised, or any other issue in relation to the project which may warrant review of ethics approval of the project. *(A written report detailing the adverse occurrence or unforeseen event must be submitted to the Committee Chair within one working day after the event.)*

(c) you make submission to the Human Research Ethics Committee for approval of any proposed variations or modifications to the approved project before making any such changes;

(d) you provide the Human Research Ethics Committee with a written "Annual Report" on each anniversary date of approval (for projects of greater than 12 months) and "Final Report" by no later than one (1) month after the approval expiry date; *(A copy of the reporting pro formas may be obtained from the Human Research Ethics Committee Secretary, Sue Evans please contact at the telephone or email given on the first page.)*

(e) you accept that the Human Research Ethics Committee reserves the right to conduct scheduled or random inspections to confirm that the project is being conducted in accordance to its approval. Inspections may include asking questions of the research team, inspecting all consent documents and records and being guided through any physical experiments associated with the project

(f) if the research project is discontinued, you advise the Committee in writing within five (5) working days of the discontinuation;

(g) A copy of the Statement of Findings is provided to the Human Research Ethics Committee when it is forwarded to participants.

Please note that failure to comply with the conditions of approval and the *National Statement on Ethical Conduct in Human Research* may result in withdrawal of approval for the project.

You are required to advise the Secretary in writing within five (5) working days if this project does not proceed for any reason. In the event that you require an extension of ethics approval for this project, please make written application in advance of the end-date of this approval. The research cannot continue beyond the end date of approval unless the Committee has granted an extension of ethics approval. Extensions of approval cannot be granted retrospectively. Should you need an extension but not apply for this before the end-date of the approval then a full new application for approval must be submitted to the Secretary for the Committee to consider.

The Human Research Ethics Committee wishes to support researchers in achieving positive research outcomes. If you have issues where the Human Research Ethics Committee may be of assistance or have any queries in relation to this approval please do not hesitate to contact the Secretary, Sue Evans or myself.

Yours sincerely,

Dr Tania Signal
Chair, Human Research Ethics Committee

Cc: Project file

Approved

Appendix B

National Social Survey 2015 Lifestyle Behaviour Questions Used in Current Study

Q: QHD3

Now, thinking about your mental health, which includes stress, depression and problems with emotions, for how many days during the past 30 days was your mental health NOT good?

Q: QSLEEP

During the past 30 days, for about how many days have you felt you did not get enough rest or sleep?

Q: QILL1

Have you ever been told by a doctor that you have any chronic health problems, including the following:

a) Heart disease

b) High blood pressure

c) Stroke

d) Cancer

e) Depression/Anxiety

f) Diabetes Type 1

g) Diabetes Type 2

h) Arthritis

i) Chronic back/neck pain

j) Asthma

k) COPD (airways disease, emphysema)

l) Chronic kidney/renal disease

m) None of the above

Q: QVEG1

Ok now we will ask you about some of your current health behaviours.

How many serves of vegetables do you eat on a usual day? One serve of vegetables is equivalent to half a cup of cooked vegetables or one cup of salad vegetables.

Q: QFRU1

How many serves of fruit do you eat on a usual day? One serve of fruit is equivalent to one medium piece or two small pieces of fruit.

Q: QCORE11

The following questions ask about smoking and alcohol consumption.

Are you presently a smoker? (a person who smoked at least one cigarette per day for the past month)

ALCOHOL CONSUMPTION (AUDIT-C): PRL CORE QUESTIONS

Q: Qalc1

In the past year, how often did you have a drink containing alcohol?

(E.g. A can or bottle of beer, a glass of wine, wine cooler, or one cocktail or a shot of hard liquor (scotch, gin, vodka).

1. Never

2. Monthly or less

3. 2-4 times a month

4. 2-3 times a week

5. 4-5 times a week

6. 6 or more times a week

7. Don't know/Unsure

8. No response

Q: Qalc2

How many drinks containing alcohol did you have on a typical day when you were drinking?

1. 1 to 2

2. 3 to 4

3. 5 to 6

4. 7 to 9

5. 10 or more

6. Don't know/Unsure

7. No response

Q: Qalc3

Considering all types of alcoholic beverages, how often did you have 6 or more drinks on one occasion in the past year?

1. Never

2. Less than monthly

3. Monthly

4. Weekly

5. Daily or almost daily

6. Don't know/Unsure

7. No response

PHYSICAL ACTIVITY (AAQ): PRL CORE QUESTIONS

Q: QAAQ1

The following questions are about any physical activities that you may have done in THE LAST WEEK.

In the LAST WEEK (emphasize time period), how many times have you WALKED continuously for at least 10 minutes, for recreation, exercise or to get to or from places?

Q: QAAQ2

We would like to know, in hours and minutes, how much time you would estimate that you spent walking in this way in the LAST WEEK?

Q: QAAQ3

In the last week, how many times did you do any VIGOROUS gardening or heavy work around the yard, which made you breathe harder or puff and pant?

Q: QAAQ4

In hours and/or minutes, what do you estimate was the total time that you spent doing VIGOROUS gardening or heavy work around the yard in the last week?

Q: QAAQ5

The next questions exclude household chores, gardening or yard work.

In the LAST WEEK, how many times did you do any VIGOROUS physical activity that made you breathe harder or puff and pant? For example, jogging, cycling, aerobics, competitive tennis.

Q: QAAQ6

In hours and/or minutes, what do you estimate was the total time that you spent doing this VIGOROUS physical activity in the last week?

Q: QAAQ7

In the last week, how many times did you do any other more MODERATE physical activities that you have not already mentioned? For example, gentle swimming, social tennis, golf, etc.

Q: QAAQ8

In hours and/or minutes, what do you estimate was the total time that you spent doing these activities in the last week?

Sititing time

Q: QIPAQ8

Now we'd like you to think about how you travelled from place to place, including to places like work, stores, movies, and so on.

During the last 7 days, on how many days did you travel in a motot vehicle like train, bus, car or tram?

Q: QIPAQ9

How much time did you usually spend on one of those days travelling in a motor vehicle?

Q: QIPAQ26

Now we would like you to think about the other time that you spent sitting during the last 7 days. Include time at work, at home, while doing course work and leisure time. This may include time spent sitting at a desk, visiting friends reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

During the last 7 days, how much time did you usually spend sitting on a WEEK DAY?

Q: QIPAQ27

During the last 7 days, how much time did you usually spend sitting on a WEEKEND DAY?

Appendix C

National Social Survey 2015 Demographic Questions

Q: Qgender
Record respondent's gender (ask only if necessary)

Q: Qage
What is your current age?

Q: Qdem2
How tall are you in centimetres?

Q: Qdem3
What is your weight in kilograms?

Q: Qdem19
In total how many years of schooling do you have?
This includes the total of primary, secondary, technical or tertiary.

Q: Qdem20
Last week, did you have a paid job of any kind (including self-employed)?

Q: Qdem23
Please indicate the level at which you work
1 Manager & administrator
2 Professional
3 Associate/para professional
4 Tradesperson
5 Clerk
6 Salespersons & personal service worker
7 Plant & machine operators, & driver
8 Advanced clerical & service worker
9 Intermediate clerical & service worker
10 Intermediate production & transport worker
11 Elementary clerical, sales & service worker
12 Labourer & related worker
13 Don't know
14 No response
15 Other

Q: Qdem37
Finally, do you presently live in a city, town, or rural area?

Appendix D

Instructions for Authors for Health Psychology®

Prior to submission, please carefully read and follow the submission guidelines detailed below. Manuscripts that do not conform to the submission guidelines may be returned without review.

Submission

The main emphasis of *Health Psychology*® is on original research in health psychology. Systematic reviews (including meta-analyses) and narrative reviews are also considered for publication. Editorials, commentaries, scientific statements, and tutorials are by invitation only. Submissions are welcomed from authors in psychology and other health-related disciplines.

Submit manuscripts electronically (.rtf, PDF, or .doc) to

Kenneth E. Freedland, PhD, Editor-in-Chief
Professor of Psychiatry and Psychology
Washington University School of Medicine
St. Louis, Missouri, USA
Email

Keep a copy of the manuscript to guard against loss. Do not submit manuscripts via mail or email.

In recognition of the reality that institutional spam filters may capture files from the APA and the Journals Back Office, please take the following steps to facilitate communication with our editorial office:

- Provide an alternative email address which we can use to contact you in the event of technical difficulties with email communication using your primary address;
- Add "apa.org" to your list of "safe" addresses and consider asking your IT administrators to add it to their "white list;" and
- Contact Lindsay MacMurray if you do not receive confirmation of your submission within three business days or an editorial decision letter within three months.

General correspondence may be directed to the Editor's Office.

Information About Submissions

The page limit for research manuscripts, reviews, and meta-analyses is 30 pages. The page limit is inclusive of **all** parts of the manuscript, including the cover page, abstract, text, references, tables and figures.

Authors may request consideration of longer papers, in advance of submission, when there is clear justification for additional length (e.g., the paper reports on two or more studies or has an unusual or complex methodology). If possible, excess material should be placed in an online supplement rather than in the manuscript.

Brief reports are acceptable for innovative work that may be premature for publication as a full research report because of small sample size, novel methodologies, etc. Brief reports should be designated as such and should not exceed a total of 12 pages, inclusive of **all** parts of the manuscript, including the cover page, abstract, text, references, tables and figures.

All manuscripts should be double-spaced, with margins of at least 1 inch on all sides and a standard font (e.g., Times New Roman) of 12 points.

On the submission portal you will be asked to provide contact information for three individuals who are qualified to serve as unbiased reviewers for your paper. These people must have published peer reviewed work in a relevant field. They must be without any real or perceived conflict of interest with you and your co-authors. They cannot be at the same institution as any author, cannot be a co-author on any recent publications, and must not be a former or current trainee, advisor or mentor, etc.

Submissions that exceed the page limits will be returned to the author for shortening prior to the initiation of peer review.

Submission Letter

The cover letter should indicate that the authors have read and followed the *Health Psychology* Instructions for Authors. It should also include a statement indicating that the paper has been seen and approved by all authors. The cover letter should describe how the paper advances research in health psychology, referring to the journal mission to assure that the submission fits with the scope of papers published in *Health Psychology*.

The full mailing address, telephone, fax, and email address for the corresponding author should be included in the cover letter and title page, along with the names and affiliations of all co-authors.

The cover letter must confirm that the manuscript has not been published, is not currently submitted elsewhere, and that it does not contain data that is currently submitted or published elsewhere.

When a manuscript contains data that is part of a larger study, authors should describe the larger study and provide references for other study papers. Authors must be prepared to provide copies of related manuscripts when requested as part of the editorial review process. Authors should clarify the relationship between their paper, including detailed specification of the overlap in participants, measures, and analysis, and others from the study. The value-added scientific contribution of their study must be clearly stated in the cover letter.

Authors of brief reports should indicate in the cover letter that the full report is not under consideration for publication elsewhere and similarly address potential overlap with other papers.

Manuscripts

The manuscript title should be accurate, fully explanatory, and no longer than 12 words. The title should reflect the content and population studied, and it should not be in the form of an assertion or conclusion. If the paper reports a randomized clinical trial, this should be indicated in the title. The title of brief reports should start with the words "Brief Report". The title page should include the names of all authors and their affiliations at the time the research was done.

All research manuscripts must include a structured abstract containing a maximum of 250 words with the following sections:

- Objective (brief statement of the purpose of the study);
- Methods (summary of the participants, design, measures, procedure);
- Results (primary findings); and
- Conclusions (specific statement of the implications of the data).

Papers such as invited commentaries, for which a structured abstract would be inappropriate, should include an unstructured abstract containing a maximum of 250 words.

Please supply up to five keywords or brief phrases after the abstract. We recommend that you choose medical subject headings (MeSH) and/or psychological index terms for your keywords. The National Library of Medicine offers a free, searchable MeSH database for PubMed

. Also, APA publishes the *Thesaurus of Psychological Index Terms* for our family of databases.

The Introduction should not exceed 3–4 pages in length. The paper should be referenced appropriately but excessive citations should be avoided.

All research involving human participants must describe oversight of the research process by the relevant Institutional Review Boards, along with the name(s) of the approving institution(s), or an explanation of why no approval was needed. Consent and assent procedures should be described briefly in the Methods section.

All statistical tests should include an effect size with confidence intervals whenever possible.

First person language ("I", "we") should be avoided. Terminology should be sensitive to the individual who has a disease or disability. The journal endorses the concept of "people first, not their disability." Terminology should reflect the "person with a disability" (e.g., children with diabetes, persons with HIV infection, families of people with cancer) rather than the condition as an adjective (e.g., diabetic children, HIV patients, cancer families). Nonsexist language should be used.

It is important to highlight the significance and novel contribution of original work. Replications and extensions of previous studies are welcome, but the rationale and discussion should give due weight to the main purpose of the study (i.e., to confirm, disconfirm, or extend previous research), and it should not give excessive weight to minor innovations or superficially novel features.

Health Psychology publishes a variety of types of papers and work across the entire spectrum of translational research. The translational implications of the research should be discussed but not overstated. Programmatic research is especially welcome. If the study is integral to an ongoing, well-focused program of research, the study's relationship to previous and planned work in the research program should be described.

Checklist for Manuscript Submission

Numbers following entries refer to relevant section numbers in the *Publication Manual*.

Format

- Have you checked the journal's website for instructions to authors regarding specific formatting requirements for submission (8.03)?
- Is the entire manuscript—including quotations, references, author note, content footnotes, and figure captions—double-spaced (8.03)? Is the manuscript neatly prepared (8.03)?
- Are the margins at least 1 in. (2.54 cm; 8.03)?
- Are the title page, abstract, references, appendices, content footnotes, tables, and figures on separate pages (with only one table or figure per page)? Are the figure captions on the same page as the figures? Are manuscript elements ordered in sequence, with the text pages between the abstract and the references (8.03)?
- Are all pages numbered in sequence, starting with the title page (8.03)?

Title Page and Abstract

- Is the title no more than 12 words (2.01)?
- Does the byline reflect the institution or institutions where the work was conducted (2.02)?
- Does the title page include the running head, article title, byline, and author note (8.03)? (Note, however, that some publishers prefer that you include author identification information only in the cover letter. Check with your publisher and follow the recommended format.)
- Does the abstract range between 150 and 250 words (2.04)? (Note, however, that the abstract word limit changes periodically. Check APA Journals Manuscript Submission Instructions for All Authors for updates to the APA abstract word limit.)

Paragraphs and Headings

- Is each paragraph longer than a single sentence but not longer than one manuscript page (3.08)?
- Do the levels of headings accurately reflect the organization of the paper (3.02–3.03)?
- Do all headings of the same level appear in the same format (3.02–3.03)?

Abbreviations

- Are unnecessary abbreviations eliminated and necessary ones explained (4.22–4.23)?
- Are abbreviations in tables and figures explained in the table notes and figure captions or legends (4.23)?

Mathematics and Statistics

- Are Greek letters and all but the most common mathematical symbols identified on the manuscript (4.45, 4.49)?
- Are all non-Greek letters that are used as statistical symbols for algebraic variables in italics (4.45)?

Units of Measurement

- Are metric equivalents for all nonmetric units provided (except measurements of time, which have no metric equivalents; see 4.39)?
- Are all metric and nonmetric units with numeric values (except some measurements of time) abbreviated (4.27, 4.40)?

References

- Are references cited both in text and in the reference list (6.11–6.21)?
- Do the text citations and reference list entries agree both in spelling and in date (6.11–6.21)?
- Are journal titles in the reference list spelled out fully (6.29)?
- Are the references (both in the parenthetical text citations and in the reference list) ordered alphabetically by the authors' surnames (6.16, 6.25)?
- Are inclusive page numbers for all articles or chapters in books provided in the reference list (7.01, 7.02)?
- Are references to studies included in your meta-analysis preceded by an asterisk (6.26)?

Notes and Footnotes

- Is the departmental affiliation given for each author in the author note (2.03)?
- Does the author note include both the author's current affiliation if it is different from the byline affiliation and a current address for correspondence (2.03)?
- Does the author note disclose special circumstances about the article (student paper as basis for the article, report of a longitudinal study, relationship that may be perceived as a conflict of interest; 2.03)?
- Does the author note provide information about prior dissemination of the data and narrative interpretations of the data/research appearing in the article (e.g., presented at a conference or meeting, presented as part of a colloquia at a university, posted on a listserv, or shared on a website, including academic social networks like ResearchGate, etc.)?
- In the text, are all footnotes indicated, and are footnote numbers correctly located (2.12)?

Tables and Figures

- Does every table column, including the stub column, have a heading (5.13, 5.19)?
- Have all vertical table rules been omitted (5.19)?
- Are all tables referred to in text (5.19)?
- Are the elements in the figures large enough to remain legible after the figure has been reduced to the width of a journal column or page (5.22, 5.25)?
- Is lettering in a figure no smaller than 8 points and no larger than 14 points (5.25)?
- Are the figures being submitted in a file format acceptable to the publisher (5.30)?
- Has the figure been prepared at a resolution sufficient to produce a high-quality image (5.25)?
- Are all figures numbered consecutively with Arabic numerals (5.30)?
- Are all figures and tables mentioned in the text and numbered in the order in which they are mentioned (5.05)?

Copyright and Quotations

- Is written permission to use previously published text; test; or portions of tests, tables, or figures enclosed with the manuscript (6.10)? See Permissions Alert (PDF, 13KB) for more information.
- Are page or paragraph numbers provided in text for all quotations (6.03, 6.05)?

Submitting the Manuscript

- Is the journal editor's contact information current (8.03)?
- Is a cover letter included with the manuscript? Does the letter
    - include the author's postal address, e-mail address, telephone number, and fax number for future correspondence?

- state that the manuscript is original, not previously published, and not under concurrent consideration elsewhere?
- inform the journal editor of the existence of any similar published manuscripts written by the author (8.03, Figure 8.1)?
- mention any supplemental material you are submitting for the online version of your article?