A Long Way from Home: Investigation of Work Stress and Remoteness in the Mining Industry

by

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Executive Summary

Background

The mental health of remote mining workers has been a heated topic in the Australian media over the last decade. This has arisen in part due to concern over the great distances mining workers travel to and from work, typically via plane, living on site for days or weeks at a time and then flying home to rest for a proportionate number of days. Questions have been raised about the intensity of their work periods, the separation from friends and family, and the experience of isolation. In 2015 these concerns culminated in a parliamentary enquiry that was held solely to investigate the risk of depression and suicide due to this work structure. In many ways this thesis represents a response to this public interest.

The gravity of the situation however extends beyond concern for the health of workers. The mining industry is the backbone to Australia's economy, contributing to 19% of our GDP. Protecting these workers in turn serves to protect Australia's fiscal health. There is additionally the concern that remote work structures are a part of a major societal change in labour dynamics. Technology is also changing the way we work, and understanding these changes and their implications for our health and relationships is an imperative for our future.

Methodological Process

To identify the effect of remote work on employee health, we turned to the field of stress theory to explain the accumulation of work stress and the types of strain this would manifest into. We adopted the Psychosocial Safety Climate - Job Demands Resources (PSC-JDR) model as our overarching theoretical framework, and developed our own local theory pertinent to the population.

A mixed methods approached was adopted for this project. Due to the unknown qualities of the study population, an initial qualitative research phase of research was conducted. This allowed us to identify what specific aspects of working in the mining industry were the most stressful, and how this affected their health and wellbeing. This qualitative data informed the direction of our hypotheses, which were tested using primary and secondary datasets. What resulted was a unique model of work stress

pertinent to mining workers that explained their experience of stress, and the role of separation and isolation.

This project was conducted in a manner that respected the privacy and constraints of the collaborating organisations. Participating employers and employees were given absolute anonymity.

Major Findings

Major findings included a proximity-support interaction, where upon separation obstructs a person's access to support from primary groups creating relationship difficulties, and concurrently encourages the development of compensatory bonds with peers in the workers new environment.

We also developed a unique scale to measure the conflict between work and life attributable to remote work - remote work-life conflict, which was found to have high reliability and high predictive validity. We discuss this unique type of work-life conflict in consideration to the broader literature of work-life conflict and work-life balance. We propose that prevailing perspectives and tools of measurement may have diminishing applicability, as new technology-facilitated work structures and practices that continue to emerge do not conform to spatial and temporal boundaries.

We found measures of work-life conflict and remote work-life conflict were strongly predictive of depression among remote mining workers, as well as the partners of remote mining workers. These depression rates were concerningly high, and also related to the length of remote work contracts.

Recommendations

We propose that work-life conflict related depression in the mining industry may be minimised by investing resources in facilitating support co-worker relations at work. Further we propose that mining organisations may wish to adopt rosters that minimise the time an employee spends away from friends and family as a way of reducing roster related depression. Employers could also evaluate the arrangement of on-site accommodation and the noise permeability of these lodgings to minimise employee sleep disturbances.

Publications

Currently one paper from this thesis is published (Chapter 4), and another is in press (Chapter 3). Details of these publications are provided prior to each chapter.

Acknowledgements

This project was funding by an Australia Post Graduate Awards Scholarship and a top-up scholarship ($30,000) from the Mining and Quarrying Occupational Health and Safety Committee.

Declaration

This thesis presents work carried out by myself and does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; to the best of my knowledge it does not contain any materials previously published or written by another person except where due reference is made in the text; and all substantive contributions by others to the work presented, including jointly authored publications, are clearly acknowledged.

19.05.2016

Wesley P McTernan Date

Endorsement

19.05.2016

Maureen F Dollard (Supervisor) Date

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I would like to acknowledge the support I received from friends, family and peers in completing my thesis.

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Chapter 1

Introduction

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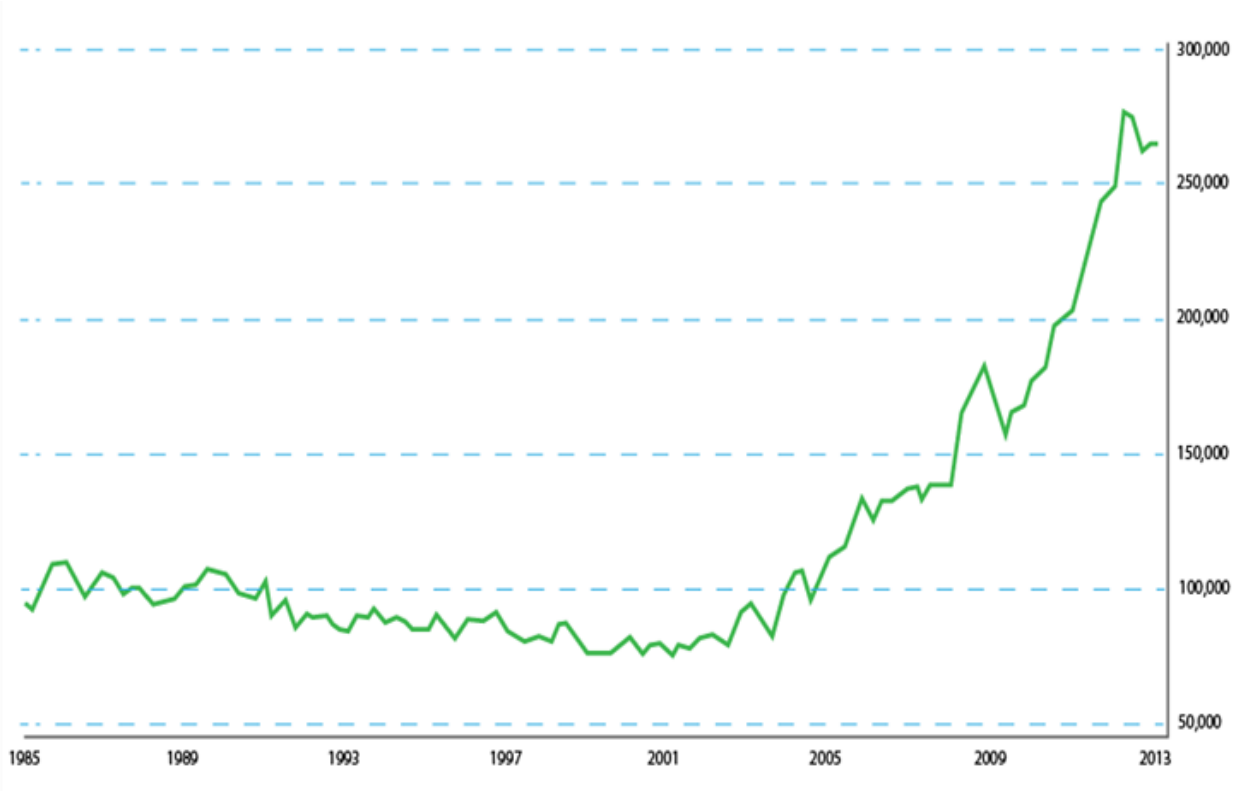
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1. Overview of Mental Health in the Mining Industry

Australia's mining sector sits amidst a boom in terms of production and expansion. The industry growth and prosperity is evident in a four-fold increase in major mining operations from 2001-2011 in South Australia (SACOME, 2011), as well as having the highest annual net profit (42.5%) (ABS, 2012) and the highest average worker salary ($117,500) (ABS, 2011) of all Australian industries. There is also evidence of a boom in terms of employment numbers. At a national level the mining industry has experienced more growth in employment than any other industry in the twelve months leading up to February in 2012 (20.4% increase) (DEEWR, 2012).

Figure 1.

The Growth in Australian Mining Employment Figures (1985-2013)



Increased employment in the mining industry means a greater number of workers are exposed to the demands and risks in the mining work environment. There is a notable risk of fatality, with mining carrying the second highest fatality rate in Australian industries (SafeWork Australia, 2011). Additionally, there are a large number of unskilled labourers entering the workforce due to the employment boom, who are less familiar with safety practices than pre-existing employees. Another concern is that the mines themselves are remote, and therefore require many workers to either relocate or engage in a Fly-in/Fly-out (FIFO) or similar work contract, which may affect their ability to maintain and derive support from personal relationships. Each of these risks present possible avenues to poor psychological health.

A literature review of health hazards in the mining industry by Donaghue (2004) found an extensive range of research published on physical risks to health in the mining industry such as noise and heat exposure, however little research was available on the psychosocial risks to health. A personal review of the literature shows that there is still very little research on the mental health of mining workers, over a decade after Donaghue's publication, and in spite of the recent industry growth. A possible explanation for this lack of research are the dismissive cultural perceptions towards mental health in Australia's rural communities (Komite, 2006), which may present a barrier to reporting and participating in psychological research. This also prevents an additional risk if mining workers are less likely to seek help for their psychological health.

Despite a lack of academic research, mental health in the mining industry has garnered significant attention in the media. In particular, a question has been raised as to whether the displacement an employee experiences from their friends and family through FIFO contracts has an effect on their mental health. This question has arisen in light of a number of suicide cases among FIFO workers.

In 2015 the topic had garnered enough attention that a parliamentary inquiry was held by the Western Australian State Government to determine whether FIFO rosters had an impact on the mental health of workers. It is worth noting that this enquiry had not

occurred when I began writing this thesis, and therefore reflects the current public interest of this project. During the inquiry in early May 2015, the general manager of Chevron Australia was invited to present evidence, in which she responded with an explicit denial of any relationship between the length of FIFO contracts among their employees and contractors, and any mental health event or case of suicide. We argue that this is unlikely, and further, that our findings suggest that this is not the case (see chapter 6).

2. Social Significance

There are several broad social implications regarding mental health in the mining industry. One predominant issue stems from the economic costs associated with psychological ill-health. Recent research has found that decreased employee wellbeing is associated with decreased productivity and employee absenteeism (McTernan, Dollard & LaMontagne, 2013; McTernan, Dollard & LaMontagne, 2014), each carrying a direct financial cost to the employer. Similarly research has found employees who experience high distress show elevated rates of absenteeism (Bültmann, et al., 2005; Hardy, Woods, & Wall, 2003; Munir, et al., 2007). Additional indirect costs also exist where when an employee cannot work at their full capacity, or work at all due to poor psychological health. Their co-workers are then required to do extra work to make up for the reduced output of that employee and may impair their performance on their usual tasks, or experience strain from this additional burden. These costs don't take into account the direct costs an employee may experience in addressing their own psychological ill-health.

If the ill-health of mining workers creates an economic burden for mining organisations, then that burden too will carry over to the national economy. As discussed earlier, Australia's mining organisations have a much higher profit margin than every other Australian industry, and in total mining and mining related industries represent 19% of Australia's gross domestic product (IBA, 2015). Identifying avenues for improving the

health and in turn productivity of these workers may therefore have broader economic benefits as well.

Another considerable important social implication is the effects that FIFO and related rosters have on the families of mining workers. In addition to the importance of familial support in maintaining the wellbeing of mining employees, it is also important for mining workers to maintain an active role in their family unit for the partners and children. In the absence of the mining worker, the domestic responsibilities of the partner at home are effectively doubled. In addition, this absence may be stressful for the children in these families, especially for children in the earlier stages of their development. Considering these wider social implications, we believe there is national interest in both understanding the psychosocial risk factors that precede ill-health, and in also understanding the ramifications of FIFO rosters on the worker and families.

3. Purpose of this thesis

Despite the current boom in the mining sector, little is known about the psychosocial factors that are pertinent to mining work. Psychosocial factors include job demands (i.e. work pressure, harassment) as well as job resources (i.e. co-worker or supervisor support). The collective investigation of this range of psychosocial factors is generally referred to as *work stress* research, as these factors are involved in the elicitation or reduction of stress arousal and a corresponding detrimental stress-response (i.e. burnout, fatigue, accidents). Further, the emergence of remote contracts (i.e. FIFO) represents an unknown quality in organisational psychology and may be a critical demand in the experience of work stress for remote mining workers. Many of our assumptions about the experience of psychosocial risk factors are based on a traditional work roster, but the experiences of remote workers may differ due to their atypical work arrangements, calling into question these assumptions. As one of Australia's most important industries economically, and one of Australia's most dangerous industries, research into the experience of work stress in mining industry, and

understanding the effects of FIFO rosters, stands to benefit mining communities as well as the broader Australian public.

4. Project Aims

Broad models for understanding the effects of psychological demands on worker health, also known as *work stress* theories, exist, which offer a sound theoretical framework for undertaking this investigation. A review of these models is provided in Chapter 2.

However, the specific types of demands pertinent to mining work, the resources at their workplaces that help with these demands, and the way that they affect mining health remains unexplored. Consequently, the initial aim of this study is to identify the unique psychosocial aspects of working conditions experienced by mining employees, and this will be the basis of the initial phase of the project. This will help develop a 'local theory', that is a model of work stress that fits within the broader theoretical model, but relates to the specific population. To achieve this, qualitative data was collected and is discussed in Chapter 3.

Third, we aimed to test this emerging local theory using quantitative methods. To achieve this, we used previously available quantitative data on the Australian national population: the Australian Workplace Barometer (AWB) dataset (Chapter 4). However specific local theory emerged in the qualitative interviews that could not be captured in the AWB dataset. Further quantitative data was collected that tested this local theory (Chapters 5-7).

5. Methodology Overview

5.1 Qualitative research

In the case of pre-existing knowledge in an area of research, hypothesis formation is guided by prior theories and study findings published in previous research. However, this fundamental imperative of empiricism requires the presence of pre-existing information to direct future research. This poses a problematic conjunction for 'unchartered territory' in social and psychological enquiry, as is the case for the psychosocial risk factors pertinent to Australian mining workers.

One possible solution is through grounded theory derived qualitative research. Grounded theory involves the collection of qualitative data on a phenomenon, and clustering re-occurring trends and themes into larger collective concepts in what is described as a process of reverse engineered hypothesis generation. As we intend to quantitatively investigate the relationship between psychosocial work factors in an under-investigated area of research, grounded theory will allow us to first identify what factors are present before I quantitatively measure them, as well as helping identify what measures may be the most appropriate to use. This additionally circumvents the issue of breadth with broad theoretical models like the Job Demand Resources model, that otherwise could lead to an overly exhaustive questionnaire.

To acquire qualitative data on mining employee work factors, I used one-on-one semi-structured interviews. Initially focus groups were intended to be used but were abandoned due to the lack of anonymity it would pose on employees when discussing sensitive topics. Discussions with industry liaisons suggested that one on one interviews would be likely to lead to more open conversations. To further create a comfortable environment that would encourage rich reflective sharing from the participant, I also avoided the use of unnecessary psychological jargon.

When developing the interview structure, three recommended criteria (Beck, 1993; Cooney, 2011) were considered for ensuring rigour. (1) Credibility: how true the research

reflects the phenomenon. This can be assessed by asking participants how well the study findings reflect their experience. Cooney however notes that the focus of grounded theory is less descriptive but more in providing an abstract explanation of the phenomenon. (2) Auditability: providing an 'audit trail', which involves using examples of raw data, and analytical processes for transparency and potential replication by others. (3) Fittingness: a clear description of the data collection environment and setting, as well as thorough demographic data that allows for the reader to identify how generalisable the study findings are to the broader population.

5.1.1 Qualitative data collection

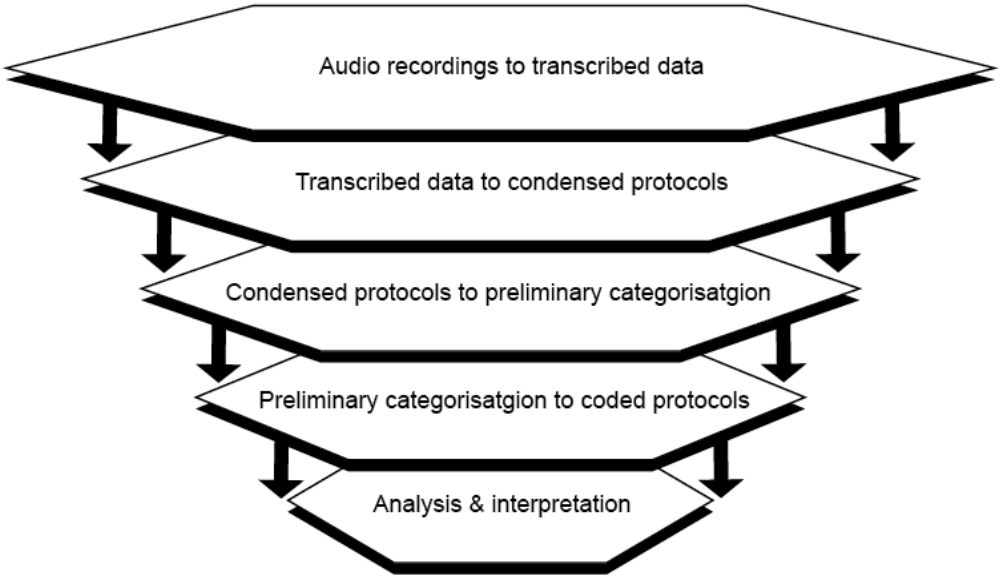
Through the help of MAQOHSC, we made contact with a South Australian mining company who agreed to participate in qualitative, and at a later date, quantitative data collection. To conduct the interviews we visited this mining site and interviewed participants over the course of 10 hours. Afterwards, we repeated the interview process with an online cohort from within and outside of Australia to help distinguish what phenomena was and was not associated with FIFO rosters. Semi-structured interview questions are attached in Appendix A.

5.1.2 Qualitative data analysis

Schilling (2006) presents a systematic protocol for the synthesis and analysis of qualitative data for content analysis, or in this case thematic analysis, as demonstrated by Hayward and Tuckey (2011). Schilling lists five stages of data transformation processes, guiding the analysis procedure from initial interview recordings through to the analysis and interpretation of the data's themes (Figure 2).

Figure 2.

Process model for qualitative analysis



First the recorded interviews were transcribed. Individual interviews were analysed for condensed protocols: this is the process of reducing the text down to the emerging constructs. Once the text is reduced into condensed protocols, they can be grouped by similarity into preliminary categories. In this case, these greater themes will be the factors of the broader theoretical model adopted, the Psychosocial Safety Climate – Job Demands Resources (PSC-JDR) model. An analysis of these findings was then conducted, and the implications for future research was discussed. For a specific account of this process, refer to Chapter 3.

5.2 Quantitative Research

In addition to the pre-existing AWB dataset we collected additional quantitative data to answer additional questions that emerged in the qualitative investigation. Once qualitative data on work stress in the mining sector had been collected and analysed, the predominant types of demands and resources mining employees experience in their job role

were identified, as well as they outcomes they may occur through excessive stress. This minimised the need to do a larger exhaustive questionnaire and prevented having to make assumptions on what study factors were to be included. The variables were assessed using pre-existing quantitative measures in a multi-stage online questionnaire in a sample of miners across several work sites. Our qualitative research identified a construct previously unexplored, and therefore a measure was developed to capture this construct based on the qualitative research we conducted. We refer to this construct as Remote-Work-Life Conflict, which is discussed in Chapter 6.

In addition to collecting data on the psychosocial factors pertinent to the mining workers experience of work stress, we also collected information on roster structure. This helped identify the impact that remote (i.e. FIFO) rosters have on employee quality of life, safety and performance.

After our qualitative research it also became evident that the effect of FIFO rosters on personal relationships was the prominent phenomenon to investigate in terms of worker quality of life. We decided to branch our research out to the partners of mining workers as well, to help address the broader impact of mining work on the community.

5.2.1 Quantitative Data Collection

To provide a working sample, several mining companies were approached for participation in our quantitative research, with the help of the Mining and Quarrying Occupational Health and Safety Committee (MAQOHSC) for data collection. Three mining organisations agreed to participate. In addition, we also liaised with a non-for profit organisation, *Mining Family Matters*, who helped us reach additional mining workers, as well as the partners of mining workers. A greater description of this process is provided in Chapters 5-7. A copy of the online survey is attached as Appendix B.

5.2.2. Quantitative Data Analysis

Different quantitative methods and programs were adopted to answer specific research questions in Chapters 4-7. Structural Equation Modeling (SEM) in Chapter 4 was conducted using secondary data, the AWB dataset, in MPlus version 6.11. Primary data collected was first cleaned in Microsoft Excel, and then transferred to IBM Statistical Package for the Social Sciences version 21 (SPSS). This data was used to conduct an Exploratory Factor Analysis (EFA) in SPSS as well as a Confirmatory Factor Analysis (CFA) in Chapter 5 using Mplus. Several Analyses of Variance (ANOVA) in SPSS in chapters 5-7 were also conducted using this primary data.

6. Thesis Structure

Thesis chapters were written and structured for publication. Where chapters have been published or are in press, reference has not been made to previous or subsequent chapters, so that the body of work in this thesis matches what is published. Consequently, epigraphs are included prior to thesis chapters to provide both an account of how each chapter contributes to the progression of the thesis, as well as providing commentary on the development of the researchers' rationale.

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Chapter 2

Epigraph

Theory driven empirical research has become a basic tenet of the social sciences, and consequently while developing my overarching research questions for my dissertation, it was important that I review the relevant theoretical perspectives that can help explain the interaction between psychosocial factors at work and mental health that I intended to investigate. These theories are typically referred to as 'work stress theories', and have many similar underlying principles. In particular is the notion of a stressor-strain pathway, which is the process whereby excessive or unresolved stress arousal can result in psychological strain.

A typical review process would be to conduct a literary review of these contemporary theories, and compare and contrast their strengths and weakness based on empirical support and applicability to my particular research questions. However extensive reviews of the major work stress theories i.e. Demerouti, Bakker, Nachreiner and Schaufeli's (2001) Job Demand Resource model, Siegrist, Siegrist and Weber's (1986) Effort-Reward Imbalance model, as well as Karasek and Theorell's (1990) Job Demand Control model, already exist (Bakker & Demerouti, 2007; Tsutsumi & Kawakami, 2004; Van der Doef & Maes, 1999, respectively). Conversely, a discussion of how these theories arose, and the origin of the underlying principles that connect them, is surprisingly absent in the literature.

We decided to review the development and principles of these perspectives, as they are based on assumptions of organisational processes which are changing as society develops new practices in labour dynamics. A key topic of this thesis reflects one of these changes in labour dynamics: a departure from traditional work structures in the mining industry towards a new emerging structure of remote working rosters (i.e. FIFO).

Consequently, a theoretical perspective that accounts for these emerging processes was beneficial in providing a theoretical framework for this thesis.

In the present paper we observed a theoretical transition in scope over the last century from the small to the big. Recent work stress theory accommodates external influences on organisations such as international work and trade policies, as well as socioeconomic and cultural influences. These theoretical trends reflect a continuing process of globalisation in the workforce. Remote mining is at the precipice of these globalisation processes. The workforce of major mining conglomerates span national borders, and are faced with different work and employment challenges depending on environmental, cultural and political constraints. Consequently, we concluded that a multilevel theoretical perspective (the PSC-JDR model) was necessary to account for macro-level processes, and has been adopted throughout the thesis.

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Chapter 2

From Small to big: A Review of the Transition Between Micro, Meso and Macroscopic Level Work Stress Theoretical Perspectives

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Abstract

This paper provides a discussion of the development of work stress theories since the seminal work of Yerkes and Dodson in 1908 to the present multi-dimensional theories of today. The broadening lens of these theories, from microscopic to macroscopic levels of analysis, reflects a transition within the field of research towards greater encompassing, and more holistic perspectives. In this paper we aimed to demonstrate the theoretical links between these perspectives, and identify the drivers of this change in focus. We argue that these changes are driven by globalisation processes and technological development that have occurred over the last century. In review of this literature, we hypothesize the trajectory of future theoretical development on work stress will continue to expand in hierarchical scope, mirroring the globalising practice of business. This paper offers insight for future theoretical development and academic research by demonstrating the growing necessity of macrolevel theory in workplace research design.

Key words: stress, theory, work, health

1. Introduction

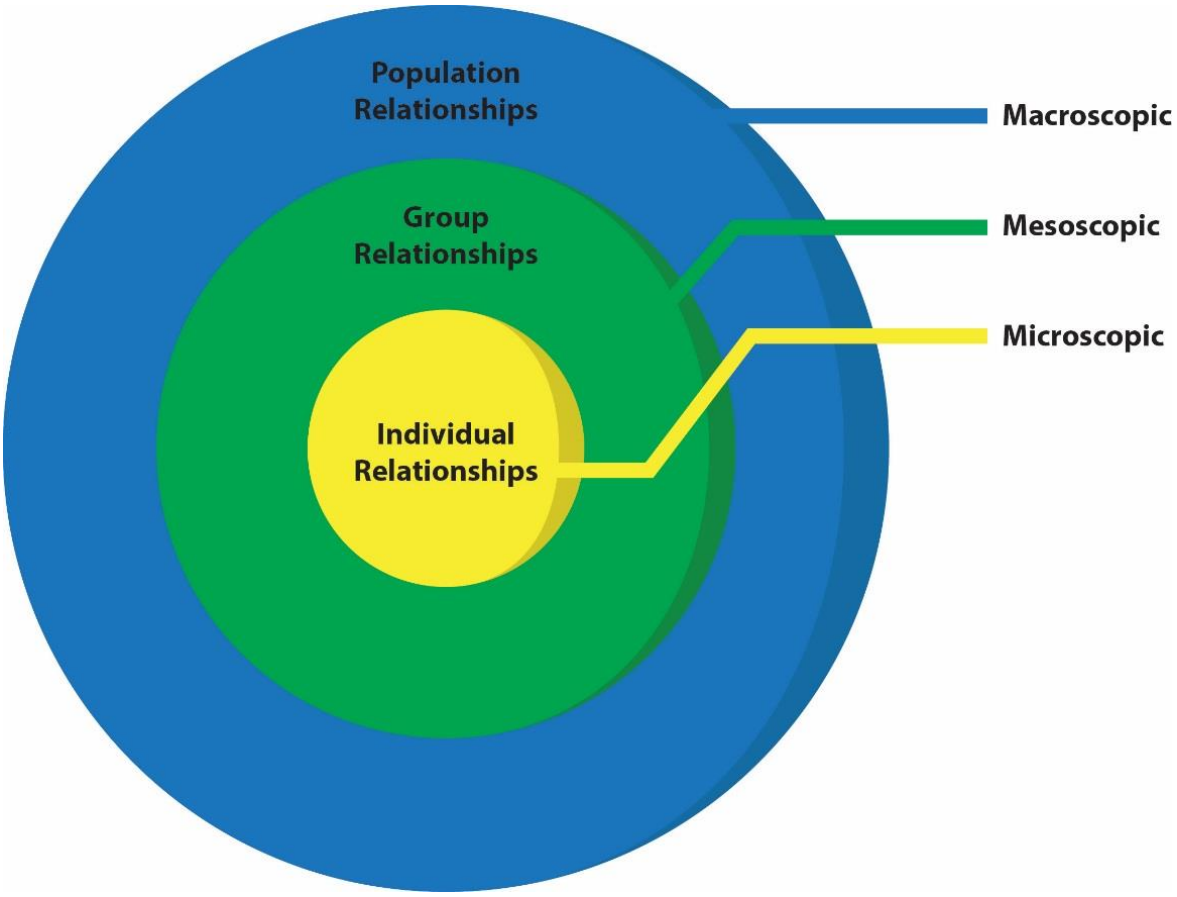
Work stress, and the theories used to explain its occurrence, represent a fundamental element of work and organisational psychology research. Modern perspectives are harmonious on a key proposition: that excessive stress arousal creates psychological and physical strain, which can manifest into a plethora of poor psychological health outcomes. However the way they conceptualise this pathway has changed drastically over the last century. Further, the information on the conceptual origins of these perspectives, and the events that led to their development is scarce. In conducting this review, we have seen a transition where research initially explored stress at the smallest level of analysis, and has since expanded to account for ever-increasing hierarchical contributors. We propose that examining this transition offers insight into the trajectory of future work stress theory. To explain this change in hierarchical scope, we turn to an informal hierarchical model: micro, meso and macroscopic levels of analysis.

1.1 Microscopic, mesoscopic and macroscopic levels of analysis

The terms microscopic, mesoscopic and macroscopic (commonly abbreviated to micro, meso and macro), have been used to describe varying tiers of influence and analysis in the social sciences, however the terms have garnered the most popularity and usage amongst sociologists and economists. They refer to three distinct yet permeable categories (Figure 1) - not to be confused with similar terminology used in Bronfenbrenner's Ecological Systems Theory (1979), that are defined by the size of the network of relationships being observed. Microscopic analysis refers to research that examines the smallest unit of sociological and psychological analysis, encompassing individual phenomenon and relationships between an individual and people close in their social proximity (i.e. partners, family). Mesoscopic analysis is concerned with interactions at the group level, such as organisations, communities and towns. Macroscopic analyses refers to the largest scope of sociological analysis, concerned with interactions between states, and

the influence of broader societal cultures. These categories offer a useful way of distinguishing the varying levels of influence within complex systems, and how these levels interact and effect phenomena.

Figure 1.
Micro, Meso and Macroscopic Levels of Analysis



A similar method for conceptualising hierarchical structures, but specifically relating to work and industrial processes was proposed by Sauter and colleagues (2002) on behalf of the National Institute for Occupational Safety and Health (NIOSH) in the United States. The NIOSH *organisation of work* model depicts three tiers of organisation at work: the work context, the organisational context, and the external context. The work context relates to factors within the workplace such as physical and psychological demands, as well

as team-level psychosocial factors like work climate and culture. Above the work context is the organisational context, which pertains to broad organisational structures and policies such as organisational restructuring, employee benefits and process management policies. Above the organisational context is the external context, which accounts for national and global economic and political influences, as well as changing population trends which affect both consumer make-up and employee demographics.

There are some significant similarities between NIOSH's organisation of work model and the formerly mentioned levels of analysis. Both conceptualisations delineate processes into three tiers to contextualise a hierarchy of influences from broader sociological trends down to the experience of an individual, and both models emphasis a top-down direction of interaction between these tiers (e.g. international trade agreements affect organisational production demands, which in turn can affect an individual's work intensity).

The prominent deviation of the NIOSH model however is that it clusters individual and work group contexts together at the lowest tier, with broader organisational influences at the middle hierarchical level. The NIOSH model likely clusters both contexts together as it is predominantly a model of physical safety, and most physical safety hazards are likely to occur for an entire work site rather than just an individual. One employee's exposure to hazardous chemicals is likely to be similar to their co-workers with similar job roles.

In contrast, the experience of psychological risk factors is less universal among employees. For example, employees within a work group are not likely to have an equal likelihood of experiencing workplace bullying. Further, an employee's reaction to bullying will be contingent on unique psychological characteristics, and their previous interactions with other co-workers. In this regard, there is a greater deviation between the individual experiences of psychological risk factors from the group experience, than that of physical risk factors. The NIOSH model is therefore a useful perspective when placing work stress within the broader context of work safety, however grouping individual and team context

together may be limiting when accounting for changes in work stress research, which address psychological risk factors specifically.

In this paper we will discuss the body of research concerned with the experience of stress at work. The vast majority of previous research on stress has focused on the individual context, however in recent decades the influence of team level climate type constructs have been explored. To cluster these contexts under the same hierarchical level reduces the ability to discriminate the changes that have occurred that led to the development of group level perspectives, e.g. climate-type constructs. We therefore propose that the former micro, meso, macroscopic model offers a more appropriate lens to contextualise and understand these changes in work stress research.

Although this paradigm is not typically applied to work stress research, it offers a relevant lens for delineating differing theoretical perspectives and explaining the broadening scope of work stress theory that has occurred over the last century. The globalisation of organisations and corporate practices, as well as the technology we use to observe and measure these influences, is continuing to grow. To explore this perspective, we conducted a narrative review of the prominent work stress theories as they developed over the last century, and their role in influencing subsequent theory. We propose that these changes in part reflect natural theoretical expansion, but are also spurred by globalising business processes, and therefore broader macroscopic theories are necessary to explain these burgeoning influences.

2. History of Work Stress Theories

A great deal of our 21st century workplace problems can be attributed to age old biological mechanisms. Homeostasis, the constant endeavour for internal equilibrium, extends beyond just maintaining a steady body temperature, and is also involved in regulating blood pH levels, cell osmosis and sleep regulation (Shulkin, 2004). When disturbed, this system can hold a profound effect on our lives. Stressors present in our environment, both physical and

psychological, can upset this equilibrium, and when placed under high strain, the sympathetic nervous system responds by an influx of catecholamine hormones (i.e. adrenaline and norepinephrine) to increase arousal (Axelrod & Reisine, 1984), and help the body respond to the stressors to return the body to homeostatic balance. In this way, some strain benefits daily function, as the heightened arousal leads to enhanced awareness and cognitive performance.

2.1 Yerkes-Dodson law (microscopic)

However, too much strain has been shown to be detrimental to daily function. When stress levels increase (by either intensity or prolonged exposure) beyond a point of stimulating maximum performance, the stress becomes excessive and damaging to health and performance. We refer to this as the stressor-strain hypothesis. This relationship between performance and stress arousal is widely recognised to be an inverse U shaped curve. The inverse U shaped relationship between arousal and performance is commonly referred to as Yerkes-Dodson law, a microscopic theory, observing an individual's stress response to stressors in their immediate environment. In 1908 Yerkes and Dodson conducted a series of experiments observing mice, measuring the effect of stimuli strength (an electric shock) on task learning speed (moving through a correct corridor). Yerkes and Dodson however never discussed arousal in their seminal paper, and drew no inference to the broader theoretical applications of their findings. It wasn't until nearly 50 years later that the concept of arousal was introduced to the model, largely attributable to the work of Hebb, Schlosberg and Duffy.

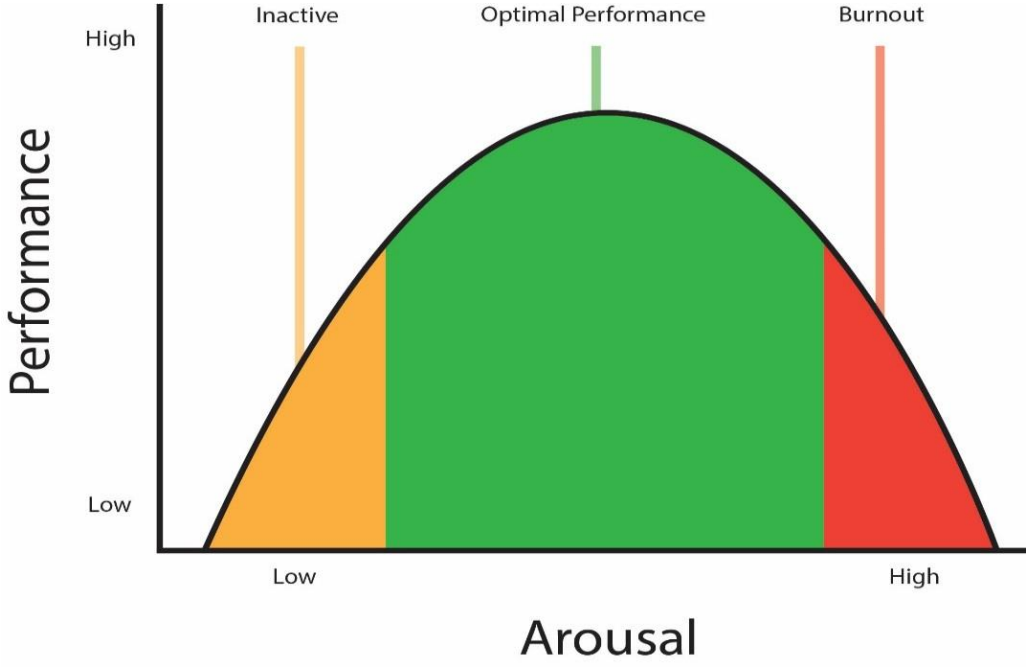
Hebb (1955) was unsatisfied with the emphasis on satisfying primary drives as an explanation for motivation and behaviour at the time, drawing on the example of a study by Bexton, Heron and Scott (1954) as a source of his disillusionment. Bexton et al. conducted a study where all of the participants' basic needs (with exception to sex) were met: i.e. sustenance, shelter, comfort, and were paid $20 a day to sit and sleep in an isolated room,

only to leave for bathroom or meal breaks. The study environment was designed to be largely void of sensory stimulation – to the extent that participants were required to wear large gloves to restrict tactile sensation, and were provided with no tasks save for a few experimental tests on their cognitive performance. The researchers found that the participants quickly grew uncomfortable for the lack of stimulation, experienced instances of hallucination, mental "fuzziness", and consequently in many cases withdrew before testing could be completed.

Hebb cited this as evidence that our actions are motivated by more than just the drive to satisfy basic needs. Otherwise, participants would have been happy continuing to participate in the study which satisfied these needs, provided comfort, and paid more than twice what a typical college student at the time could make. He argued that humans are additionally motivated by a desire for stimulation; which is reflected in our interest in creating problems for the sole purpose of solving them, such as puzzles and crosswords. Hebb's paper proposed a model of stress arousal and performance with an inverted U relationship, a relationship that had already been found in the research of Schlosberg and Stanley (1953), and Duffy and Lacy (1946). Due to the parallels, Hebb's proposition subsequently became integrated into successive discussions of the Yerkes-Dodson model (Figure 2), which is now conventionally iterated as a theory of arousal (Teigen, 1994).

Figure 2.

Yerkes-Dodson Law



Yerkes-Dodson law has some of its most relevance to organisational settings. The workplace is an environment with tangible performance outcomes, as well as an environment that exposes workers to stressors from both the occupational task (e.g. manual or psychological labour) and the occupational setting (e.g. noise or physical hazards). While not a theory of job specific stress arousal, the underlying stressor-strain hypothesis of the Yerkes-Dodson is evident in subsequent work stress theories.

2.1.1 Evidence for the Yerkes-Dodson law

Although several studies have found a U-shape between arousal and performance in laboratory research (Bregman & McCallister, 1982; Stennett, 1957), research using occupational-type stress measures (e.g. job-related tension) found negative linear relationships (Allen, Hitt & Greer, 1982; Greer & Castro, 1986; Jamal, 1985). One possible

explanation offered by Allen, et al. is that it may be difficult to identify the inverse U-shaped relationship if the workers all experienced high exposure to the stressor. Employees within a work unit may be exposed to the same stressor at high levels and therefore there may not be enough variance to detect the curve. Further, Allen et al. proposed differentiating the type of stress may help explain the differences. Subsequent work stress research adds weight to this proposition, as theorists have expanded on the type of stressor, as well as proposing mitigating factors of the stressor-strain pathway.

2.2 The Effort-Reward Imbalance model (microscopic-mesoscopic)

A prominent example of such a theory is the Effort-Reward Imbalance (ERI) model, introduced by Siegrist, Siegrist and Weber in 1982. Like the Yerkes-Dodson Law, the ERI is based on the same underlying stressor-strain assumption. However the ERI model centres on the principal of social reciprocity, where a worker expects to be rewarded proportionately to for their efforts (stressor) in terms of esteem, wages and promotional opportunities. This arrangement is partly formalised, written in a contract such that completing work entitles a worker to weekly or fortnightly pay. Reciprocity also occurs because of less formalised contracts. A social expectation exists that working hard will be rewarded with promotional opportunities, and positive feedback will be given when workers excel. Whether because of a formal or informal agreement we expect a symmetrical balance between effort exerted and rewards received based on the principle of social reciprocity. Yet this expectation may not be met due to misunderstandings, or breaches of both formal and informal contracts.

Although high levels of effort or poor job rewards alone can contribute to ill-health, it is the asymmetric balance of greater effort over received reward that has the most notable cause of strain according to Siegrist et al. (2004). Further, the continued exposure to this imbalance creates feelings of inadequacy and lack of appreciation that reduces employee

self-regulation and increases the susceptibility for experiencing strain-related illness. This imbalance is referred to as the extrinsic (or situational) hypothesis of the ERI model.

A key feature of the ERI model is the inclusion of an intrinsic component, where a person's predisposition of commitment to work is factored into the model. Overcommitment, that is an excessive commitment to an employee's job and need for approval, can further exacerbate the imbalance between effort and reward, in that an employee's overcommitment will drive them to work harder than the available rewards the work contract stands to offer (see Figure 3).

The ERI posits that an imbalance between the exertion of energy at work and the reward given for that effort, a continuous struggle without reward, evokes both the sympathetic-adrenomedullary system relating to the 'fight or flight response' and the pituitary–adrenal–cortical system relating to the lesser known 'conservation-withdrawal reaction' (Siegrist, Siegrist, & Weller, 1982), a state of inactivity and reduced energy consumption.

The ERI extends the stressor-strain relation of Yerkes and Dodson by proposing a work specific stressor (effort in the form of job demands, hours, etc.) and proposes a mitigating factor (rewards) on the stressor strain pathway. The work of Siegrist and his colleagues therefore represents a broadening of theoretical scope from the Yerkes-Dodson law, however is still categorically microscopic in focus, examining the relationship between stress and strain at the individual level.

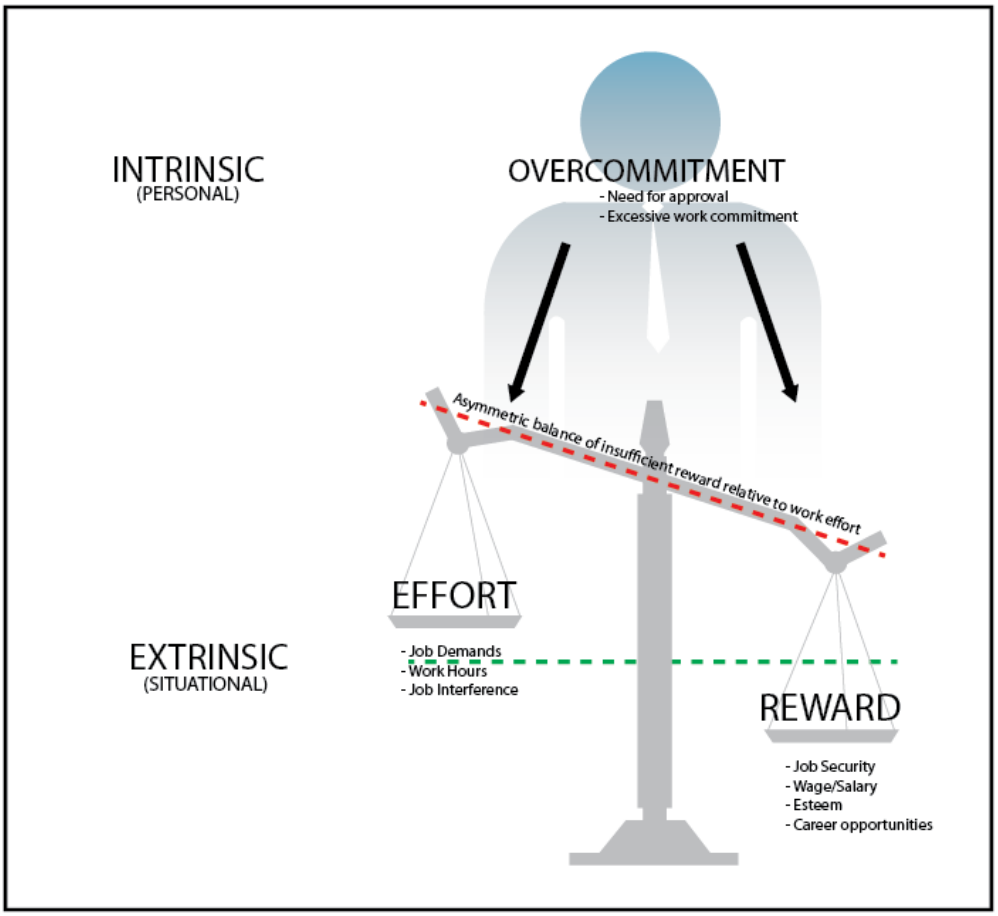
Siegrist et al. also address why employees willingly engage in asymmetric contracts i.e. when efforts outweigh rewards. Some examples are a lull in the job market, or strategically taking on a job to improve career prospects at a later date (e.g. working at a low-pay food outlet to gain hospitality experience for a higher paying job). Periods of low employment opportunities can therefore be expected to be followed by an increase in employee health problems. Siegrist (1996) further proposes that employees with low levels of occupational status control (i.e. blue collar workers, workers with poorer employment

prospects) are more likely to be engaged in high effort/low reward contracts. These macrolevel factors that involve national economic health and conversely economic downturn, factors that affect an employee's ability to change work, are therefore pivotal in an employee's effort-reward imbalance. Empirical investigation of these types of macrolevel influences on the experience of ERI however are absent. A review by Tsutsumi and Kawakijmi (2004) of empirical research on the ERI model showed previous studies have exclusively measured microscopic level factors (i.e. efforts and rewards).

In contrast a recent paper by Owen, Bailey and Dollard (in press) found the ERI model to function at the organisational (mesoscopic) level. Fundamentally, efforts and rewards are a product of organisational level factors, i.e. the organisation dictates the demands imposed on employees and the rewards they receive. There should also be some commonality in the occurrence and experience of these factors among an organisation's employees, i.e., when production demands are high at work, additional effort in some capacity will likely be required of most workers. Owen et al.'s paper is evidence of a recent shift in perspective towards the mesoscopic context in empirical ERI research.

Figure 3.

The Effort Reward Imbalance Model



2.2.1 Evidence for the Effort-Reward Imbalance model

A transnational confirmatory factor analysis by Siegrist, et al. (2004) found consistent support for the internal consistency of the psychometric measures of ERI. Further in twelve of fourteen samples high levels of ERI were associated with significantly higher levels of ill- health. Another paper reviewed 45 studies applying the ERI model, and found overwhelming support for the extrinsic hypothesis, but mixed support for the intrinsic hypothesis (van Vegchel, De Jonge, Bosma, & Schaufeli, 2004). Another criticism of the intrinsic component of the ERI is that it fails to take into account intrinsic rewards (Kasl, 1996). Later theories such as the Job Demand Control (JDC) and the Job Demands Resources (JDR) models include intrinsic rewards in terms of a motivational component.

Another limitation of the ERI model is that it does not consider an optimal level of arousal. The ERI model would suggest that a job role with low demands and low rewards would be satisfactory, which is incongruent with Yerkes-Dodson law.

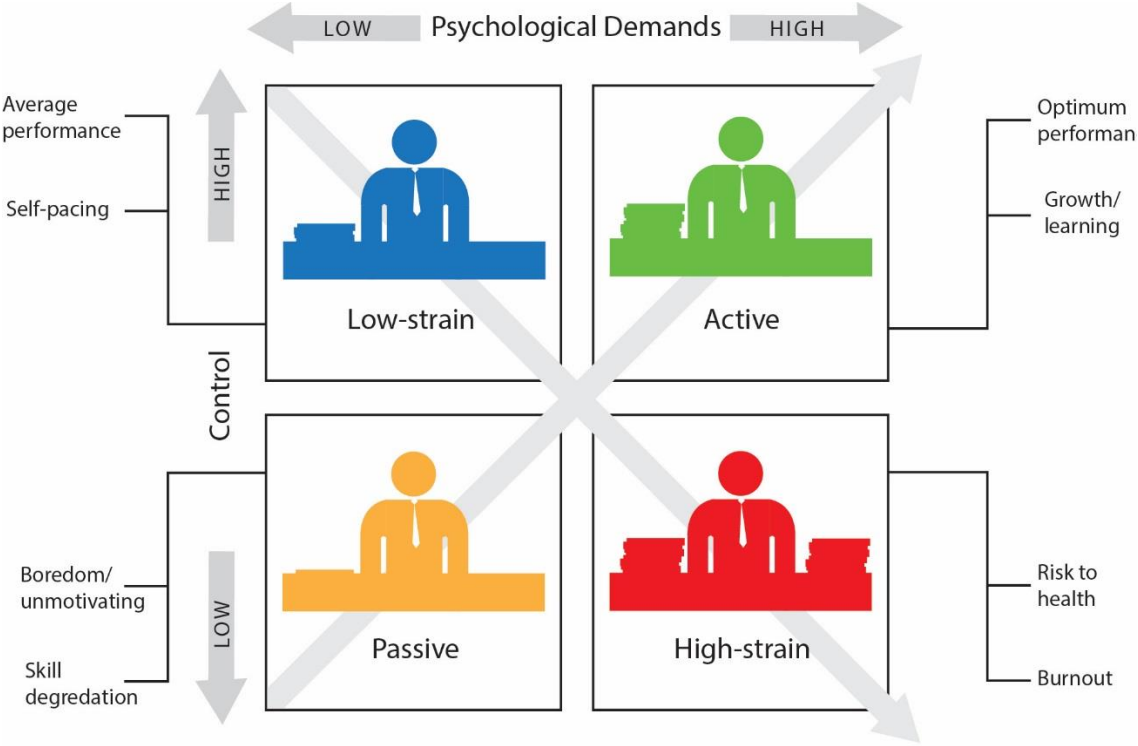
2.3 Job Demand Control (Support) Model (microscopic-mesoscopic)

A subsequent theory by Karasek and Theorell (1990) reintroduces the concept of beneficial arousal identified in the Yerkes-Dodson law, which is not discussed in the ERI. Karasek and Theorell propose in their Job Demand Control (JDC) model that employees in job roles with high psychological demands and low job control, are at a greater risk of experiencing depression, anxiety, fatigue and physical illness. On a biological level, the authors explain this in relation to a less severe form of the fight-or-flight response. When exposed to a stressor (job demand) workers experience an increased state of arousal to respond to that stressor. Karasek et al. theorise that when workers do not have enough control over the environment to respond appropriately to chronic work demands, that residual arousal energy is transformed into unused and harmful strain. This process is referred to as the job strain hypothesis. Conversely, workers with low demands and low control will be under-aroused, and experience boredom and a degradation of underused skills.

Karasek and Theorell (1990) proposed that when workers have both high control and high demands (but not overwhelming), they are in the most active types of jobs and experienced the most growth and learning, referred to as the active learning hypothesis (see Figure 2). Parallels can be seen here with the Yerkes-Dodson law, in that Karasek and Theorell propose that there is an optimum amount of stress arousal, and that too little and we are under-stimulated, echoing the Bexton and colleagues's (1954) findings on low stimulation environments. Karsek and Theorell's main theoretical innovation therefore is the concept of control as a mitigator of the stressor-strain pathway.

Figure 4.

The Job Demand Control Model



An extended version of the JDC model, the Job Demands Control Support (JDCS) model is also prominent in contemporary work stress literature. After the publication of several pieces of research finding a buffering effect of workplace social support on job demands, Johnson and Hall (1988) expanded the JDC model to include a social support axis. They proposed the iso-strain hypothesis: that jobs combining high demands, low control and in addition low workplace social support (isolation) would be the most detrimental to health. Johnson and Hall found support for the hypothesis, with an increased risk of cardiovascular disease for workers in high iso-strain jobs. Like the ERI model, the JDC(S) focuses on the stress experience of the individual. However, the addition of a third dimension to the model (demands, control, *support*) reflects a shift in the focus of work stress theories, as it measures a mesoscopic factor – the social support provided by the organisational group.

Like Siegrist, Karasek has also provided macrolevel contextualisations of his seminal theory. In 2008 Karasek elaborated on the JDC model to what he refers to as the "associationist" demand-control model. In this revised model, Karasek attributes contemporary economic and social organisation factors to the occurrence of stress and ill-health, and cites increasing globalisation processes and work complexity as reasons for his revision. Karasek revises his discussion of the JDC model to articulate work as subsystem, and that the model also applies to the larger socioeconomic structure. For example, control can relate to one's latitude to use their skills within the broad social structures they are engaged in, not just the workplace. Although the new associationist perspective helps contexualise the experience of work stress within the macrolevel context, these macrolevel factors lack empirical examination. In terms of empirical investigation and common usage, the JDC model can be considered a micro-mesoscopic theory of work stress, but this appears to be changing.

2.3.1 Evidence for the Job Demand Control (Support) model

Empirically there is mixed support for the JDC and JDCS models. In a literature review of the model spanning twenty years, Van der Doef and Maes (1999) examined research of the JDC and the JDCS across 63 samples. The authors found support for the strain and iso-strain hypothesis, yet less consistent support for the buffering effect of control was found. The authors concluded that the buffering effect was only present when job control provides control to a specific demands of the occupation, for example, the control an employee has over the use of their time buffering time-based demands.

Another limitation of the JDC is that it assumes a certain level of control is essential across all occupations. For example, an employee in a factory setting tasked with product assembly where products can only be assembled in a particular way (e.g. a hamburger chain) will be limited in the amount of control they could apply in performing their job role. Comparatively, an employee working in illustrative design would have a greater range

of means to approach the design of an image for a client, and it is necessary that they approach each client's task differently. Although all workers are likely to enjoy more control over their job, it is arguably more beneficial to certain job roles. In this regard, the control hypothesis is limited in its assumption of the generalizability of job control, as well as the universal efficacy the control buffering effect.

2.4 Job Demands Resources model (microscopic-mesoscopic)

Bakker and Demerouti (2007) present a similar argument, finding the literature provided support for Karasek and Theorell's strain hypothesis (the impact of job demands) but mixed results for the support of their buffer hypothesis (the buffering effect of job control); concluding that control can only *partially* buffer job demands. Demerouti, Bakker, Nachreiner and Schaufeli (2001) present an alternative model, the Job Demands-Resources (JDR) model. The JDR is a more generalisable model of work stress, stemming from the notion that different workplaces will have their own unique specific job conditions which can broadly be categorised as either demands or resources. As these categories are quite broad, a much larger number of variables can be conceived in explanatory models.

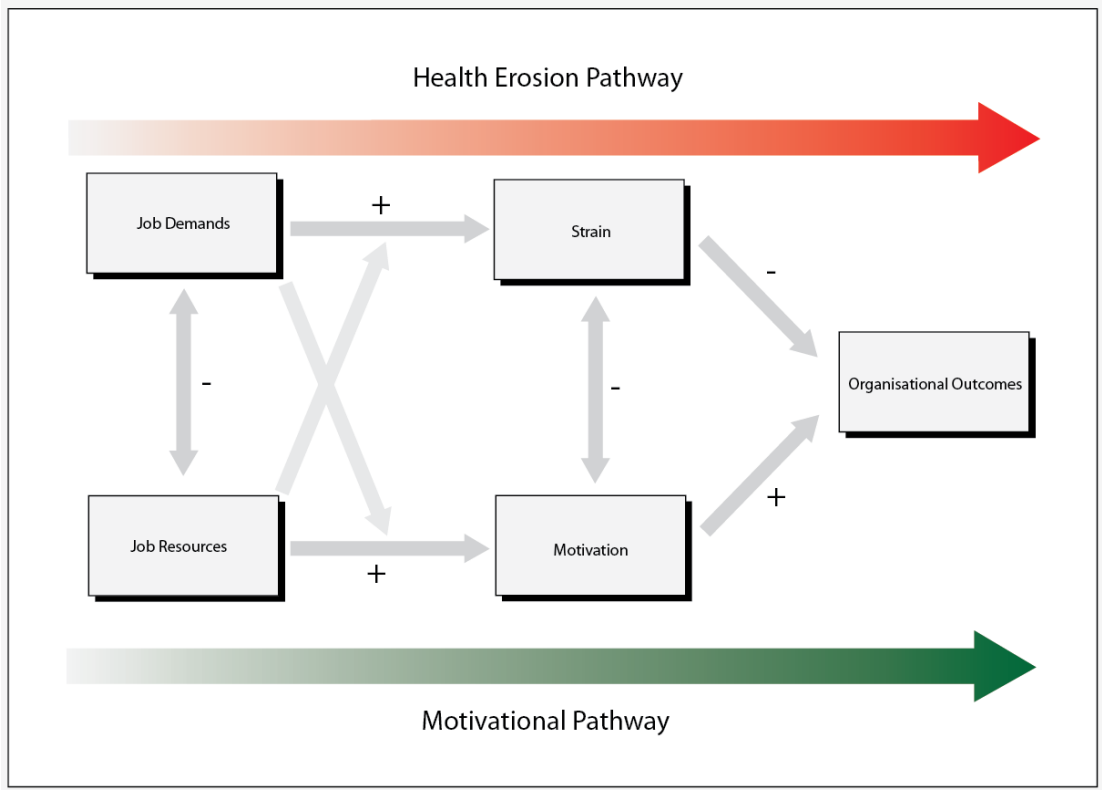
The JDR model proposes two key pathways in which demands and resources interact with strain. The health erosion pathway, where an excess of demands such as psychological and emotional demands, lead to strain related outcomes (i.e. the stressor-strain pathway). Additionally the JDR model includes a motivational pathway, where resources such as job control and social support lead to motivation and engagement. Both pathways have an impact on the organisation in terms of productivity and turnover (see Figure 5), as both motivation and strain have positive and negative effects on productivity respectively. Influenced by the JDC, the JDR includes the buffering effect of resources in the health erosion pathway, and conversely the inhibiting effect of job demands upon the motivational pathway.

Like the ERI and the JDCS, the JDR model aims to create a more complete explanation of stress at work by extrapolating on the types of stressors and manifestations of strain, however it also explores various *beneficial* working conditions (resources) beyond job control, support and rewards that relate to the experience of work stress. In this regard the JDR is a more holistic model, and demonstrates a continuing broadening of the scope over work stress.

The JDR model represents a greater shift towards mesoscopic analysis than its predecessors – or at least in their original manifestations, although it still emphasises microscopic factors pertaining to the individual experience of stress. Many of the prominently explored job resources are mesoscopic in nature, in that they are work group or organisational level resources, such as organisational rewards and workplace social support. Further, the JDR model places an emphasis on mesoscopic organisational outcomes, in that the erosion pathway may negatively affect the performance of a worker and therefore organisational outputs, and the motivational pathway will conversely improve performance. Conceptually, there is a further perspective shift towards the conditions and 'health' of the organisation, over the experience of the individual.

Figure 5.

The Job Demands Resources Model



2.4.1 Evidence for the Job Demands Resources model

Although the youngest of the discussed work stress models, the JDR model has already gathered strong support in the literature. Llorens, Bakker, Schaufeli and Salanova (2006) assessed the robustness of the model using measures of work overload as demands, and job control and support as resources. The authors found the structural pathways were consistent across Spanish and Dutch working samples, using electronic or paper data collection and using similar measures of the same constructs. Support for both the motivational and health erosion pathways have been found in several large cohort studies (Bakker, Demerouti & Euwema, 2005; Bakker, Demerouti, Taris, Schaufeli & Schreurs, 2003; Hakanen, Schaufeli & Ahola, 2008), although they have been limited to European samples.

Since its initial publication, several papers have added to the JDR model. Xanthopoulou, Bakker, Demerouti and Schaufeli (2007) tested the inclusion of personal resources (in addition to job resources) such as optimism and self-efficacy to the model. Xanthopoulou et al. found that although personal resources did not buffer the health erosion pathway, they did mediate the relationship between job resources and engagement. Hakanen, Schaufeli and Ahola (2008) also explored the role of home demands, and home resources; however they found that these external factors did not contribute to either the health erosion or motivational pathway.

2.5 Psychosocial Safety Climate theory (mesoscopic-macroscopic)

One of the more recent work stress theories, the Psychosocial Safety Climate (PSC) model, extends the theoretical framework of its predecessors by focusing on what precedes deleterious working conditions. It has been argued that work stress is fundamentally an *organisational* issue: the locus of work stress is organisational factors, and therefore research should be centred on organisational factors, not individual level factors (Dollard & McTernan, 2011). To address this the PSC model shifts the emphasis away from the employee to the organisational unit.

PSC theory centres on the shared perceptions of employees, on organisational policies, practices and procedures that foster a conducive work environment for psychosocial safety. These perceptions can further be divided into four unique and related principles: senior management commitment, management priority, organisational communication, organisation participation. If an organisation has a climate of positive attitudes and communication towards psychosocial safety, they are less likely to expose employees to working conditions that create excessive strain and ill-health. Further, these values and attitudes are likely to encourage the provision and usage of resources that help buffer or alleviate this strain.

In this regard, the PSC model is primarily a mesocentric work-stress theory, as the focus is on the organisational unit. In contrast, the JDCS model is microcentric (centres on the individual factors) but also mesoscopic (encompasses group-level factors i.e. social support within a unit). The scope of the PSC model burgeons towards macroscopic theory and analysis, as recent research has explored the inclusion of national-level influences within its theoretical model. Dollard and Neser (2013) examined aggregated data from five dataset and 31 European countries, finding a hierarchical pathway from socioeconomic factors (i.e. union density, labour market policies) to PSC, to worker health, and then GDP.

2.5.1 Evidence for Psychosocial Safety Climate theory

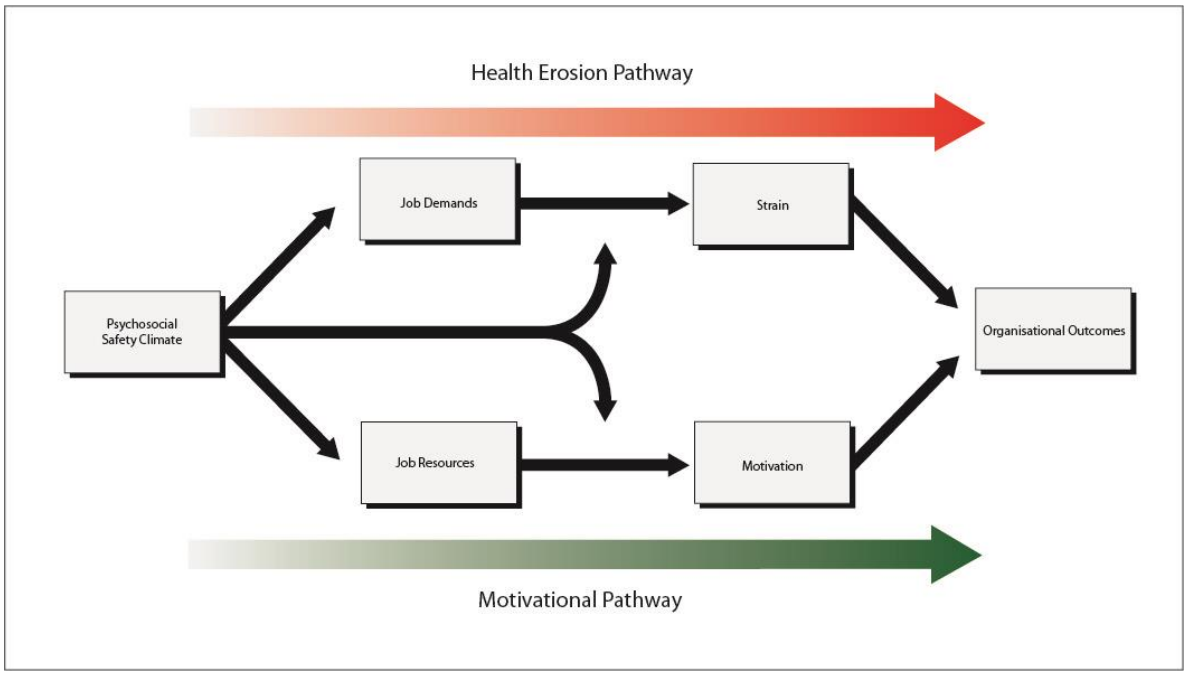
An advantage of the PSC model is that PSC functions as an antecedent to deleterious working conditions, and therefore is theoretically harmonious with other work stress theories (Figure 6) that examine the stressor-strain pathway from the stressor onwards. Several papers have explored this harmony, finding PSC precedes the health erosion and motivational pathways of the JDR model (we refer to this as the Psychosocial Safety Climate – Job Demands Resources (PSC-JDR) model. In a large Australian sample Law, Dollard, Tuckey and Dormann (2012) found PSC was positively related to work rewards and negatively related to bullying and harassment. Similarly, Idris, Dollard, Coward and Dormann found PSC to predict the health erosion pathway among Malaysian workers, where PSC predicted job demands (work load, emotional demands and psychological demands), which in turn predicted health problems.

In addition to having a primary function preceding workplace conditions, PSC is theorised to have a secondary function in buffering work stress. Dollard and Bakker explain that in this capacity PSC functions as a safety signal, where high PSC empowers workers confidence in their access to organisational resources, diminishing the perceived threat of demands. There is empirical evidence to support this. Dollard and Bakker (2010) found PSC buffered the relationship between emotional demands and emotional exhaustion.

Similarly, Hall, Dollard, Winefield, Dormann and Bakker (2013) found PSC buffered the positive relationship between job demands and depression.

Figure 6.

The Psychosocial Safety Climate - Job Demands Resources Model



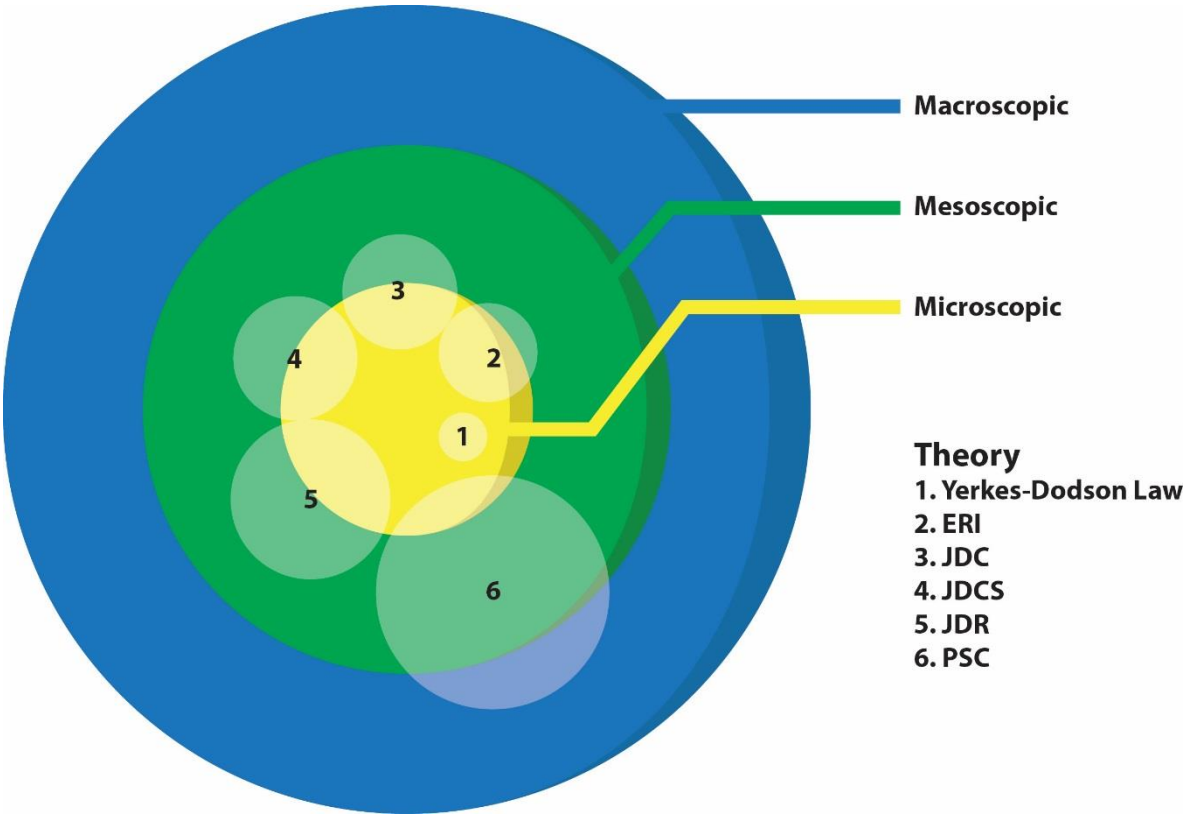
3. Discussion

The aforementioned literature represents the prominent theoretical perspectives in work stress research as they have emerged since the development of Yerkes-Dodson Law. The underlying stressor-strain pathway is evident in each theoretical model, and a trend is evident of each subsequent theory stemming from, and encompassing their predecessors. Like most theoretical development, the development of these perspective has been largely driven by an attempt to address the limitations of previous perspectives. For example, Hebb saw Bexton et al.'s (1954) laboratory study as evidence against Drive Theory, which helped spur interest and the development of Yerkes-Dodson Law. Likewise, Bakker proposed the

Job Demands Resources model, in part account for job-specific variability in the relevance of job control. However, in each successive model we have also seen a shift in scope. Work stress theories have not only changed to encompass an increasingly hierarchical framework, but have also shifted their central focus towards these mesoscopic and macroscopic factors (Figure 7).

Figure 7.

Conceptual Map of the Broadening Focus of Work Stress Theories



ERI = Effort Reward Imbalance Model, JDC = Job Demand Control Model, JDCS = Job Demand Control Support Model, JDR = Job Demand Resources Model, PSC = Psychosocial Safety Climate Theory.

3.1 Reasons behind changing focus

A potential contributor to the broadening focus may be due to the rise, and ensuing fall of social psychology in the United States. Many social psychologists were employed during WWII, to research both civilian and soldier adjustment during the war (House, 2008; Sewell, 1989), only to be reabsorbed back into academia (House, 2008). This post-war growth was hindered in the 1990s, due to greater ethical restrictions placed on human research, which has been argued as a source of its decline (Brannigan, 2004). Notorious studies such as the Stanford Prison, and Milgram Experiment raised significant ethical considerations during the 60s and 70s. In this regard, social psychology research may have shifted out of the laboratory, and into a naturally occurring social setting, the workplace. The influence of social psychology could explain for a shifting focus towards the work group (mesoscopic), and away from the working individual (microscopic).

Meso and macro-level contributors towards ill-health have also been gathering increasing prominence in public health literature which has likely influenced the development of psychological health related theory. In Labonte's (1992) socio-environmental approach to health promotion, the author notes that although heart disease is the main cause early mortality, in previous decades the main cause was infectious diseases. The primary cause of early mortality has changed with the course of human history, along with developments in technology and changing social and cultural behavioural trends. Fundamentally then, addressing cardiovascular disorder directly may have an immediate effect on decreases mortality rates today, however will not necessarily address the cause of early mortality in coming decades.

Illustrating the role of socio-environmental causes, Labonte discusses the gap between lower and higher socioeconomic status (SES) individuals in premature mortality rates, which has been increasing over time (Dahlgren & Whitehead, 2007; Meara, Richards, & Cutler, 2008). People with lower SES are more like to be living in neighbourhoods with higher crime prevalence and pollution, and be engaged in employment with poorer organisational resources and greater work demands. Fundamentally these environmental

factors precede the more proximal risk factors that lead to early mortality, and therefore addressing these upstream socio-environmental contributors circumvents implementing secondary strategies that target the direct causes which may change in the future. The growing attention towards environmental contributors in public health literature is likely to influence the related field of psychological heath and work stress, therefore spurring this change in direction.

The broadening scope towards macroscopic factors may also be explained by burgeoning organisational practices. As developments in communication and transport technology facilitate business operations across greater distances, into multi-hierarchical and trans-national structures, it is logical for theory to mirror this multidimensionality. Popular franchises such as the McDonalds restaurant franchise embody these transitions, having to navigate local and national health and safety regulations, as well as cultural practices that influence their daily operations. In this regard, these theoretical changes may be a product of both opportunity and necessity.

Another consideration is that developments in transport and communication technologies have facilitated the measurement of mesoscopic and macroscopic factors. The emergence of internet technologies in particular have facilitated communication between research institutions across national borders allowing for a greater ease of international collaboration, and collaborative datasets. Similarly, computer technology development has faciliated the ability to analyse this data. The techniques and software for multilevel modelling didn't emerge until the early 90s (Goldstein, 2011), and it wasn't until much later that access to this technology was widely available. Previous theories of work stress have been limited by the technology to test them, and this may too in part explain the broadening scope of previous work stress theories by their creators in recent years.

3.2 Future of work stress theory

If the development of work stress theories continues to mirror the broadening hierarchical changes of business globalisation, it is reasonable to assume that future work stress research will continue to expand in theoretical scope alongside this industrial expansion. Many managerial decisions can be delivered more readily via telephone of email, enabling teams across global states. It is plausible to see a stronger emphasis on national policy and culture as we see a rise in 'virtual teams', organisational units that span one or more country, as well as more culturally diverse teams due to technology that facilitates international travel and migration. The need for macroscopic work stress theories is therefore likely to continue to increase with this growth.

We therefore can propose that future research in work stress should consider adopting a more mesoscopic theoretical model such as the PSC-JDR model. This model offers the most holistic account of work stress, in that it accounts for the multidimensionality of contemporary business, and the hierarchical contributors that influence their practices.

3.3 Conclusions

Work stress theory is on a trajectory of continuing scopic expansion, mirroring the network and hierarchical expansion of business operations. Transport and communication technology developments facilitate this growth, and therefore increasing expansion is likely to continue with continuing technology development. Future research will need to adapt to these changes, to continue to explain the external influences on workplace stress.

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Chapter 3

Epigraph

In the past quantitative and qualitative research methods have been perceived as incompatible and irreconcilable ideologies (Bergman, 2008). However this attitude has changed in recent years, with proponents seeing mixed-methods research as a way of adding to the rigor of academic papers through the clarity qualitative research stands to offer (Bryman, 2006). One advantage of mixed methods research is that it can overcome a limitation that can occur when relying on quantitative methods alone, which is the formation of a research question in a vacuum (a lack of previous empirical research).

In the previous chapter we identified a suitable overarching theoretical model for this thesis: the Psychosocial Safety Climate - Job Demands Resources (PSC-JDR) model. When discussing job demands and resources, Bakker and Demerouti (2007) propose that each industry and organisation will have its own unique set of working conditions that will be pertinent to the stress experience. However in the present case, literature on the nature of work stress in the mining industry – the specific stressors relating to the occupation and its environment as well as the consequential effects on health and wellbeing – is scarce. Qualitative research helps guide specific questions for quantitative research, in identifying the key issues pertaining to the issue at hand, or locally. Alternatively, researchers run the risk of collecting data on unnecessary information or fail to collect data on necessary information (e.g., testing global theory). Identifying the key industry specific demands and resources for mining work allowed us to save time and reduce the research burden on participants.

For the present study I visited a remote worksite in South Australia, which primarily employed workers from Adelaide. Here, I immersed myself in the work environment when conducting my qualitative interviews. This firsthand experience of the FIFO mining

lifestyle not only led to richer responses as employees discussed work while in the work environment, but also helped in my enculturation within the industry. Afterwards, a comparative sample was collected online with mining workers from other countries. This allowed for a comparison of the experience of FIFO and non-FIFO workers.

Our qualitative interviews led to the development of local theory – theory that pertains to the particular population that exists within the overarching theory: the PSC-JDR model. In particular we found evidence for a unique phenomenon of proximity. Co-workers developed strong bonds, adopting familial-type support roles. Conversely, greater strain was placed on their relationships at home. This can be explained by the sociological concept of the 'proximity principle, where proximity encourages the formation of social bonds. However, our findings eluded to an opposing, 'displacement principle', where separation created strain and eroded social bonds. This concept was included into our theoretical model and explored in the subsequent paper.

Illustrative photography was also collected during the study, and is documented on the subsequent pages.

This paper is currently in press, as an accepted book chapter in the **2nd Asia Pacific Book on Psychosocial Factors at Work in the Asia Pacific.**

Figure A.

Mobile Processing Plant Used in Surface Mining



Figure A shows a mobile processing plant on caterpillar tracks, used for processing material in surface mining. I was impressed by the sheer scale of the machinery, which was the size of a large building and continues well outside of the frame of the photo. This is just one of many different machines used in the mining process. It's interesting to note the large amount of dust in the air, making the image appear blurry.

Several interesting safety measures are built into the design of the plant. Parts of the machinery are painted blue for visibility (important with all that dust!), as this is the most contrasting colour to the surrounding environment. High railing is adjacent to all walkways, on all sides of the plant. Lights are also installed around the plant ensuring visibility at all points of operation.

Figure B.

Residential Area for FIFO Mining Workers



In Figure B transportables, or *dongas*, are arranged for on-site accommodation. Concrete walkways connect the units, and lead to the remaining facilities at camp, such as the recreational facilities and the mess hall. Native flora is relatively undisturbed within and around the campsite, which despite the heavy industrialisation in area, reminds you of how far away you are from urban society.

Rooms are moderately spacious but more than reasonable, and are fitted with the essentials: bedding, linen and toiletries. Rooms are also equipped with air conditioning, televisions and DVD players. Each room also had its own en suite. On the whole, it was apparent that organisation was considerate of the comfort of its employees. Noise however was an issue, as the walls were quite permeable to sound. Machinery from the site was audible at all times, as well as the movements of your neighbours.

Figure C.

Wearing Personal Protective Equipment (PPE)



Australia is a world leader in work safety, and this a key priority for mining employers. Figure C shows some of the important Personal Protective Equipment (PPE) required of people working or visiting Australian mining sites. High visibility clothing is a must as noise and dust particles hinder the ability to notice other employees, which poses a risk when operating large and dangerous machinery. Mining machinery is large and powerful to extract dense material in large quantities, and creates very loud noise, making earplugs a must. Sand and dust are picked up by the wind, so workers must wear protective eyewear when outside. A hard hat is essential, in the event something is dropped from above or from rogue debris. Similarly, but not visible, steel cap boots are also required of workers to protect their feet from falling objects. Although I was not a worker, I was still required to adhere to the same safety standards as employees.

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Chapter 3

Beneath the surface: An exploration of remoteness and work stress in the mines

"These people become your family": On the job stress experiences for Fly-in/Fly-out workers

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Abstract

Advances in transport and telecommunication have facilitated a partial transition towards the remote employment of personnel in primary industries. Remote employment however requires stark lifestyle changes for employees. The aim of this ethnographic study was to explore the experience of stress and remoteness amongst miners. Nineteen mining employees participated in semi-structured interviews; 11 remote miners were interviewed at their place of work in a South Australian mining company operating a Fly-In/Fly-Out (FIFO) roster structure. Comparative perspectives were obtained from an additional 8 miners working in Australia and the Philippines also operating within a FIFO roster, and Canada and Sweden where miners lived in neighbouring mining communities. We used a grounded theory approach and the Job Demands Resources framework to identify the job demands, job resources, and outcomes unique to mining work. Our analysis revealed that work stress was a common experience amongst mining workers, with the potential to manifest into impaired psychological wellbeing and sleep. Work pressure and environmental exposure (e.g. wind and temperature) were identified as the most prominent job demands. Remote workers additionally experienced work-family and work-life conflict. In relation to resources, remote miners reported a unique experience of social support. Remote miners frequently work away from the family which strains familial relationships. Facilitated by increased proximity, co-workers assume an intensified supportive role than would typically be provided by friends and family at home. Physical and Psychosocial Safety climate were identified as upstream organisational factors that may precede or mitigate work stress and poor health outcomes.

Key Words: work stress, wellbeing, remote work, mining, social support

> "It's not like living with your own family. These people become your family essentially. You really have to make the most of it. The best possible situation is to try and get on with people, and not think too much about being isolated."
>
> – Australian FIFO Miner, Male

1. Introduction

Australia's vast landscape is abundant in valuable mineral deposits, presenting great potential for economic and industrial development. Problematically, however, the locations of these resources are largely dispersed inland at a great distance from Australia's coastal urban populations, creating an obstacle for organisations to recruit and deploy a workforce to operate within these remote regions. Comparatively, other major mining nations like the United States or South Africa have a higher population density and a longer history of mining, enabling greater infrastructure in the nearby communities adjacent to mining sites. However, developments in transport and telecommunications services coupled with significant growth in Australia's mining industry in recent decades, has generated Fly-in/Fly-out (FIFO) and to a lesser extent Drive-in/Drive-out (DIDO; but also referred to as FIFO due to similarity) employment practices. These practices of air or motor-vehicular travel for rotational shifts with accommodation on site, have become the industry standard for operating out of remote locations.

With a large number of new employees inexperienced with the machinery and industry practices required for operations having entered the mining workforce during the industry boom in recent decades, workplace safety is a substantial concern for employers. Further, lucrative employment prospects have stimulated a large number of workers to shift career paths, adding to the inexperience of the employee base. The safety risks are reflected

in mining carrying the second highest fatality rate in Australian industries (SafeWork Australia, 2011). A prominent review of the literature investigating health hazards in the mining industry by Donaghue in 2004 found quite an extensive range of research published. Donaghue found the risk of physical injury from manual labour and traumatic injury, as well as hearing hazards as the predominant risks; however little research was found investigating psychosocial risks to health.

Of the research available on psychosocial work factors, there has been a focus on the effect of the mining lifestyle on worker-family relations, as FIFO work rosters may strain familial relationships due to extended separation of miners from their families. When examining the relationship between job characteristics and life satisfaction, Iverson and Maguire (2000) found in a sample of mining workers living in a remote Queensland mining community, that worker family isolation (the extent that the worker reported that they and their family felt disconnected each other and friends) and low levels of kinship support had the largest deleterious effect on the worker's life satisfaction.

Surprisingly, although there is a large body of research on health and safety risks in mining, less attention has been paid to psychosocial risks such as work-family conflict. Existing research on this topic has focussed on the perspective of family members of mining workers rather than the direct experience of workers themselves. Kaczmarek and Sibbel (2008) found Australian children with fathers working in FIFO mining experienced no greater levels of depression or anxiety than other children; however their mothers reported greater stress relating to communication problems, support, and behavioural control within the family. Similarly, a focus group study of women living in a remote mining community found that women who moved to a remote town for their partner to work in the mining occupations reported social problems due to living in an isolated community and having moved away from their families and friends (Lovell & Critchley, 2010).

Greater psychological distress experienced by women living in mining communities, which are considered male-centric (Lovell & Critchley, 2010; Sharma &

Rees, 2007), has existed for decades, with cases of disproportionately high rates of psychiatric cases amongst women in mining communities documented as early as the 1970s (Burvill & Kidd, 1975). In either case of employees working on a FIFO roster or relocating their family to mining communities for work, a conflict between a worker's family and work role is a persistent and prevalent problem for the mining industry.

With exception to the limited research conducted on the conflict between mining workers employment and their family life, there is a concerning lack of research regarding the psychosocial factors pertinent to employee health and wellbeing in the mining industry. Poor employee wellbeing is associated with impairments to productivity and increased turnover (McTernan, Dollard, & LaMontagne, 2014). Given the key economic contribution of mining in several developed and developing nations, the health and wellbeing of mining employees is vital in securing the industry's prosperity. Further, considering prevailing safety concerns within the industry, identifying psychosocial factors that contribute to psychological strain will allow organisations to target these safety factors to prevent on-site accidents and injuries. Identifying and addressing concerning psychosocial factors, in particular now that industry growth is stabilising, stands to help reduce future industry accidents and mitigate wellbeing-related productivity deficits. Understanding contributing factors that may mitigate these deleterious outcomes is therefore beneficial to employers and employees, as well as offering insight into primary industries that adopt FIFO rosters such as oil and gas.

However, several barriers exist that could hinder this line of enquiry, and could explain the current absence of available research. First, evidence suggests that a strong stigma towards mental health and help seeking exists in Australia's rural and remote communities (Rost, Smith, & Taylor, 1993). These attitudes may create resistance in people within mining communities from engaging in psychological research, and this may be particularly exacerbated by concerns of confidentiality from their employers. Second, mining workers are predominantly male and men are more reluctant to seek help with mental health, as seeking help is perceived as not 'masculine' (Galdas, Cheater, &

Marshall, 2005). Since mining employees are predominantly male employees working in isolated environments, a substantial barrier is evident that makes research on mental health in mining more challenging.

Despite playing a major role in the global economy and the well understood risk factors associated with the physical work role, the psychosocial aspects of mining work have gone largely unexplored. To address this gap, an ethnographic explorative study was conducted in an Australian mining company, involving eleven semi-structured interviews. This was repeated in a follow-up online sample of eight participants across countries to cross-validate findings. As there is little available research on psychosocial health in the mining industry, a qualitative study provides not only descriptive insight into uncharted territory, but also provides a starting point for future quantitative investigation.

1.1 Theoretical framework – The Psychosocial Safety Climate - Job Demands Resources model

The Job Demands Resources model (JDR; Demerouti, Bakker, Nachreiner & Schaufeli, 2001) is proposed as the theoretical scaffolding in the design and analysis for the present study. The JDR model has gained popularity in psychological stress research literature, due to its conceptual flexibility to occupational and organisational differences, as well as being theoretically harmonious with other contemporary work stress theories, i.e. the Job Demand Control Model (Karasek and Theorell, 1990) and the Effort Rewards Imbalance Model (Siegrist, Siegrist & Weller, 1982). The JDR model posits two distinct yet interconnected pathways of psychosocial factors and outcomes: the health erosion pathway, where excessive workplace demands lead to psychological strain by way of heightened stress arousal that depletes energy reserves; and the motivational pathway, where workplace resources enable a worker to perform job tasks that lead to positive workplace outcomes, such as increased engagement. Further, research suggests that these two pathways are interconnected. A range of workplace resources have been found to

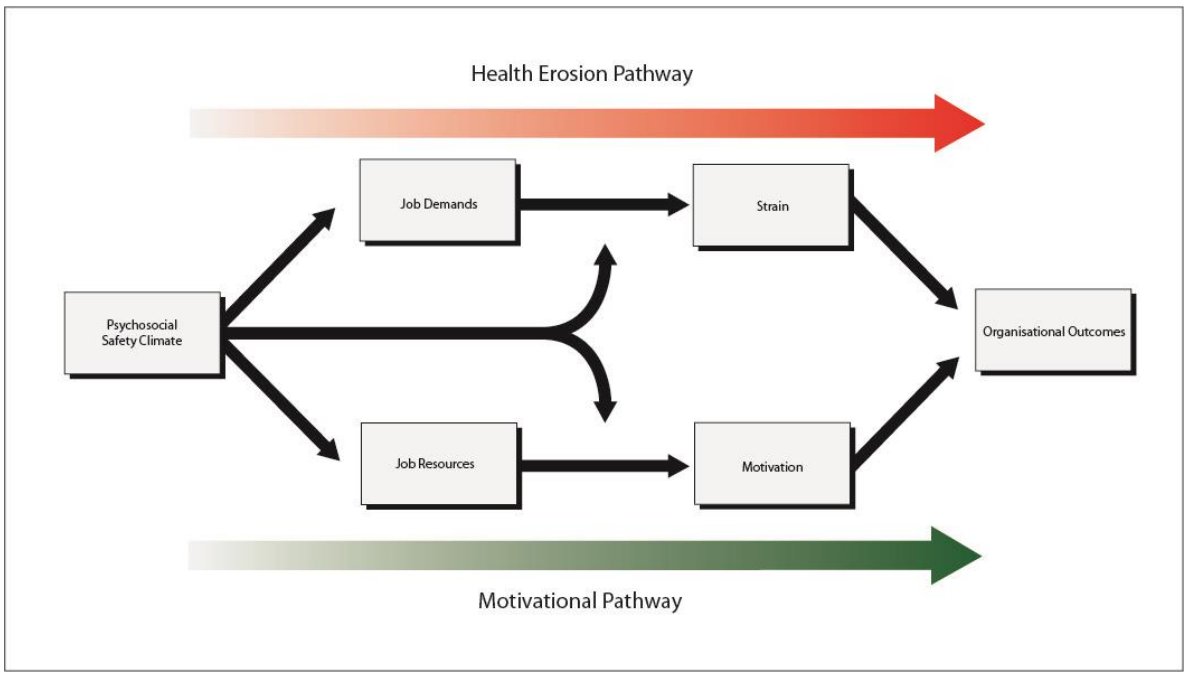
buffer workplace demands thereby minimising psychological strain (Bakker, Demerouti, & Euwema, 2005).

Researchers Bakker and Demerouti (2007) propose that workplaces are unique, and therefore that the types of workplace demands and resources experienced by workers are unique to the organisation and work role. With this in mind, Bakker and Demerouti identified the important role of qualitative investigation, prior to conducting quantitative research, to explore and identify the core features of an unknown work environment. Given the unexplored psychosocial characteristics relating to mining work, the JDR model is an ideal framework for guiding conceptualisation in the present qualitative study.

Recent research by Dollard and colleagues (Dollard & Bakker, 2010; Dollard & McTernan, 2011) extends the JDR model to account for organisational system antecedents of workplace demands and resources. Psychosocial Safety Climate (PSC) – the policies, practices and procedures within an organisation relating to its values and attitude towards psychosocial health safety – is a distal predictor of both the health erosion and motivational pathways of the JDR model. Safety climate refers to the present state or 'temperature' of an organisational safety culture. Further research by Idris, Dollard, Coward and Dormann (2011) has shown that PSC is a construct unique from physical safety climate and individually predictive of workplace psychosocial risk factors. By targeting upstream safety climate factors, organisations may minimise some of the negative downstream consequences. PSC has also been found to function as a safety signal that buffers stress (Dollard & Bakker, 2010), by empowering workers confidence in organisational psychosocial resources. Therefore, the Psychosocial Safety Climate – Job Demands Resources (PSC-JDR) model is used as a guiding theoretical framework for the present study (Figure 1).

Figure 1.

The Psychosocial Safety Climate - Job Demand Resources Model



Using this model as a guide the authors aim to identify the key demands pertinent to remote and non-remote mining workers, the key resources that help workers manage job demands, and the way in which job strain manifests.

2. Method

2.1 Sample 1

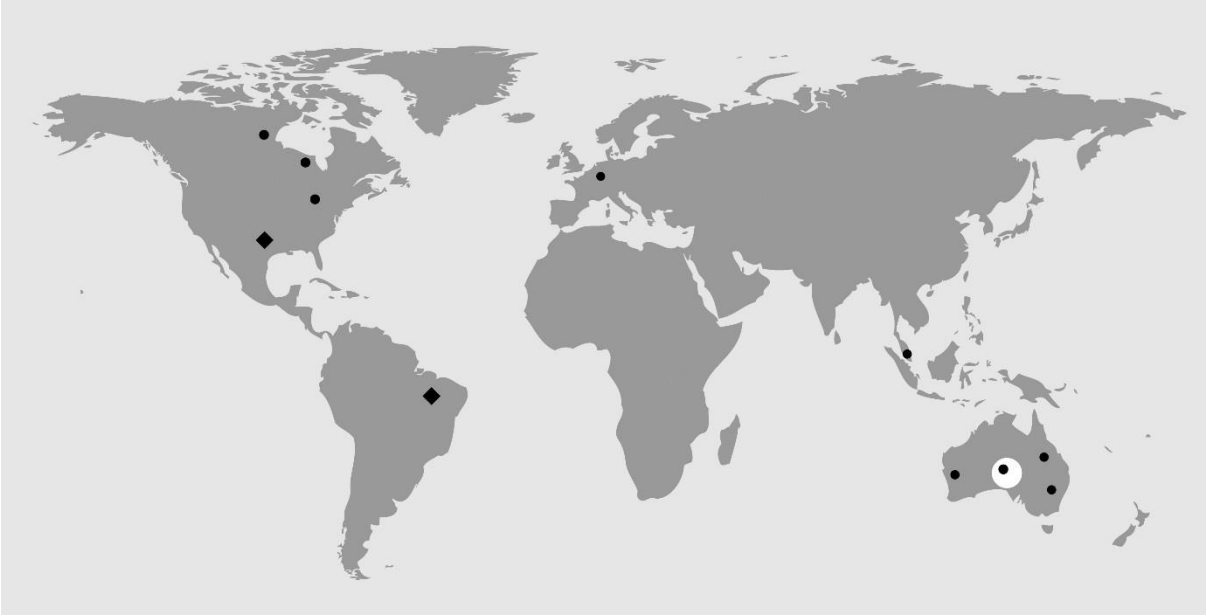
In early 2012 mining organisations with work sites located in South Australia were approached for involvement in this study. By mid to late 2012 a company had agreed to facilitate the interview process with its employees. Interviews were conducted on the mining site late 2012, and with the exploration team at their central office early 2013. A purposeful sample was chosen to acquire a representation of typical company demographics (such as age, gender and occupation; see Table 1). To safeguard anonymity, further industry demographic identifiers (e.g. geographical region and minerals produced) are not disclosed. Sample 1 comrpised of 11 employees.

2.2 Sample 2

A second sample was used to cross-validate, and possibly add to the findings of Sample 1. An information letter targeting the network's mining community was posted online in a social media network website reddit.com. The interview techniques of the initial sample were repeated, except face-to-face communication was replaced with personal communications via the networks forum and email liaison. This resulted in an additional 8 mining employees participating in Sample 2 from Australia (n = 4), Canada (n = 2), Sweden (n = 1) and the Philippines (n = 1). Two additional employees from the United States and Brazil were removed due to insufficient data from interviews. A visual data map of the data origin is presented in Figure 2.

Figure 2.

Data Map of Sample 1 (11 Participants) and Sample 2 (8 Participants)



White circle represents the location of ethnographic interviews. Black circles represent transnational comparative sample. Black diamonds represent interviews removed due to insufficient data.

2.3 Materials

Questions from two previous grounded theory studies that also examined work stress (Idris, Dollard & Winefield, 2010; Kinman & Jones, 2005) were used as a basis for interview question structure. Questions were modified and expanded to specifically draw out the types of demands, resources and outcomes as per the PSC-JDR framework. Participants were additionally asked to add any information they felt was relevant but not covered in the initial questions, and were given the opportunity to ask the interviewer questions about the research. Interviews in Sample 1 were recorded using a voice recorder with the participants' permission. Before commencing research ethics approval was obtained from the University Human Research Ethics Committee.

2.4 Procedure

A gradual mode of inquiry was introduced in the present study: successive stages of incremental questioning were adopted to facilitate interviewee comfort and disclosure.

Stage 1. The first stage inquired about the general experiences of workers within the mining industry. Considering the stigma towards mental health in rural Australian communities (Rost, Smith & Taylor, 1993), and the rural culture of mining sites, we anticipated reluctance to discuss personal experiences of mental health strain. For this reason, interview questions were initially directed to the broad experiences of mining employees in general, instead of directly asking about the interviewees experiences.

Stage 2. The interviewer then followed up interviewee responses by asking participants about their own experiences, for example: "you mentioned many of the workers have issues with being away from their families; is this something you've experienced personally?" By asking broadly, then moving towards individual experiences, we increased the likelihood of participants sharing information by easing the participant into a level of comfort to discuss personal issues.

Stage 3. Finally, participants were asked to think back to a workplace event that demonstrated a particular stressor raised in the previous two questions; this form of mentally re-living an event to trigger contextual memories is based on context-dependent memory theory (Smith, 1994). Context-dependent memory theory proposes that contextual information is stored with the memories of a given phenomenon, and by thinking back on the environmental context, and mentally walking through the event, richer memory information will be triggered from the arising contextual cues. A common example of this mechanism is re-tracing your steps when trying to remember where you placed your car keys.

We proposed that this novel approach of gradually increasing the depth of inquiry would result in a better quality participant responses, and maximise interviewee comfort.

Before conducting the interviews, several trial interviews were conducted with peers of mixed age and gender. This process allowed for question refinement to minimise unnecessary jargon, and for rephrasing of questions to improve the overall transition between questions and clarity.

2.5 Analysis

We aimed to evolve a local theory of work stress in remote mining work, by identifying phenomena unique to remote mining workers and placing this within the broader PSC-JDR conceptual framework. Grounded theory (Glaser, Strauss, & Strutzel, 1968) was adopted as the framework for coding data and analysis. Grounded theory has been described as a form of reverse-hypothesis generation, an inductive process where data is coded into emerging themes that then guide the development of theory.

Recorded interviews from Sample 1 were transcribed into the word processing software, Microsoft Word 2013. Interviews from Sample 2 were additionally transferred to Microsoft Word so that both sets of interviews could be formatted and checked for spelling before being transferred into NVivo version 10 for analysis. Key themes were then

explored in terms of the over-arching PSC-JDR theoretical framework, creating a base for local theory development. After initial coding, a cluster analysis was conducted to identify overt node overlaps (where similar terms are used by participants interchangeably such as mental/psychological).

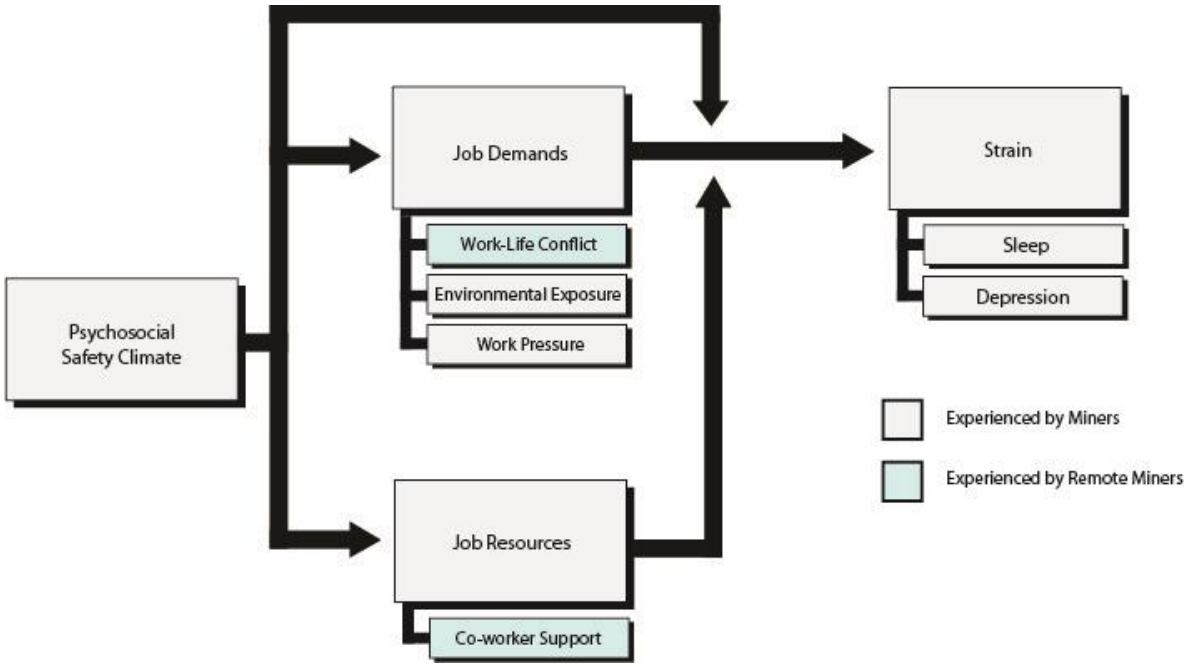
Thematic analysis was conducted with consideration to Braun and Clarke's (2006) discussion on appropriate theme identification and coding, where thematic classification is a process of examining intra and inter-interview theme frequency, as well as its relevance to the research questions. In consideration of these guidelines, identified themes were discussed by more than 50% or more of interviews, and in most instances over 70%. Consistency of responses emerging in the interview process between Sample 1 and 2 indicated a point of saturation had been reached.

3. Findings

Using the Psychosocial Safety Climate - Job Demand Resource Model as a guiding theoretical framework, several themes emerged (Figure 3). A common experience of job demands were work pressure, physical environmental exposure, and work-family conflict. In terms of job resources, remote miners frequently reported social support from co-workers, which helped them cope with stress. Outside of job demands and resources, safety culture was identified as an organisational factor that may precede or reduce work stress and poor health reactions. Interviewees identified management and employee attitudes towards safety as a cause of good safety practices and prevention of safety incidents. The most prominent strain-related outcomes related to wellbeing and sleep. Next we elaborated these themes, and mapped these with relevant literature. Themes and illustrative quotes are provided in the tables below, as well as the participant number, page number, and paragraph number (P#.#.#).

Figure 3.

Local Model of Work Stress Amongst Mining Workers



3.1 Safety climate

Safety climate, that is the present state or *temperature* of an organisation's safety culture, emerged as a prominent theme among the remote and non-remote mining workers. The remote Australian miners from Sample 1 and one from Sample 2 indicated that safety was a topic everyone cared about, that they felt responsible for the safety of their co-workers, and that their co-workers were responsible for their safety. Interviewees also described safety culture as something that was evident amongst employees on the ground, as well as a priority driven by management.

Both Zohar (2000) and Dollard (Dollard & McTernan, 2011), theorists in physical and psychosocial safety climate respectively, propose that safety climate is a multi-level construct evident in unit level safety practices as well as top-down management driven policy implementation. Interviewee responses supported the multi-level interpretation, expressing a perspective that management was highly concerned with the safety of

employees (Table 1: P10.18.3) as well as fellow co-workers (Table 1: P8.2.1) and that this cultural attitude spanned the entire worksite (Table 1: P8.4.2).

Comparatively, a non-FIFO miner in Canada and a FIFO miner in the Philippines from Sample 2, both mentioned concerns regarding safety practices. The Canadian miner mentioned experiences of working on a sleep debt, and a concern that unsafe working conditions may lead to worker fatality. Similarly, a FIFO Filipino miner raised similar concerns, suggesting the site was behind in safety practices compared to 'modern' mining sites (Table 1: P20.1.5). It's possible the strength of safety climate may then be partially explained by socio-political factors, rather than the influence of FIFO contracts. This supports the finding of national socio-political influences (e.g., union density) on safety climate, as elaborated by Dollard and Neser (2014).

Amongst the remote Australian miners, safety climate attitudes predominantly pertained to physical safety, however indicators of psychosocial safety climate emerged within interviews but to a lesser extent. Within one of the Australian mining organisations, employees were provided with telephone counselling services through an anonymous employee assistance program. One interviewee noted that although there was a high concern for physical safety, mental health was an area of growing area of interest within industry. Findings therefore suggest that psychosocial safety may be an underdeveloped but emerging area within the industry.

Aside from overt physical safety practices such as the effective use of Personal Protection Equipment (PPE) and fatigue management, workers engaged in a variety of co-worker monitoring based physical safety practices. Interviewees mentioned the use of both formal and informal "buddy systems". A new employee might get paired with an experienced employee to help them transition into the job role. Additionally, it was common for employees to develop an informal relationship with another worker to check

up on them in terms of their health and wellbeing. In this regard, safety culture (physical and psychosocial) was shared and active amongst employees.

3.2 Job resources

3.2.1 Co-worker support

Co-workers support was the most frequently reported, and multi-faceted psychosocial job resource remote Australian interviewees discussed (it was not discussed by the remote Filipino worker). They reported that the physical proximity to their co-workers with whom they lived and worked for extended periods (typically between 8 and 14 days), led to an increased level of social proximity and more salient relationships compared to other previous work arrangements. Interviewees noted that they shared the same living, social and work environments as their colleagues, including sleeping areas, eating areas, and social areas (such as the recreational room and gym facilities). In this regard workers had a 24 hour exposure to co-workers, leading to the formation of unique relationships.

The social support relationship between colleagues involved typical support roles, such as providing aid in completing work tasks, however several atypical behaviours were reported. Workers mentioned relying on each other to talk about personal problems such as issues with their family and home life. Additionally, workers reported 'watching out for each other' in terms of emotional and psychological wellbeing, and being highly aware of each other's mannerisms so that they would notice when they were struggling with home or work problems. The frequency that this level of disclosure was reported, and the degree of attention to their peers' psychological wellbeing, is indicative of a more personal rapport in mining site relationships compared to traditional work relationships.

Further, the majority of these workers reported that their co-workers were like *family* (Table 1: P11.1.6; P4.9.2; P2.5.6; P8.5.6). This type of behaviour did not emerge in the interviews with workers that were not on FIFO contracts with exception of one interviewee.

One non-Australian employee worked FIFO in the Philippines, however co-worker support did not emerge as salient during the interview process. It is likely that this type of behaviour is therefore directly due to the FIFO roster structure (which are typically longer in the Philippines), or perhaps specifically to FIFO in Australian work environments.

Table 1

Job Condition Characteristics and Illustrative Quotes of Distal (Safety Climate) and Immediate (Co-worker Support) Job Resources

Job condition	**Characteristics**	**Illustrative quotes**
Safety Climate	A concern for safety across organisational hierarchy Management makes the safety of workers a priority Employees are concerned for the safety of each other Attitudes towards safety are shared amongst workers Safety attitudes are predominantly towards physical safety, but psychosocial safety is an emerging area of attention	"That's management… A focus of trying to get everybody to think of safety as a package, not as a statistic." (P10.18.3) "The biggest thing is coming home safe. It's the most important thing." (P8.2.1) "That strong safety culture is something I like about this place." (P8.4.2) "For the mining practices, we are lagging in terms of safety… overall it's really not that great, at least compared to modern mines." (P20.1.5)
Co-worker support (FIFO)	Co-workers provided each other support on a range of work related and personal issues Supportive relationships increased with their proximity to co-workers Co-workers adopted familial-like support roles on site, acting as surrogates for the social support they would typically receive from friends and family at home	""These people become your family essentially". (P11.1.6) "Because they're away from their families, people create a family". (P4.9.2) "Here it's a close-knit family". (P2.5.6) "We kind of joke sometimes we know each other too well…. We're like family." (P8.5.6)

P#.#.# = Participant, page number, and paragraph number.

3.3 Job demands

3.3.1 Work-life conflict

Australian workers expressed a variety of ways in which their work conflicted with their personal life, attributable to long working hours and the FIFO roster. Conflicts with their family role appeared to be the most severe form of personal life conflict, as being away from home created stress by not being available for a family member when they were needed to contribute to family duties or if there was an emergency. Workers with or without families both reported a difficulty in finding time to maintain personal relationships, and this inhibited workers from forming new relationships outside of work. Workers also reported that being away from their social circles most of the time meant friends assumed they were unavailable even when they were home, making their social life suffer. Although most workers could comment on these difficulties that a remote work schedule created, there was a strong sense of ownership towards their circumstances. Workers acknowledged remote mining as a lifestyle choice, albeit one not suitable for everyone – expressing the strain it places on families and personal relationships (Table 2: P5.5.2).

Outside of affecting personal relationships, workers also reported that FIFO rosters influenced their ability to maintain personal routines, in particular the ability to keep a consistent pattern within the week of allocating time to a personal activity or hobby. Workers mentioned that they could not commit to sport because they are not able to consistently make it to games or training sessions (Table 2: P9.3.1).

Workers also reported that work conflicted with their exercise routines, as they had far less time to exercise when on their swing (period of roster rotation on site) than when at home, making it difficult to allocate a consistent time during the week for exercise. Workers also reported that going back to the same sleep/wake cycle as partners and family members when off swing was difficult. In all of these cases, it was the inability to maintain a consistent weekly routine, due to sporadic changes in use and availability of time that caused conflict with their personal life and created stress. Comparatively, mining

employees from who did not operate on a FIFO roster did not report the same conflict with their personal life. Although this does not suggest that mining workers who are not on the isolated rosters do not experience some form of work-life interference, it is likely that it is a greater issue for remote miners.

3.3.2 Environmental exposure

Remote FIFO Australian interviewees reported exposure to extreme temperatures when working outdoors where employees may spend twelve or thirteen hours. One worker reported that it was not uncommon for the temperature to reach upwards of 45 degrees Celsius (113 degrees Fahrenheit) in summer. Conversely, at night the temperature can drop rapidly, presenting a robust range of temperature for the body to be exposed to, and to adapt to. One worker expressed the change between extreme heat and cold to be physically uncomfortable (Table 2: P4.4.10).

Wind and air particles (sand, dust) were additional forms of environmental conditions that affected employees amongst Australian FIFO employees. Heavy winds were discussed as something that exacerbated the heat. One employee noted that workers were more prone to get agitated or grumpy on a windy day. Similarly, employees were required to wear safety glasses, as a heavy wind could pick up sand and dust which could get in an employee's eyes. Temperature related environmental exposures were also mentioned by a non-FIFO worker. One Canadian interviewee noted working in minus thirty degrees Celsius was common, and that the cold can affect a worker mentally. Considering that many of the major mining nations (e.g. Russia, Australia, and Canada) have regions of extreme heat and cold, environmental exposure is likely a common job demand across the industry.

Several strategies were reported for reducing heat-related stress. One strategy was to work at a medium pace, so that a constant pace could be maintained and heat exhaustion avoided. Additionally, monitoring the water consumption of one another was also reported.

One worker noted that it was difficult to monitor their own hydration, so workers would keep an eye on one another and watch for physical (e.g., lack of perspiration) and behavioural cues (e.g., a slower verbal response). This type of behaviour was suggestive of a strong over-arching safety culture within the organisation, as this was expressed by several employees from the same worksite.

3.3.3 Work pressure

Remote Australian workers of Sample 1 and 2 reported working long days when on site, where a typical working day were described as 12 to 13 hours. Interviewees working these hours reported this as a difficult aspect of their job role, whereas those who worked more typical hours on a non-rotational roster reported no difficulty with the work hours compared to their experience working long hours when engaged in a FIFO roster. Long hours were considered a difficult work demand for two reasons. First, they provided an extended exposure to work demands, and therefore a long exposure to stress arousal. Second, working longer hours resulted in less time remaining in the day for recovery.

Both Australian miners, and miners interviewed from other regions in Sample 2 reported various types of work pressure. Employers were aware that should production be hindered, or that a mistake be made on their behalf, that the resulting effect on work production had major financial implications (Table 2: P6.1.6). Other types of pressure included the responsibility of working with dangerous machinery. This included a concern of driving a truck into other machinery incurring large costs to the employer, or the risk of hitting a co-worker that could result in injury or death (Table 2: P4.3.4).

Table 2

Job Condition Characteristics and Illustrative Quotes of Job Demands (Work-Life Conflict, Environmental Exposure and Work Pressure)

Job condition	Characteristics	Illustrative quotes
Work-Life Conflict (FIFO)	Time and energy required for work makes it difficult to meet family commitments Workers experience strain on their relationships due to their work commitments Workers feel they do not have enough energy to talk to family members Workers find it difficult to maintain friendships	"Your family has got to support you being out here. You've only got to look around the industry and most of the guys are in their fifties and on their second or third marriage…. It does have that sort of effect on your family life, and not every relationship is built for it." (P5.5.2)
	Workers cannot commit to a routine, such as being part of a sporting team	"Being out of the settings where you would normally exercise, it's hard to join a sports club, it's hard to live your lifestyle tailored to you." (P9.3.1)
Environmental Exposure	Employees work outdoors, with a higher frequency of exposure to the environment Employees work in regions with more severe temperatures both hot and cold Workers are exposed to dust in sandy regions Workers are exposed to noise from the machinery and equipment	"We all go through the first aid and stuff... You are watching people like 'look, go sit in the car', you try and avoid that… but sometimes you may not realise it, it will creep up on you… I don't think I've ever had anything physically go wrong with me… even in the last few days I have been pretty hot. It just dries you out because it's so dry… It can be quite physically uncomfortable here. It's either extremely cold or extremely hot." (P4.4.10)
Work Pressure	Workers are required to work long hours, more so if they are on a FIFO type contract Workers are concerned that mistakes could cost their employer gross	"This [job] puts a lot of pressure on you, especially the kind of job I'm doing, where every decision I make might cost millions… That's stressful." (P6.1.6)

	amounts due to the value of the material produced	
	Workers are concerned that mistakes could cause serious injuries or fatalities due to the dangerous nature of the work and the machinery used	"Our work can be quite physical… and quite dangerous… mentally it's draining, because you're watching all the time. You know you don't want to run someone over, you could lose a hand or finger, yeah so you've got to be quite vigilant." (P4.3.4)

P#.#.# = Participant, page number, and paragraph number.

3.4 Health outcomes

3.4.1 Sleep

Sleep disturbances were reported as not only a potential outcome of stress from work, but also something that can exacerbate it. This was found in the first sample and verified in the second. Interviewees commented on how the thin walls of the living quarters allowed noise to transfer between adjacent rooms quite easily, so that workers had to be careful with the amount of noise that they made so not to disturb other employees (Table 3: P10.5.1). Further, having employees working different hours during the day meant a person's sleep patterns may be disturbed by their neighbours.

Several comments were made about how poor sleep can affect a workers job performance, by both remote Australian miners and non-Australian miners. One Canadian miner reported noticing workers on a sleep debt making frequent job errors, exacerbated by the cold (Table 3: P18.3.4). In this regard, although rotational shifts such as FIFO rosters may aggravate the sleep disturbances, sleep may be a particularly important concern for the industry as a whole.

3.4.2 Wellbeing

Several ways in which work demands affected worker wellbeing were discussed in Sample 1 and verified in Sample 2. Low mood, feelings of anxiety or feeling depressed were reported as a possible outcomes of stress that arise from work, in particular if an employee was having problems coping with working on a FIFO roster. Mood appeared to also be directly tied to co-worker relationships, as support or conflict from another co-worker would help or deteriorate mood (Table 3: P11.3.4; P9.8.7). In this regard wellbeing status may be preceded by work-family conflict issues that arise from FIFO rosters, but the negative impact could be mitigated by co-worker support.

In a severe example, a Swedish worker from Sample 2 working underground commented on the psychological effects of light deprivation and isolation, observing a co-worker 'bark' at the walls, from spending too much time underground (Table 3: P14.3.2).

These responses are not surprising, as a decline in wellbeing is a typical strain outcome of stress according to the JDR model of work stress. However, it may be the case that remoteness and isolation associated with mining work appears to exacerbate the concerns relating to mental wellbeing. Difficult working conditions, such as light deprivation, may pose further risks.

Table 3

Job Condition Characteristics and Illustrative Quotes of Health Outcomes (Sleep and Wellbeing)

Job condition	**Characteristics**	**Illustrative quotes**
Sleep	FIFO workers experience difficulty getting to sleep, and staying asleep due to noise permeating the thin walls of transportable accommodation Workers were more likely to make mistakes at work when they had inadequate sleep	"Then it can get pretty tough. You know because it can be hard to sleep. … a lot of our earlier accommodation where you've got these dongers where you've got four rooms per building, but the insulation in them is not all

		that flash, …they're noisy, they wobble if someone walks up one end. Everyone up the other end can feel them walking into their room." (P10.5.1) I have experienced irritability with co-workers while trying to perform physical tasks on a sleep debt many times. A common example might be lining up a drill at 3 am in the dark in -30 C temperatures and having the driller consistently overshoot its correct placement." (P18.3.4)
Wellbeing	Experience of decreased mood or increase in anxiety Workers may withdraw socially due to a decrease in mood Experiences of increased temper, or becoming agitated more easily Difficulty concentrating on work tasks due to feeling down or depressed	"There are little subtle signs you see. People sometimes you know - one of the signs is that they can go into their shell a little bit. They can get a little depressed a bit because they're not getting their point across, no one kind of understands them." (P11.3.4) "Your mood becomes affected so it's harder to work with everybody. Losing sight of, you know, normal kind of level work problems, and maybe narrowing down to little things that aren't such a big deal." (P9.8.7) I've just once seen and heard of a guy going nuts down there. In the beginning he would stand in completely dark places and "bark" at the walls." (P14.3.2)

P#.#.# = Participant, page number, and paragraph number.

4. Discussion

This study explored the unique working conditions of the mining industry and the implications of remoteness on workers, and aimed to build a local theory of stress framed on the Psychosocial Safety Climate - Job Demands Resources (PSC-JDR) model. The finds of our survey add qualitative support to the PSC-JDR model, in that interviewees reported a causal relationship between the discussed job demands and outcomes, as well as reporting a buffering effect from co-worker support. Further, the unique experience of certain demands and resources further supports Bakker and Demerouti's (2007) proposition that industries will differ in the types of demands and resources experienced. Our study extends theory however by identifying a unique proximity effect to social support, discussed below.

The qualitative investigation reported here lays down the initial ground work for future quantitative research by identifying the key industry-specific constructs relating to the stress pathway for mining workers, in particular the areas more prevalent for remote miners. Further, qualitative data can help understand additional facets of issues within the industry that are already identified.

One such example within the present study was work-family/ work-life conflict associated with remote work, which places strain not just on familial and peer relationships, but also on the worker's ability to maintain sporting and leisure hobbies. This disruption of personal routines, which goes beyond maintaining social relationships and into maintaining intrinsic self-actualisation processes from sport and leisure activities, is a previously undiscussed facet of work-life conflict that may warrant future investigation. Additionally, these types of activities aid in stress alleviation (Zuzanek, Robinson & Iwasaki, 1998). Inhibiting regular engagement in these activities may remove some of the pre-existing stress buffering mechanisms workers utilize.

Our findings on safety culture within the Australian mining sample also provides interesting insights into industry culture. Despite an awareness of physical risks associated with the job due to machinery and environmental exposure, employees felt there was a

strong culture towards safety amongst employees and employers. It is important to note that safety climate was perceived to be enacted amongst employees as well as management. This adds qualitative support to safety climate theory, which is theorised to function across multiple levels of organisational hierarchy (Dollard & McTernan, 2013).

Indicators of a psychosocial safety climate were evident but emerging, as one participant described it as a growing area of interest in the industry. This can be partially explained by mental health and well-being being relatively new concepts to the workplace, as well as the resistance towards addressing mental health in rural Australia where Australian mines are located. It may also be the case that stigma towards mental health may have prevented interviewees from discussing mental health to a further extent. In this regard, a lack of shared vocabulary makes it difficult to obtain an impression on the sample's psychosocial safety climate. However, as communication is a key element of psychosocial safety climate, a lack of discussion suggests that psychosocial safety climate may be underdeveloped.

One of the most unique themes to emerge was the close relationships FIFO miners had with co-workers, who were like 'family'. An explanation for the enhanced co-worker support roles could be accounted for by systems of group cohesion and the proximity principle. The proximity principle refers to the increased likelihood of people forming social bonds and establishing group cohesion when they are in frequent physical contact. Evidence for this phenomenon has been found in campus boarding facilities (Marmaros & Sacerdote, 2006; Newcomb, 1961; Priest & Sawyer, 1967, Rubin & Shenker, 1978), and has been associated with increased disclosure (Rubin & Shenker, 1978), which may explain the enhanced support. As workers in isolated environments, such as remote miners, experience a similar living environment, this theoretical perspective could help explain this phenomenon.

The emerging theme of sleep disturbances amongst FIFO miners was anticipated by the authors, as rotational rosters, may result in inconsistent sleep cycles between their work sleep-wake cycle and that at home where it needs to be harmonious with partners and

family members. Further the transportable accommodation of remote mines have poorer noise insulation which is likely to disturb sleep. As disturbed sleep can impact cognitive faculties such as attention and alertness (Miller, Wright, Hough & Cappuccio, 2014), this could be an area mining organisations may wish to address.

Reports of changes in mood were anticipated and are typical of a high stress environment such as mining work. Poor mood was mentioned more commonly, but not exclusively by the Australian FIFO miners. This may in part be due to the pressure a FIFO roster places on at-home relationships. Work-family conflict has been shown to be related to greater depression prevalence (Frone, Russell & Cooper, 1997; Hammer, Cullen, Neal, Sinclair, & Shafiro, 2005), and given that the interviewees reported FIFO roster placed pressure on home relationships, this may explain the reported mood disturbances.

4.1. Theoretical implications

The present study adds to the PSC-JDR model, which has lacked qualitative investigation. Interviewees reported casual pathways between demands and health outcomes, supporting the model's health erosion pathway. Further, Co-worker support was identified as a situational resource, supporting the buffering pathway of the JDR model. In addition, we identified a local theory of work stress for remote and non-remote mining work, supporting the industry contexualisation of the occurrence of different demands and resources proposed by Demerouti, Bakker, Nachreiner and Schaufeli (2001).

Perhaps the most important theoretical implication of the present study was identifying a proximity effect of social support. Social support at work is a key construct in contemporary work stress theory in both Karasek and Theorell's Job Demand Control model (1990), as well as a critical resource in Demerouti et al.'s Job Demand Resources model. Considering the rise of transient work arrangements, both FIFO rosters adopted by mining companies as well as off shore drilling, remoteness and its effect on social support at work and home may become a growing issue. Work stress theory may need to

accommodate these changing work structures as transport and telecommunication technologies that support these practices continue to develop.

4.2 Future research

Considering the strong support networks reported among interviewed remote workers, future quantitative research should therefore assess whether greater co-worker support is reported amongst mining workers, and if this acts as a buffering resource for work stress. Considering remote mining workers also reported strain on at home relationships, future research should investigate whether remote workers experience greater conflict between work and home. The length of FIFO contract these workers are on also warrants investigation, as longer rosters may create greater conflict between domains.

4.3 Practical implications

This proximity effect also carries concerns for organisational practices regarding co-worker relationships in remote workplaces, as well as policies and practices that may affect at home relationships. These findings indicate organisations stand to benefit from fostering positive co-worker relationships, which in turn buffers stress at work. Additionally, investing in infrastructure that helps minimise work-family conflict such as communication services, may reduce stress and stress-related outcomes.

Similarly, organisations may wish to focus their attention on other identified demands and outcomes that emerged in the interviews. Although it may be difficult to limit working hours that contribute to the employees experience of work pressure, efforts could be made to improve employee's quality of sleep. The reduction of sleep disturbances could be facilitated by ensuring the sleeping quarters of day and night shift workers are separated, so that their daily and nightly movements to not interfere with one another's sleep. Sound insulation would also restrict the amount of noise permeating through bedroom walls, helping improve the quality of sleep on site.

4.4 Limitations

One of the possible limitations of the present study is that individuals from the comparative sample could not be interviewed in person. Although this was not realistically possible, it may affect the types of, and depth of information people choose to disclose. Another limitation is that the potential for selection bias. Several organisations were approached for Sample 1, and it may be that the selected company that chose to participate may represent a more positive work culture. Similarly, although Sample 2 was selected from a large online community of mining employees, it is possible that this may not reflect the ideas and opinions of those less engaged with social media. In both cases, a bias might occur where we only received information from those that wish to share it rather than a representative sample. Nevertheless the sampling strategy in Sample 1 was purposively chosen to represent all of the major demographic categories of the sample.

4.5 Closing remarks

It is important to note that each occupation and industry provides an environment of unique experiences of various job stressors and resources. What makes remote mining work so unique, is the way in which this remoteness changes an individual's relationships with both their family, and their co-workers. Although some of the difficulties that arise from this unique work structure may be difficult to address, understanding the way in which these factors interact helps in both understanding the way in which stress arousal manifests, and also shines a light on the areas best to focus on to reduce work-related stress.

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Chapter 4

Epigraph

In the previous chapter we developed our local theory of work stress by identifying key demands and resources unique to the experience of work stress for mining workers. The most prominent phenomenon to emerge was the effect of remoteness (FIFO and related contracts) on the relationships workers have with their co-workers, friends and families. We discussed several psychosocial theoretical perspectives pertaining to the concept of proximity, and how this can explain both erosion of home relationships, and simultaneously increase the quality of co-worker relationships.

In the present chapter we tested this local theory using the AWB dataset, which was ideal as it contains both mining workers and non-mining workers, which we used to test the effect of remoteness on these relationships. Further, we decided to test this remoteness interaction on two causal pathways between stressor and strain, as the idea of reverse, and therefore reciprocal relationships between stressors and strain outcomes is a growing perspectives in organisational psychology research. The findings in this chapter support our hypothesis of a proximity effect on social relationships (Figure A illustrates the pathways of our local theory of work stress tested in this chapter). Being evident in both causal and reverse (i.e. reciprocal) pathways adds additional support to the presence of this proximity interaction effect.

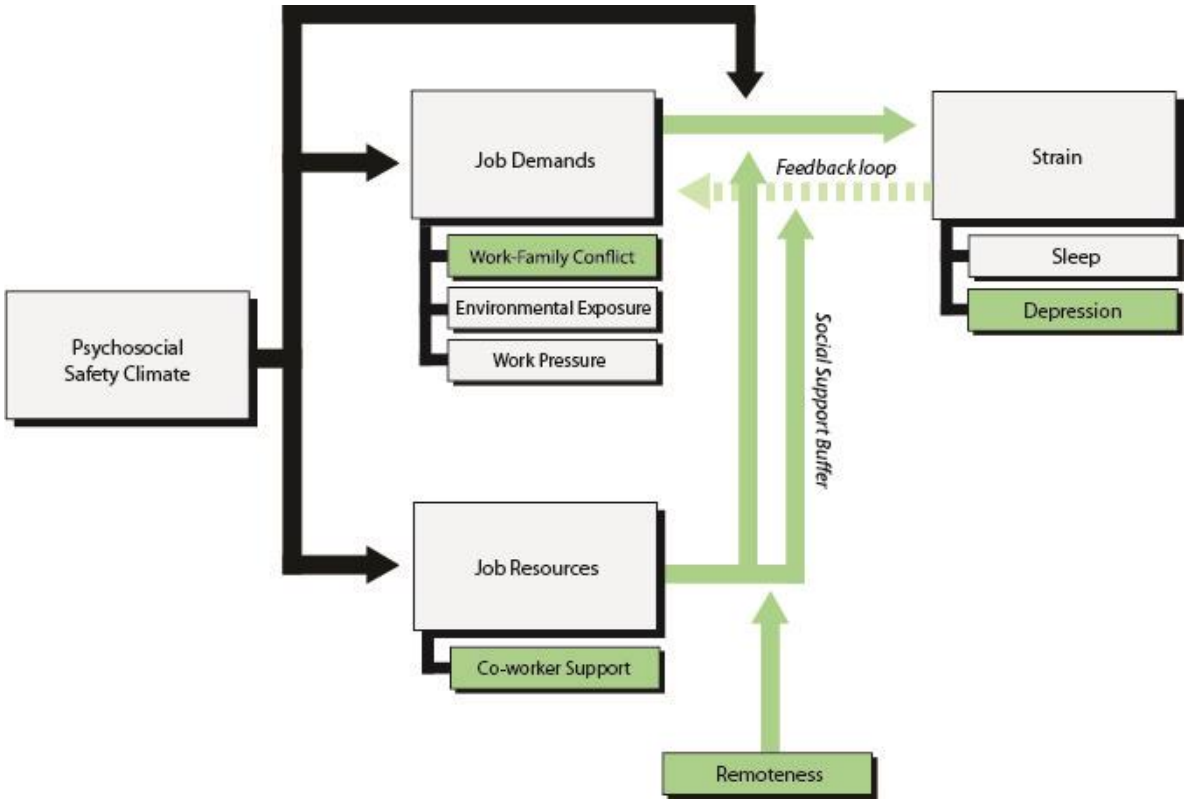
Reflecting on these findings, it is important to consider that as the structures at work are changing, and the interactions between people at work and with the people outside of work are also changing. Theory on social relationships and support too need to be adapted to these changes if they are to remain useful in informing workplace practice and policy. Although the mining industry is used as case example of these changes, these findings may

be applicable to other remote work arrangements such as off-shore oil and gas in America and Canada, or the emerging migratory rural workers in China.

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Figure A. Development of Local Theory of Work Stress in Chapter 4



Green indicates pathways tested in Chapter 4.

Chapter 4

Enhanced Co-Worker Social Support in Isolated Work Groups and Its Mitigating Role on the Work-Family Conflict-Depression Loss Spiral

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Abstract

This paper examines a loss spiral model (*i.e.*, reciprocal relationships) between work-family conflict and depression, moderated by co-worker support. We expected that the moderation effect due to co-worker support would be evident among those working in isolation (*i.e.*, mining workers) due to a greater level of intragroup attraction and saliency attributable to the proximity effects. We used a two wave panel study and data from a random population sample of Australian employees (n = 2793, [n = 112 mining, n = 2681 non-mining]). Using structural equation modelling we tested the reciprocal three way interaction effects. In line with our theory, co-worker support buffered the reciprocal relationship between WFC and depression, showing a protective effect in both pathways. These moderation effects were found in the mining industry only suggesting a proximity component moderates the social support buffer hypothesis (*i.e.*, a three way interaction effect). The present paper integrates previous theoretical perspectives of stress and support, and provides insight into the changing dynamics of workplace relationships.

Keywords: depression; work-family conflict; social support; mining

1. Introduction

1.1. Social Support and Work-Family Conflict among Remote Workers

Social support is typically sought from and provided by primary groups: friends, family members and partners. Different types of primary group support, in particular spousal support, have been shown to be predictive of outcomes of life satisfaction as well as positive and negative mood (Walen & Lachman, 2000). Social support has also been theorized as a key moderator of the experience of stress in both the psychology (Bakker & Demerouti, 2007; Cohen & Wills, 1985; Karasek & Theorell, 1990) and sociology literature (Avison, Ali & Walters, 2007; Pearlin & Bierman, 2013; Wheaton & Montazer, 2010; Turner & Brown, 2010). It therefore plays an important role in dealing with daily stress, such as the stress from work, through the informal support structures typically offered by partners, friends and family.

However, a recent trend in the work arrangements adopted by primary resources industries may restrict the availability of these support networks. Fly-in/Fly-out (FIFO) rosters, where a worker is flown to a remote worksite to stay and work for a period of days and return home for rest days, has become a prevalent strategy for remote employment in the mining industry as well as offshore oil and gas industries. FIFO rosters have become especially popular among Australian mining employers, due to the great distances between coastal urban populations and inland mining sites. Employees, particularly those with partners and children, prefer FIFO contracts over relocating to mining communities that are closer to mining sites but these lack the infrastructure of Australia's major urban populations.

This relocation however restricts both the support a worker can receive from primary groups, as well as the support they too can offer. This would suggest that Australian mining workers, in particular those on FIFO contracts, will experience greater conflict between their work and family domain. Recent research in the Australian Workplace Barometer project supports this, with mining workers reporting the highest rates of work-family conflict across all Australian industries (McLinton & Bailey, 2014). Work-family conflict has been theorized as a construct that elicits a stress response (a stressor) (Frone, Russell & Cooper, 1997), which can lead to impairments in psychological health such as depression, and also a product of stress (Kelloway, Gottlieb & Barham, 1999). In this regard, the relationship between work-family conflict and psychological health may be

bidirectional. Problematically, remote mining workers do not have access to their primary support networks that are important for buffering this stress process. However, in the absence of their typical support networks, we drawn on the *proximity principle* to suggest that remote mining workers will seek social support from those around them on site, *i.e.*, their co-workers. In the present paper, we therefore propose that a bi-directional relationship between work-family conflict and depression will be mitigated by co-worker support among mining workers.

1.2. Work-Family Conflict and Mental Health

Work-family conflict is associated with a myriad of psychological health impairments. Work-family conflict, also referred to as *work-home conflict* is an antecedent of psychological health including outcomes such as depression (Frone, Russell & Cooper, 1997; Hammer, Cullen, Neal, Sinclair & Shafiro, 2005), wellbeing (Grant-Vallone & Donaldson, 2001), burnout (Tone Innstrand, Melbye Langballe, Arild Espnes, Falkum & Gjerlow Aasland, 2008), and exhaustion Demerouti, Bakker & Bulters, 2004). We can explain this phenomenon through the stressor-strain process: the experience of work-family conflict elicits stress in an individual that if not addressed leads to psychological strain related outcomes, *i.e.*, a decline in psychological health and wellbeing. This process is an underlying assumption in contemporary work stress theories in psychology such as Karasek's Job Demand Control Model (Karasek & Theorell, 1990) and more recently Demerouti and Bakker's Job Demand Resources model (Bakker & Demerouti, 2007), as well as popular sociological theory on stress such as Pearlin's stress-process model (Pearlin, Menaghan, Lieberman & Mullan, 1981).

Conversely, there is also evidence to suggest that conflict between work and family domains can be an *outcome* of stress. Research by Kelloway, Gottlieb, and Barham (1999) found that an increase in work-family conflict was significantly predicted by the perceived psychological stress of employees. One explanation Kelloway, *et al.* propose is that our personal resources (*i.e.*, emotional and physical energy) are depleted in response to stressors, which in turn leaves us with inadequate resources to cope with the conflict between work and family life. Moreover a meta-analysis by Allen, Herst, Bruck and Sutton (1967) found work-family conflict predicted stress and stress-related outcomes. This incongruence could be evidence of bidirectional relationship between stress-related

outcomes (such as generalised stress, or specific impairments like depression) and work-family conflict, where initial conflict acts as a stressor eliciting strain, which in turn depletes resources that are also needed to address the conflict between the work and family domain.

Adding support to this proposition, Demouriti, Bakker and Bulters (2004) explicitly explored work-family conflict as a stressor and strain outcome concurrently. They found that work-family conflict interacted with emotional exhaustion in a negative spiral similar to Hobfoll's (1989) loss spiral theory. According to Hobfoll, a person's resources are taxed when addressing stressors. Once a person's resources are low, they are then less equipped to deal with subsequent stressors, and consequently less equipped to address the initial stressor at its next occurrence. In this sense, resources are depleted in "loss spirals" and conversely can be gained in "gain spirals". Similarly, Demouriti *et al.* (2004) argued that a person who is exhausted would have insufficient energy to address work-family conflict, which in turn acts as an additional source of strain, creating more exhaustion in a loss spiral. These findings echo previous work by Leiter and Durop (1996) who similarly found a reciprocal relationship over time between work-family conflict and exhaustion.

Considering the loss spiral found by Demouriti *et al.* (2004) a similar spiral is plausible with other strain-related outcomes that relate to heightened levels of work-family conflict, such as depression (Frone et al., 1997; Hammer et al., 2005). We propose that a person experiencing depression will have insufficient energy to address conflict between work and home, which will in turn act as a source of stress further exacerbating depression. We therefore we hypothesize:

Hypothesis 1: Depression increases the level of work-family conflict (model a, Figure 1).

Hypothesis 2: Work-family increases the level of depression (model b, Figure 1).

1.3. The Social Support Buffer Hypothesis

In the absence of their usual support network of friends, family and partners, remote mining workers may be at a greater risk of strain-related health outcomes that arise from the experience of stressors. Within the literature of psychology, social support is regarded as a critical resource in protecting mental health, and has been argued to act as a *buffer* of psychological stress in the prominent work of research contemporaries such as Cohen and

Wills (1985), Karasek and Theorell (1990) and Bakker and Demerouti (2007). In one of the earliest papers to discuss the social buffer effect, Cohen and Wills proposed social support may function as a coping mechanism against an elicited stress response by preventing the initial stress appraisal, in light of the available peer support. They also proposed that social support may aid in preventing the stress response by functioning as a resource that provides alternate means to address the stressor. Adding additional support Frese (1999) observed the support buffering hypothesis—that is, the buffering effect of social support against stress—amongst a range of different stressors (e.g., physical and psychological) and outcomes (e.g., depression and anxiety) with different forms of support (e.g., co-worker and spousal).

Similar perspectives of stress and support are proposed in the sociology literature, but provide additional qualitative perspectives on the mechanism through which the stress response occurs. Pearlin's (Pearlin et al., 1981) *stress process model* proposes that the stress response that arises from the experience of a stressor can lead to negative self-appraisal, affecting self-esteem and our sense on control of life events. Pearlin proposes that through this mechanism, poor mental health, in particular depression, can arise. Further, social support has been argued to play a vital role in protecting mental health in buffering the stress process in Pearlin's model (Avison et al., 2007; Pearlin & Bierman, 2013; Wheaton & Montazer, 2010; Turner & Brown, 2010). Social support has been argued to buffer the stress response in that support networks provide resources to cope with the occurrence of stress. Together these perspectives not only reflect theoretical convergence across disciplines, but a complimentary account of the stress and social support experience. We hereon refer to this process as the *social support buffer hypothesis*.

However, in the absence of their usual support network, it is plausible that remote workers will seek social support from their co-workers. We offer two theoretical perspectives to support this proposition. First, the proximity principle suggests remote mining workers will be at a greater disposition to seek social support from co-workers in the absence of friends and family. In the field of social psychology the proximity principle refers to the increased likelihood of people forming social bonds and establishing group cohesion when they are in frequent physical contact. Since the 1960s research has investigated the phenomenon in terms of geographical proximity, largely in studies of friendship formation amongst university students living in campus boarding facilities (Marmaros & Sacerdote, 2006; Priest & Sawyer, 1967; Rubin & Shenker, 1978), but the theory has also been investigated in terms of

interpersonal similarity as a form of proximity (Hassan, Salgado & Pavon, 2008). Proximity in university dorm-rooms was additionally associated with increased disclosure (Rubin & Shenker, 1978), which may facilitate supportive discussion. This finding would suggest that workers in isolated environments such as remote miners, who have more social interactions with co-workers than typical, and less with friends and family at home, are increasingly likely to receive and rely upon social support from their co-workers.

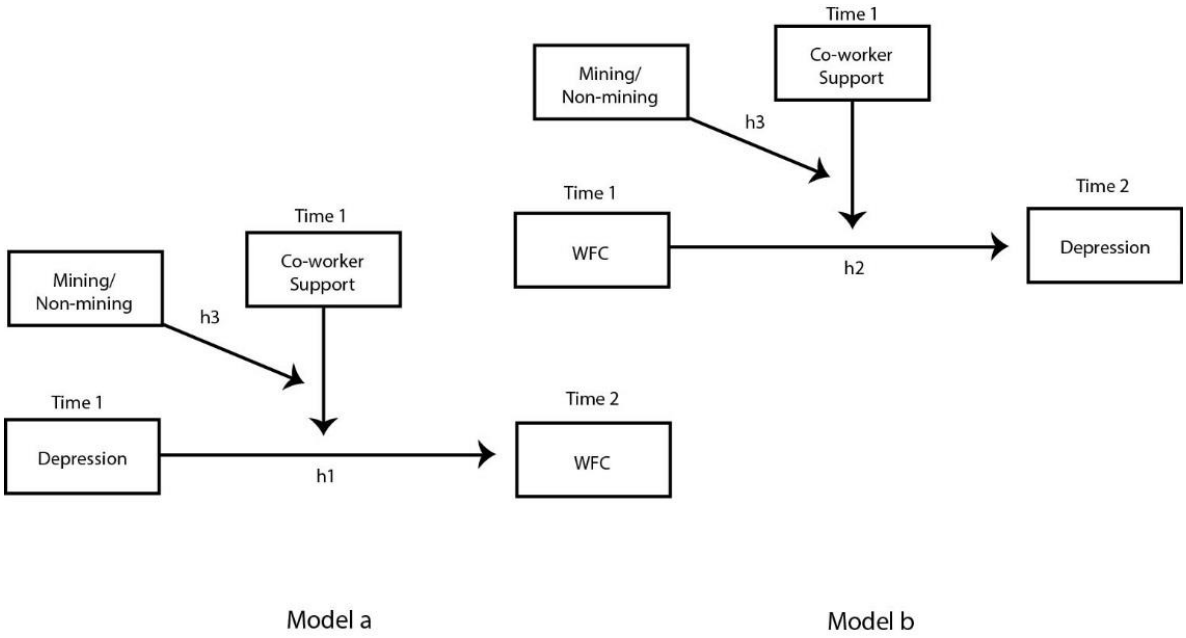
Second, more alleviative co-worker social support in isolated workplaces could also be explained by processes of self-categorisation. According to self-categorisation theory (Turner, Hogg, Oakes, Reicher & Wetherell, 1987), the personalities of members of a collective are influenced by the behaviours and social norms of that group. These prototypical behaviours of the group form a 'social identity' for the individual. Prototype behaviours typically are those that emphasise characteristics of the group as well as behaviours that differentiate group members from other groups. For example, a person working in the agricultural industry may wear clothing that reflect his profession outside of work, that both associate him with the agriculture industry as well as distinguish him from a person in an office job role. Reflecting prototype behaviour enhances group saliency, intragroup social attraction and overall group cohesion (Hogg & Terry, 2000). The greater frequency that remote mining workers interact should therefore result in a greater number of prototype behaviours and a stronger social identity, and consequently, greater intragroup cohesion and stronger social relationships. Self-categorisation theory, therefore, provides an additional explanation for strengthened social relationships amongst remote mining workers, which should in turn buffer strain. Both of these theoretical perspectives support the notion of a proximity component to social support, which we propose will result in a social support buffering effect among a mining cohort. We therefore propose:

Hypothesis 3: Co-worker support amongst mining workers reduces or buffers the bidirectional relationship between work-family conflict and depression.

The following model is proposed to test our hypotheses:

Figure 1.

Buffering Hypothesis of a Work-Family Conflict/Depression Loss Spiral



WFC = Work-Family Conflict; h1-3 indicate hypotheses tested.

1.4. Aims and Significance

This paper aims to construct a model that unifies two predominant perspectives within the literature, the social support buffer hypothesis and loss spiral theory. Further, we elaborate on the social support buffer hypothesis by exploring the environmental factor of workgroup proximity, which should mitigate the efficacy of social support according to the proximity principle, and self-categorizing processes. The inclusion of mining as a group factor has additional important practical implications for industry. The mining industry plays a vital component of world economies, in particular the mineral-driven economies of Australia, South Africa, Canada, Russia, and the United States.

Examining depression has potential practical implications for industry practices as well. Depression is associated with memory (Wessel, Meeren, Peeters, Arntz & Merchelbach, 2001) and decision-making (Raghunathan & Pham, 1999) impairments. With the high rates of

traumatic workplace injuries in the mining industry (Safe Work Australia, 2015), research that can inform strategies to alleviate stress-related illnesses with cognitive correlates stands to improve site safety, as well as staff wellbeing. Additionally, depression is associated with several productivity factors such as presenteeism and sickness absenteeism that have financial implications for the employer (LaMontagne, Sanderson & Cocker, 2010; McTernan, Dollard & LaMontagne, 2013). Considering these safety and performance correlates, this study may be beneficial in improving our understanding of the pathways of work-related stress, to inform organisational policies and practices, and in turn improve the health of employees, companies, and their related economies.

2. Method

2.1. Procedure and Participants

This study uses survey data collected as a part of nation-wide surveillance project of work stress factors, the Australian Workplace Barometer project. We used a repeated measures design across two time points of data collection with a 12-month time lag, between 2009 and 2010 from New South Wales and Western Australia, and between 2010 and 2011 for South Australia. Ethics was obtained from the University of South Australia's Human Research Ethics Committee. The sample consisted of 2793 (48.3% male, 51.7% female) working Australians between the ages of 18 and 85 who completed the survey at both time points. Within our Sample 112 (83.9% male, 16.1% female) were identified as working in the mining industry which was used to create the dichotomous variable regarding whether they were mining workers or not (see measurement description below).

Telephone interviews were conducted with participants. To recruit participants, phone numbers were randomly selected from the Australian white pages telephone directory for each state. After contact was made, the interviewer asked to speak to an employed member of the household over 18 years of age and who had the most recent birthday. It was this individual who was then invited to participate.

2.2. Measures

Depression was measured using the nine-item Patient Health Questionnaire (PHQ-9). The nine items reflect the criteria for Major Depressive Disorder used in the DSM-IV

(Kroenke, Spitzer & Williams, 2001) e.g., "During the last month, how often were you bothered by feeling down, depressed or hopeless?" Responses range from 0 (not at all) to 3 (nearly every day). Work-Family Conflict was measured using Netemeyer, Boles and McMurrian's (1996) five-item measure. Items reflected the negative spill over from work into the family domain, e.g., 'My job produces strain that makes it difficult to fulfil family duties'. Responses were made on a seven point Likert type scale ranging from 1 (strongly disagree) to 7 (strongly agree). The fifth item was removed due to poor factor loading.

Co-worker support was measured using the co-worker support subscale from the Job Content Questionnaire 2 Karasek et al., 1998). The measure of co-worker support consisted of 3 items, e.g., "I am treated with respect by my co-workers". Participants responded on a 4 point Likert type response scale ranging from 1 (strongly disagree) to 4 (strongly agree).

Participants reported the industry they worked within, giving responses classified under the Australian and New Zealand Standard Industrial Classification (ANZSIC). These responses were recoded into a dichotomous measure indicating whether or not the participant worked within the mining industry (2) or not (1).

2.3. Data Analyses

Using MPlus version 6.11 (Muthén & Muthén, 1998), a Structural Equation Model (SEM) was conducted using a full two-wave panel design. Missing responses were replaced by the series mean of participant scores. To test Hypothesis 1 and 2: four models were constructed: a stability model; model a (WFC, Co-worker Support, Mining → Depression); model b (Depression, Co-worker Support, Mining → WFC) and a reciprocal model (a and b).

Once the model with the most appropriate fit was established, the interaction terms were added to the model to test hypothesis 3 (the moderating effect of co-worker support amongst mining workers). When modelling interaction effects in SEM, standard fit indices are inapplicable. Therefore alternative measures of fit, The Akaike Information Criterion (AIC) and the Sample-Size Adjusted Bayesian Information Criterion (SABIC) were examined to measure the fit of the interactions added to the reciprocal model. See Little, Bovaird and Widamen (2006) for a discussion on the use of fit indices when modelling interaction terms. We chose to use SEM for our analysis because it allowed us to test both causal models simultaneously, as well as allowing us to model the additional complex interaction terms.

3. Results

3.1. Descriptives

Before conducting the analysis, means, standard deviations, Cronbach's alphas (Table 1) and correlations (Table 2) were computed. All variables showed satisfactory internal consistency (between 0.81 and 0.90). Both WFC and depression had a test-retest reliability of >0.50, and co-worker support of >0.30. These reliability coefficients were all statistically significant and of typical stability for this type of research.

Table 1.

Means, Standard Deviations (SD) and Cronbach's Alpha (α) for Australian Employees

Measure	Mean	SD	A
1. Co-worker support 1	9.79	1.29	0.87
2. Co-worker support 2	9.70	1.20	0.88
3. WFC 1	14.51	6.94	0.90
4. WFC 2	14.41	6.64	0.90
5. Depression 1	3.46	3.72	0.81
6. Depression 2	3.21	3.50	0.82

Mean-centering was conducted in the analysis before generating interaction terms. Numbers after variable name indicate time wave. N = 2793.

Table 2.

Correlation Matrix of Study Variables for Australian Employees

Measure	1	2	3	4	5
1. Co-worker support 1	−				
2. Co-worker support 2	0.31	−			
3. WFC 1	−0.06	*NS*	−		
4. WFC 2	−0.05	−0.05	0.60	−	
5. Depression 1	−0.10	−0.06	0.28	0.22	−
6. Depression 2	−0.08	−0.08	0.21	0.28	0.53

NS indicates non-significant correlations; otherwise all other statistics are significant to 0.05 or less. N = 2793.

3.2. Analysis

Table 3 shows the comparative models tested: model a, model b, as well as testing both models simultaneously. It should be noted that in all four models, the chi square values were significant. This is nearly always the case for large models with large samples (400 or more cases) in which case researchers should rely on fit indices for model interpretation (Kenny, 2016). The fit indices (RMSEA, TLI and CFI) were sound for each model tested, however the reciprocal model yielded a lower chi square indicating it was a better overall fit, supporting Hypotheses 1 and 2. Interaction terms were then added to the reciprocal model.

Table 3.

Main Effects and Fit Indices for Study Models Over Time for Australian Employees

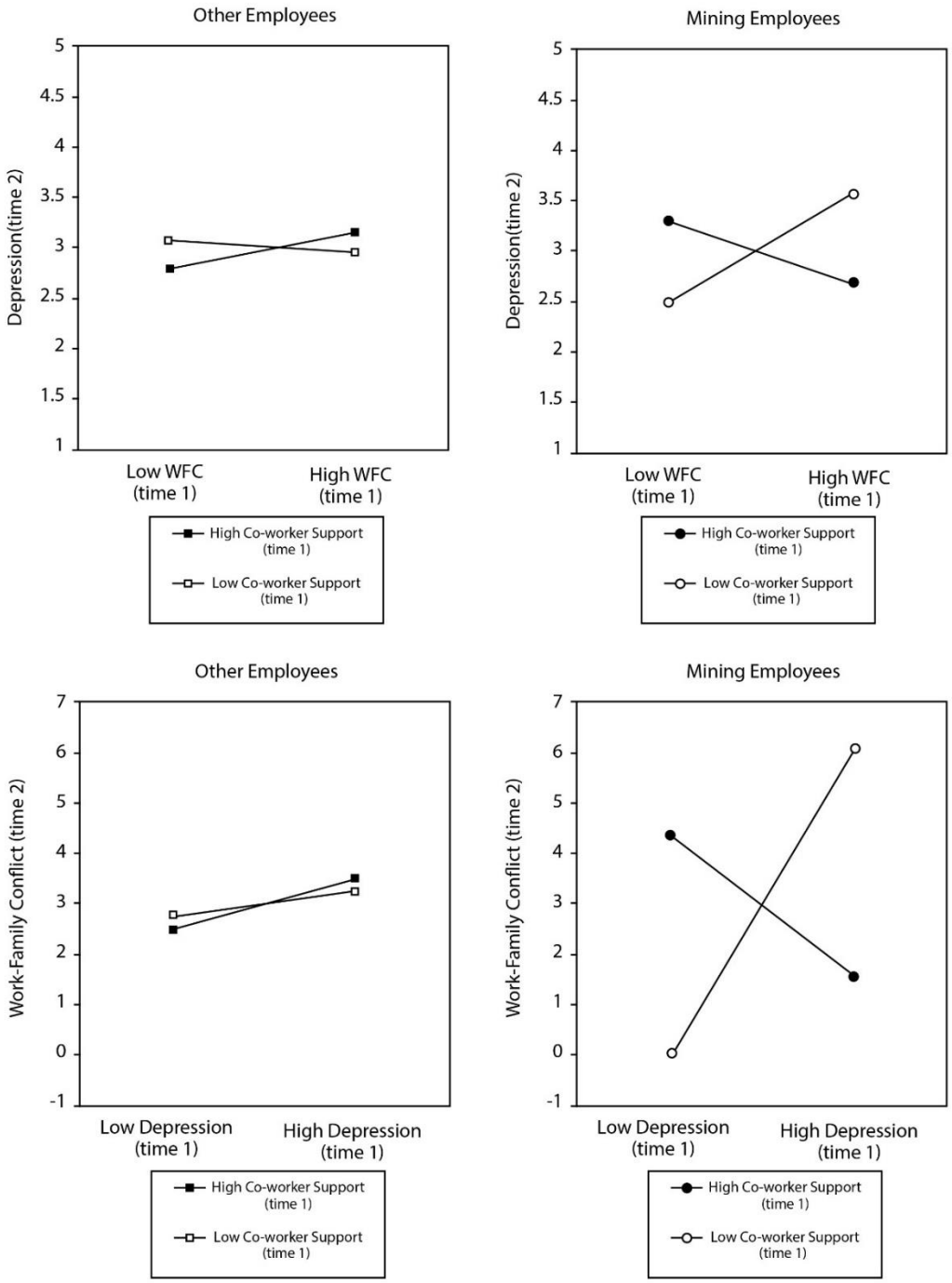
Model	***Main Effects***	***B***	***P***	x^2	***df***	***p***	**RMSEA**	**TLI**	**CFI**
1. Stability model				2595.29	469	<0.001	0.040	0.944	0.950
2. Model a	WFC→ Depression	0.01	<0.001						
	Co-worker Support → Depression	−0.02	Ns						
	Mining → Depression	0.03	Ns						
				2584.35	465	<0.001	0.040	0.943	0.950
3. Model b	Depression → WFC	0.18	0.02						
	Co-worker Support → WFC	−0.01	Ns						
	Mining → WFC	0.26	0.03						
				2584.14	465	<0.001	0.040	0.943	0.950
4. Reciprocal model	WFC→ Depression	0.01	<0.001						
	Co-worker Support → Depression	−0.02	Ns						
	Mining → Depression	0.05	Ns						
	Depression → WFC	0.17	0.02						
	CoSupport → WFC	−0.02	Ns						
	Mining → WFC	0.29	0.02						
				2573.59	462	<0.001	0.040	0.943	0.950

B = unstandardized beta coefficients. x^2 = chi square, df = degrees of freedom, p = probability, RMSEA = Root Mean Square Error of Approximation, TLI = Tucker Lewis Index, CFI = Comparative Fit Index. N = 2793.

The inclusion of the interaction terms (Hypotheses 3) yielded a lower AIC (168315.94) than the reciprocal model (168323.65) and a SABIC (168685.13) not notably greater than the reciprocal model (168684.44), suggesting the inclusion of the interaction terms creates an equal if not better overall model fit. Interaction terms are displayed in Figure 2.

Figure 2.

Interaction terms for the moderating effect of co-worker support on the work-family conflict depressive loss spiral in mining and a general work sample in Australia.

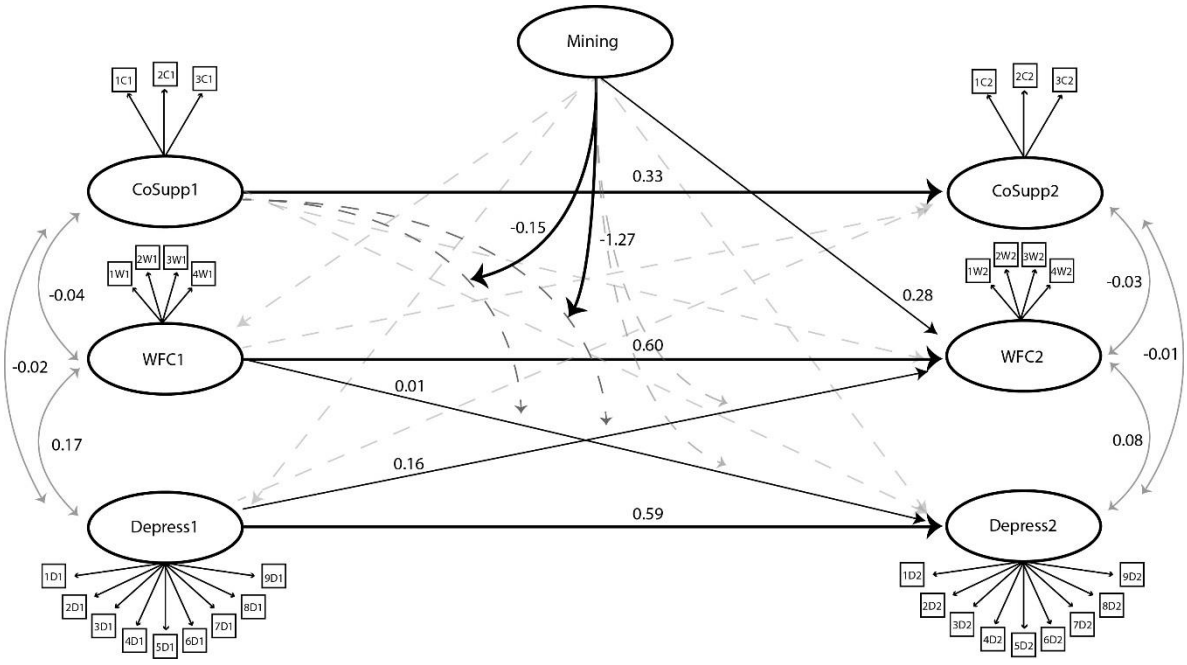


WFC = Work-Family Conflict.

Figure 3 shows the regression coefficients (*B*) of the modelled regression paths and correlations of our hypothesized model. Non-significant pathways are represented by dashed lines. Hypotheses 1 and 2 were confirmed, showing that Depression at time 1 significantly predicted an increase in WFC at time 2 ($B = 0.16$), and to a lesser extent WFC at time 1 significantly predicted and increase in Depression at time 2 ($B = 0.01$). The two way interaction was non-significant, showing co-worker support did not moderate the regression path from depression to WFC over time or WFC to depression over time. However, the three way interactions were significant confirming Hypothesis 3, showing mining strongly moderated the interaction of co-worker support on the regression path between depression and WFC ($B = -1.27$) over time and WFC to depression ($B = -0.15$) over time.

Figure 3.

A Two Wave Panel Design Structural Equation Model with Two and Three-way Interaction Terms



CoSupp = Co-worker Support. WFC = Work-family Conflict. Depress = Depression. Dashed lines represent non-significant main effects.

4. Discussion

The purpose of the present paper was to expand the current theoretical knowledge of stress processes by proposing a unified model of stress by modelling two prominent theoretical concepts simultaneously: loss spiral theory, and the social support buffer hypothesis which is common among psychological and sociological stress theory. Further, we extend the theoretical understanding of social support by exploring proximity effects via the additional interaction of remote work (mining) in this integrated model. Our study hypotheses were supported, finding a reciprocal relationship between depression and WFC, which was buffered by social support only among mining workers. Theoretical and practical contributions are discussed.

First, in finding a reciprocal relationship between work-family conflict (WFC) and depression this paper adds to the emerging body of research on Hobfoll's (1989) growth and loss spiral theory, which has implications for current stress process perspectives. In particular, this finding helps account for a gap in current stress process perspectives, as loss spiral theory could explain the incongruency in previous research regarding WFC's role as either a stressor or an outcome of stress. Loss spiral theory suggests WFC can act as both a cause and outcome of stress. Personal resources are depleted in addressing the stress caused by WFC, which leads to insufficient resources to respond to another stressor (*i.e.*, depression). Resources are further taxed to respond to that stressor, which results in less resources respond to WFC in the future, creating a loss spiral. Similarly depression functions as a stressor as symptoms of depression (such as lethargy and anhedonia) make it difficult to engage in both work and social roles. Personal resources are depleted in addressing this elicited stress, leading to insufficient resources to address the experience of WFC. Hobfoll's theory suggests that unidirectional assumptions on the experience of stress may not always correct, and therefore the current prevailing perspectives on the stress process (*i.e.*, the Karasek's JDC theory, Bakker's JDR theory and Pearlin's stress process theory) could be expanded to account for reciprocity between stressors and stress outcomes.

There are also considerable implications of the two way interactions being non-significant and the three-way interactions being significant (Hypothesis 3). Our findings suggest that co-worker support significantly acted as a buffer of work-family conflict within the mining working population, but not significantly in the general working population. This supports our hypothesis that there is a proximity component to the

buffer hypothesis, that proximity mitigates the efficacy of social support. Extrapolating on this hypothesis, not only does proximity enhance the effect of social support, but the antithesis seems to also be evident, in that distance appears to be deleterious on social relationships. This is evident in a significant pathway between mining at Time 1 to work-family conflict at Time 2 ($B = 0.28$).

These findings may serve to explain the incongruent findings for and against the social support buffer hypothesis present in the literature. Although several studies have found small to moderate support for the buffer hypothesis among work cohorts (Frese, 1999: Greenglass, Fikensenbaum & Burke, 1996; Terry, Nielsen & Perchard, 1993), several studies have found no effect (Dekker & Shafeli, 1995; Ingledew, Hardy & Cooper, 1997). As outlined in the introduction, we believe that the increased proximity that mining colleagues experience, who are often on FIFO or similar contracts, enhances the social cohesion amongst co-workers and the strength of their social bonds, therefore enhancing the protective strength of social support as a buffer. It is plausible that cohorts used in previous research differed in both intra-group proximity, which will affect the efficacy of co-worker social support in alleviating stress.

There is the additional possibility that part of the moderation could be attributed to gender effects. Ystgaard, Tambs and Dalgard (1999) found the social support buffer present amongst male adolescents but not female. Ystgaard *et al.* speculated that this gender difference may be attributable to traditional gender roles: that male friends will disperse more problem solving advice and that female friends will provide a more passive support role, and that the former may be more effective. As the 83.9 % of the mining worker respondents were male, a larger male population could explain the relationship. To rule out this possibility, we conducted a post-test analysis replicating model using gender instead of mining as the third interaction term. The relationship was shown to be non-significant at both model a. and model b., adding further support to our hypotheses.

A practical implication of these findings is that a means for minimising the WFC-depression loss spiral is identified for mining workers, and may also be generalizable to other isolated working populations. Organisational policies and practices that foster supportive and cohesive co-worker relationships may be able to help minimise depression and WFC. Considering the associated productivity cost deficits associated with depression [31], there may be considerable financial benefits by

co-worker support targeted organisational practices. Further, mining workers represent a critically under-examined population in terms psychological health despite their contribution to substantial economies. This paper therefore contributes to a gap in empirical research which has been noted in previous literature (Vojnovic, Michelson, Jackson & Bahn, 2014).

While the two-wave design enabled reciprocal relationships to be examined over time, a third time wave would have more definitively elucidated the changes in these relationships over time. It is also possible that the period of at home and away time experienced by remote workers could affect the degree of conflict between the work and family domain, as the length of FIFO rosters can vary considerably. Additionally, factors such as telecommunication facilities (e.g., phone reception and internet services) and the remoteness of the workplace could also affect the experience of work-family conflict. By examining these additional work context variables, future research could identify which workplace factors are more pertinent to the experience of work-family conflict amongst remote workers.

Another limitation was that the number of mining workers on FIFO contracts, was not identifiable. It is possible that those on FIFO contracts may experience a greater reliance on co-worker support than those living in neighbouring communities. However, it is likely that those that were not on FIFO contracts still experience remoteness as they live away from major urban populations, and still work similar hours. Further, the supportive culture that arises due to FIFO rosters is likely to spill-over to non-FIFO employees who they work with. Future research should explore the effect of roster type and length to see if this affects employee's experience of co-worker support. A larger sample of mining workers would also be beneficial to obtain ample power to explore these roster-related effects on the experience of co-worker support.

4.1 Conclusions

In conclusion, the present paper offers a unification of stress process perspectives, and challenges unidirectional assumptions between stressors and strain-outcomes. Additionally the unique role of proximity may explain previous discrepancies in the literature, and therefore warrants consideration in future research design. As the way that we work changes, the effects that these changes have on our social relationship both at home and at work, warrants increasing attention.

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Chapter 5

Epigraph

In the previous chapter we tested the effect of remote work on social support. This added to our local theory of work stress by identifying a proximity effect of social support, which could explain previous incongruences in the literature. However, our qualitative investigation in Chapter 3 showed that remote work did not conflict with just the family lives of mining workers, but other aspects of their personal lives also, such as being able to commit to sporting routines, or attend important social events (e.g. funerals, weddings).

Elaborating on this process, this unique type of conflict we refer to as *remote work-life conflict* experienced by mining workers differed to generalised work-life conflict due to two key differences in time related strain. In contrast to a typical work roster, a remote mining worker does not only have *restricted* time availability for non-work roles during work days, they have *no availability* of time at all. Additionally, the time availability across their entire work cycle is *irregular*, in that it does not align with a typical work cycle (5 days of work, 2 days rest). Consequently routine activities that are structured around usual work cycles are not available for remote mining workers. We developed a scale that captures the conflict pertaining to the availability and irregularity of time for remote mining workers, which we refer to as the Remote-Work-life Conflict (RWLC) scale.

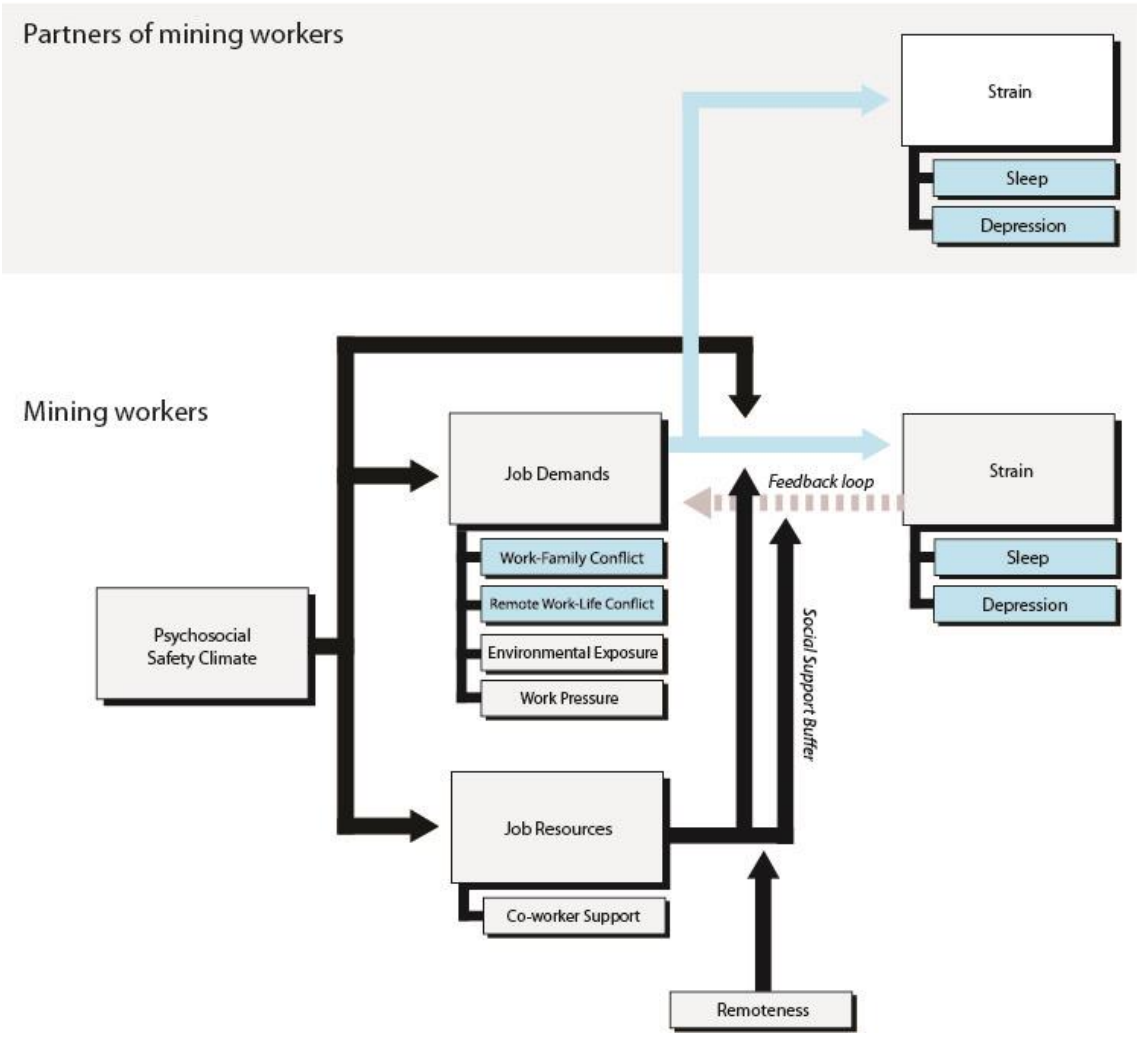
Further, we came to the conclusion that to holistically identify the impact of remote mining work on a mining workers home life, we needed to see the impact it places on those they leave behind. We therefore expanded our sample to include partners of mining workers, to get a more holistic perspective on the phenomenon. This also allowed us to cross-validate the tool with a qualitatively different sample, as opposed to a random split sample which has become an antiquated method of cross-validation.

The use of mining worker partners also compliments the local theory development of the previous chapter: that proximity strengthens social relationships among mining workers. The efficacy of the RWLC scale among partners shows a

contrasting effect: that separation deteriorates family and personal relationships. An updated model of our local theory within the broader theoretical model, as well as the pathways tested in the subsequent chapter are highlighted in the Figure A.

Figure A.

Development Local Theory of Work Stress in chapter 5



Blue boxes and arrows indicates variables and pathways introduced in chapter 5.

Chapter 5

A new tool for assessing the conflict of remote work and life, and the explained variance of depression and sleep quality

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Abstract

In the present study we aimed to validate a new scale that measures the unique time related work-life conflict associated with mining work. The scale was found to have a high internal consistency ($\alpha = .90$) as well as a sound divergent validity from, and predictive validity over, work-family conflict. Within our sample, remote work-life conflict explained more variance in depression and sleep quality amongst miners and partners than work-family conflict. We conclude that the Remote Work-Life Conflict (RWLC) scale helps explain the effect of FIFO rosters on workers and the broader community, offering a useful tool for future research that can be used in conjunction with pre-existing role conflict measures. Practical benefits of the measure in psychosocial health surveillance are discussed.

Keywords: tool development; work-life conflict; depression; sleep; mining

1. Introduction

In the last decade there has been an increase in mining operations worldwide. To address increased mineral production and the nation's low population density, mining companies operating within Australia have shifted their employment strategies towards rotational Fly-in/Fly-out (FIFO) or Drive-In/Drive-Out (DIDO) rosters. These types of rosters are generally referred to as FIFO collectively. This employment strategy allows organisations to employ workers from Australia's coastal cities, and deploy them through rotational rosters at their in-land mining sites where workers live on site for a period of days or weeks at a time. We here-on refer to mining workers engaged in these roster arrangements as remote mining workers.

Becoming a remote mining worker can be lucrative, however an additional psychological burden is placed upon these employees as their working arrangements can disrupt personal routines and make it difficult to maintain relationships at home. Broadly, we refer to the negative spill-over from the work to the personal life domain as *work-life conflict*, however our qualitative findings in Chapter 3 suggest that a unique type of work-life conflict exists for remote mining workers. FIFO work structures limit an employee's ability to maintain personal routines, as well as limit their ability to attend to personal responsibilities, to a much greater extent than traditional work arrangements. In contrast, a worker engaged in a traditional work roster can regularly allocate time each week to an activity, and even if their work requires that they stay back late, they can still attend some home family duties when they get home. The aim of the research in the present paper was to develop a scale that measures this unique form of work-life conflict, which we refer to as *Remote Work-Life Conflict*. The second aim of the paper was to evaluate the psychometrics of the scale by establishing its reliability, as well as divergent and predictive validity.

1.1 Work-life conflict

Over the last twenty to thirty years there have been major changes in the way we spend our time working. To many, the departure from the traditional nine to five/five days per week work structure, towards more flexible contemporary work structures is positive, allowing employees to participate in further education or training programs while still working, or spend more time with their families. Not employing workers on a

traditional roster is also beneficial for businesses that operate outside of traditional work hours, or have sporadic production demands. These businesses may structure their employment options according to these demands, which may vary at different times of the day or year (such as season fruit growers that require additional employees during harvest).

Technology has further fostered changes in work arrangements, with more people being able to work partially, or completely from home. However, this is accompanied with an increasing expectation from employers that an employee will answer calls or emails outside of designated work hours. Problematically these changes result in the boundaries between our work lives and our personal lives becoming increasingly blurred, leading to conflicts between our work role, and our family or social roles.

Family roles are typically prioritised higher than other non-work roles, and they require a commitment to a more rigid routine (such as driving children to and from school), compared to the flexibility of other social roles (such as dining out with friends). Consequently, previous work-life conflict research has focused on the conflict between work and family, referred to as *Work-Family Conflict* (WFC) to a greater extent than conflict between our work and other social roles.

An early perspective adopted by researchers to explain WFC processes is Role Theory (Cooke & Rousseau, 1984; Biddle, 1986). Proponents of Role Theory suggest inter-role conflict occurs when there are one or more roles competing for finite resources such as time and energy. For example, when an employee is required to stay late at work, they are required to use time that may otherwise be devoted to their family. Similarly, the arrival of children will require a greater allocation of time to the employee's family role than before, limiting the available time to commit to work. In both cases, trying to complete additional commitments in either role requires additional energy. Over time, a depletion of energy can lead to exhaustion.

Grandey and Cropanzo (1999) propose Hobfoll's Conservation of Resources (COR) theory as an alternative approach for explaining WFC. COR theory helps explain the stress response that arises from resource loss or competition in WFC processes. Resources (e.g., time and energy) are not just used in performing either work or family roles, but also in the process of mediating the competition between both roles. An individual is faced with developing a strategy to cope with this role conflict, which can

be an energy consuming process itself. If the conflict between roles competing for resources cannot be resolved, an individual will experience stress leading to negative psychological outcomes such as depression or anxiety.

Both theoretical accounts of WLC however are harmonious in regard to a competition of resource (time and energy) allocation between domains, and that this competition creates strain, leading to poor psychological health outcomes. This is also theoretically similar to the health erosion pathway of the Job Demand Resources model (Demerouti, Bakker, Nachreiner & Schaufeli, 2001), showing a strong theoretical convergence of these propositions. A scale of WLC should therefore reflect this competition of time and energy resources, and also show an association with psychological health outcomes.

1.2 Work-life Conflict and Depression

Previous types of work-life conflict measures have predicted psychological health outcomes, in particular work-family conflict. Several studies showed work-family conflict was a strong antecedent to depression (Frone, Russell, & Cooper, 1997; Hammer, Cullen, Neal, Sinclair, & Shafiro, 2005). Given that there is an increase in non-traditional work structures that may increase work-family conflict, this may in part offer an explanation of the increase in depression prevalence worldwide. Data from the Global Burden of Disease Study showed that between 1990 and 2010, depression increased from the 15th to the 11th worst disease in terms of lost years of 'healthy' life (Murray & Lopez, 2013). Similarly, in 2001 the World Health Organisation predicted depression would be the second leading contributor to the global disease burden by 2020. Further, depression is accompanied by anhedonia and fatigue, making it difficult for employees to engage in work. Recent research by McTernan, Dollard and LaMontagne (2013) found depression was associated with increased sickness absenteeism and presenteeism, estimating the burden at $AUD 8 billion per annum. Depression therefore represents a growing concern for individuals and employers. Being able to accurately identify and minimise the antecedents of depression offers an important preventative approach for tackling the increasing depression burden.

Similarly, there is research that suggests romantic relationships can be beneficial for psychological wellbeing, which may explain the positive relationship between WFC

and depression. In a meta-analysis of 93 studies, Proulx, Helms and Buehler (2007) found that marital quality was highly related to measures of wellbeing (including depression and anxiety measures) cross-sectionally and over-time. Further, in a large sample of 1,621 American college students, participants who were in romantic relationship had fewer mental health problems (Braithwaite, Delevi, & Fincham, 2010), suggesting the importance of romantic relationship beyond non-marital committed arrangements.

1.3 Work-life Conflict and Quality of Sleep

There is also evidence that WLC related strain will manifest in the form of sleep disruption. Berkman, Buxton, Ertel and Okechukwu (2010) found employees who had managers that rated poorly on supervisory practices towards work-family conflict, on average slept nearly half an hour less each day. Similarly, Geurts, Rutte and Peeters (1999) found in a sample of Dutch medical students that work-home interference was associated with sleep deprivation. Adding support to a sleep-related strain manifestation of WLC, a study by Akerstadt, et al. (2002) found an impairment of sleep quality was related to variables that reflected both a competition of time and energy resources. Both the hours worked, including overtime (time), and the demands experienced (energy) at work were associated with disturbed sleep, not feeling rested and difficulty waking.

There is also reason to believe that sleep quality will be worse amongst remote mining workers. A study on remote mining workers in South Australia (Ferguson, Baker, Lamond, Kennaway & Dawson, 2010) found workers slept significantly less when on site (day shift, M = 6.1 hours; night shift, M = 5.7 hours) than their rest days off site (M = 7.3 hours). These findings support the previously reported sleep problems in Chapter 3. The discontinuous nature of remote work presents a barrier to an individual's sleep/wake cycle, as their sleep/wake cycle is likely to differ between their work and rest days. When at work, remote employees work for long periods of hours and typically have little free time before going to sleep. In contrast, in their free time, during rest days, they have no work role commitments, but will likely be trying to compensate for sleep loss in their family and social roles.

1.4 Developing a scale for remote work-life role conflict

Several aspects of the FIFO roster may lead to a specific type of work-life conflict where the previous outcomes (depression and sleep disruption) may be exacerbated. First, the resource of time is not just restrained within a working day, but is not available at all. In a typical case of negative work spill-over, an employee may come home from work late, and therefore have less time to attend family and personal commitments that were required in that day. In contrast, a remote mining worker does not have any time available during a work day. In this regard there is an *absence* of time, in contrast to a *limitation* of time.

We propose that this absence leads to a greater restraint on personal commitments, and can manifest in several forms of conflict. Domestic duties are increased for partners and family members at home in their absence, placing strain on the relationship. In addition other social responsibilities may not be able to be met. For example, birthday parties are typically held in the evening or on weekends, which does not conflict with a typical work roster. A remote mining worker on the other hand, does not have any time during a work period which may span this period, to attend this type of event. Similarly, weddings are typically held on weekends as this is the more commonly available time for people, however may be a time of work for remote mining workers as their rosters do not normally align with a seven day cycle.

In addition to restricting the availability of personal time, a remote mining workers contract also restricts the regularity of personal time. FIFO contracts do not typically fit a seven-day cycle like regular jobs, and can range from 8 days on to 6 days off, to two weeks on and two weeks off. In this regard any activity that requires a weekly commitment of time cannot be participated in. In particular, a remote mining worker does not have the ability to participate in most sporting and leisure activities. For example, being on an Australia rules football team will typically require a commitment of one evening during the week to practice, and one day morning on the weekend to play against another team. Most people have some sporting or hobby commitment that requires this type of routine commitment, which is not possible on a FIFO contract.

There is evidence that sporting and leisure activities may offer a buffer to daily stress (Caltabiano, 1995; Gerber & Pühse, 2009). Not being able to participate in these types of activities may be detrimental to psychological wellbeing, and may therefore

increase the risk of depression. This is congruent with the previously discussed perspectives of Role Theory and COR theory, in that greater allocation of time to their employment due to remote employment, will limit the time available for other life roles. We therefore argue that RWLC will be related to greater severities of depression.

To capture these types of time availability and time regularity manifestations of work and personal life conflict that remote mining workers are likely to experience, we developed the following scale items (Table 1), which were guided by the qualitative data that emerged from the interviews discussed in Chapter 3. As we intended to use this in conjunction with Netemeyer, Boles and McMurrian's (1996) Work-Family Conflict scale, we also adopted a seven point Likert type scale. This reduced the scoring variability between the scales, so that score variance between the scales is more aptly attributable to construct differences.

Table 1.

Remote Work-Life Conflict Scale

The following questions are about how work can affect your home and personal life. How well do you agree with the following statements?							
	Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree
1. My job makes it difficult to maintain social relationships outside of work	❑1	❑2	❑3	❑4	❑5	❑6	❑7
2. I find I miss a lot of social activities and opportunities because of my work (such as birthdays and playing sports)	❑1	❑2	❑3	❑4	❑5	❑6	❑7
3. My job makes it difficult to form new friendships or romantic relationships	❑1	❑2	❑3	❑4	❑5	❑6	❑7
4. My work arrangement makes it difficult to fulfil social responsibilities (such as helping a friend move house or attending a funeral)	❑1	❑2	❑3	❑4	❑5	❑6	❑7

1.5 Cross-validation of the Remote Work-Family Conflict scale

Cross validation is an important process in model development in preventing type III errors (Mosteller, 2006). Previously researchers have adopted a random-split sampling method for cross-validation, however this approach has been criticised as the samples are not truly different and results can be attributable to chance (Collins, Reitsma, Altman, & Moons, 2015), and that a more distinct sample is more appropriate. The partners of remote mining workers represent a unique population who are likely to share in the experience of strain associated with FIFO rosters due to work life *crossover*.

According to crossover theory, strain can be passed across individuals, contrasting the transmission of strain between domains (i.e. work and non-work) within an individual (Westman, 2002). Testing Westman's crossover theory, Bakker, Demerouti and Dollard (2008) found an individual's job demands was positively related to the experience of home demands, family-work conflict and exhaustion of their partners. Explaining their findings, Bakker et al. propose that increasing demands at work limit an individual's ability to meet home demands, creating greater family-work conflict for their partners (where their additional home demands affect their work domain) and exhaustion.

Extending crossover theory, we propose not only create strain via the home conflict other non-work roles. When in a relationship, people frequently use their free time synchronously, such as going to dinner or seeing a movie, as well as participating in group social activities as a couple. Remote work disrupts this regular participation in leisure activities that may be used to ameliorate stress by their mining partners. This is in addition to more typically considered relationship obligations that may be hindered, such as parental duties if they have a child, and attending important social events such as weddings, birthdays and funerals. Participating in these responsibilities alone may be difficult or uncomfortable for the partner. We propose that remote work is therefore likely to conflict with the personal lives of a mining employee's partner, and offer a novel sample for cross-validation.

We also anticipated that this conflict would manifest into similar strain-related outcomes for partners. Greater responsibilities at home and not being able to attend social events with their partner are likely to place strain on the relationship, and create comparable risks for depression. The at-home partner will also likely experience

problems with sleep, as more of their time is allocated to family duties when the mining employee is away. Additionally, when the partner returns, their presence will likely disrupt the sleep/wake cycle of the at-home partner.

Presently there is no research that examines the work-life conflict that arises due to specific remote work rosters. Current work-life conflict measures examine generalised work demand conflict, which although may be applicable to mining work, may not capture the unique aspects of working remote rosters. These unique characteristics however may be integral to our understanding of the experiences of remote workers and how they cope with mining work, and concurrently maintain family and social roles. Therefore the psychometric assessment of work-life conflict specific to remote employees may be beneficial to the future minimisation of associated health and social outcomes of this kind of remote work. To address this gap in the research, we developed a new tool for assessing specific remote work-life conflict to complement existing assessment tools. We tested the internal validity of this tool using remote mining workers. To cross validate this tool, we tested the tool with people in relationships with mining workers, who we predict will experience similar strain due to the absence of their partner. To assess the tools predictive validity, the tool was used to test whether it could explain additional variance of established stress-related outcomes of work-life conflict; sleep and depression.

1.6 Practical and Theoretical Benefits

This study holds notable practical and theoretical benefits. Understanding how the unique role conflict of remote work can affect employees and partners may help inform the employer of strategies for improving employee health and morale. Previous research has under-evaluated the impact of work role conflict with social roles, however we theorise remote workers and their partners will have an atypical experience of this form of work-life conflict. Additionally this tool may be beneficial for employers, who may be able to take corrective action to roster structures based on the levels of remote work-life conflict experienced by their workers or their partners at home.

The present study adds to current theoretical frameworks by going beyond the typical employee-centric approach to organisational research, and examines the potential implications of organisational factors on the broader community (partners).

This study also adds to our developing local theory of work stress, by measuring the influence of proximity on personal relationships.

2. Method

2.1 Procedure

The study employed a cross-sectional online survey using an online questionnaire platform, *Fluidsurveys.com*. Data were collected between late 2013 and early 2014. Two groups of participants were invited to participate: mining employees, and persons who identified themselves as partners of mining employees. Between 2012 and 2014 several mining organisations were approached for participation. Three agreed to provide a URL link to an online survey to their employees via their internal mailing lists. Additionally, an Australian family support group for mining employees and their partners, *Mining Family Matters*, was contacted, and provided an invitation of survey participation on their website and through their social media page on Facebook.

2.2 Samples

The total sample consisted of 131 Australian participants of which 55 were employed in mining organisations operating in Australia, and 76 were partners of persons employed by mining organisations. Participating mining employees were predominantly male (79.5%) and were aged from 24 to 56 (M = 37.26, SD = 8.59). Partners of mining employees were predominantly female (96.1%) and were aged 18 to 59 (M = 34.45, SD = 8.42).

2.3. Measures

2.3.1 Depression

The nine item Patient Health Questionnaire (PHQ-9, $\alpha = .90$) was used to measure depression. The nine frequency response scaled items reflect the criteria for major depressive disorder used in the DSM-IV (Kroenke, Spitzer, & Williams, 2001), such as "during the last two weeks, how often were you bothered by feeling down, depressed or hopeless?" Item responses range from 0 (*not at all*) to 3 (*nearly every day*),

with a total scale range of 0-27. A higher score indicated a greater amount of depression.

2.3.2 Sleep Quality

Sleep quality was measured using the quality of sleep subscale from Schat, Helloway & Desmarais (2005) Physical Health Questionnaire. Participants are asked to rate their quality of sleep in the previous three months. The Quality of Sleep scale (α = .84) contains 4 frequency response items ranging from 0 (*not at all*) to 7 (*all of the time*), with a total range of 0-28. An example item is, "how often have you woken up during the night?" A higher score reflected a poorer quality of sleep.

2.3.3 Work-Family Conflict

Work-Family Conflict was measured using Netemeyer, Boles and McMurrian's (1996) five item work-family conflict scale (α = .90). Participants were asked to rate their agreement with a statement, for example: "the amount of time my job takes up makes it difficult to fulfil family responsibilities". For at-home partners (non-miners), these items were reworded to reflect the conflict from their partners work. For example, "the amount of time my partner's job takes up makes it difficult to fulfil family responsibilities". Responses were on a Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). A higher score indicated a greater amount of work-family conflict.

2.3.4 Remote Work-life Conflict

To measure the type of work-life role conflict associated with remote work, four items were developed based on our findings from previous qualitative research (Chapter 3), which we refer to as the Remote Work-Life Conflict (RWLC) scale. Each item relates to time based strain, as either an inability to commit time or the irregular availability of time. Items address conflict with social roles (which we theorise are a great conflict amongst remote workers), therefore complementing existing measures of work-family conflict. Participants were asked to rate their agreement with a statement, for example: "My job makes it difficult to maintain social relationships outside of work". During cross-validation with remote mining worker partners, these items were

reworded to reflect the conflict from their partners work. For example, "my partner's job makes it difficult to maintain social relationships outside of work". Responses were on a Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

2.4 Statistical Analysis

To test the reliability of the Remote Work-Life Conflict (RWLC) Scale and its divergent validity from Netemeyer et al.'s (1996) Work-Family Conflict Scale, an Exploratory Factor Analysis (EFA) was conducted with the cohort of mining workers. To cross-validate the factor structure a Confirmatory Factor Analysis was conducted with partners of mining workers. Finally, to establish the predictive validity of the RWLC scale we conducted two multiple regression analyses testing the scales ability to predict depression and sleep quality, over and above the variance explained WFC.

2.4.1. Exploratory Factor Analysis

Using IBM SPSS version 21 a principal component analysis was conducted using an Oblimin rotation method with Kaiser normalisation (as we anticipate the components to be related). All nine items (five from the WFC scale and four from the RWLC scale) were entered into the analysis. To determine Hypothesis 1 that RWLC represents a unique construct from WFC, we allowed the analysis to freely determine the number of factors, based on eigenvalues greater than one.

2.4.2. Confirmatory Factor Analysis

To confirm our factor structure we conducted a confirmatory factor analysis using using Mplus version 6.11. To establish divergent validity two models were initially conducted: a 1 factor model loading all items from both the WFC and RWLC scale onto a single latent construct, and a 2 factor model loading each item onto its respective construct. Tucker Lewis Index (TLI) and Comparative Fit Index (CFI) fit indices were used to compare the fit of both models. If our hypothesis that RLWC represents a unique construct is correct, the latter model with have better fit indices.

2.4.3. Hierarchical regression analyses

Once the internal validity of the measure was established, we combined both samples to test the predictive validity of the RWLC scale over the WFC scale. Using IBM SPSS version 21 two hierarchical regression analyses were conducted to identify the added variance explained of depression by RWLC over the WFC scale. This analysis was then repeated with sleep quality as the outcome measure.

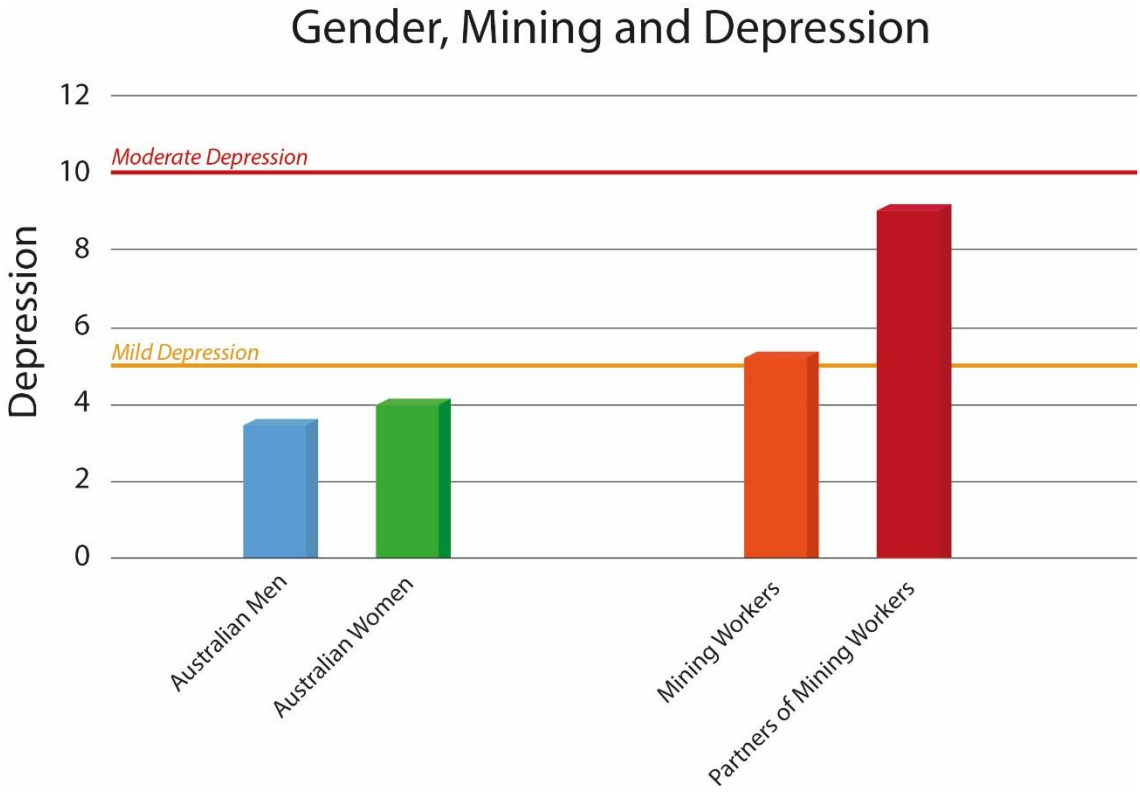
3. Results

Descriptive statistics (Table 2) were generated using IBM SPSS version 21. On average, partners reported higher scores on all observed variables with the exception of Remote Work-Life Conflict (RWLC). Partners reported notably higher depression scores (8.90) than the miners. Kroenke, Spitzer and Williams (2001) categorise a score of 5-9 as mild depression, and a score of 10-14 as moderate depression. Both mining workers and partners in our sample reported higher depression scores than recent mean scores for men (3.45) and women (4.06) in the Australian Workplace Barometer (AWB) dataset (Dollard, et al., 2015; Figure 1).

A simple t-test revealed whether gender accounted for depression scores. There was a significant differences in the scores for mining workers (M = 5.59, SD = 5.09) and the AWB male population (M = 3.45, SD = 3.74) on depression; t(55)=3.10 p = <.001. Similarly there was a significant difference between mining worker partners (M = 8.90, SD = 6.77) and the AWB female population (M = 4.06, SD = 4.3) on depression; t(76)=6.19 p = <.001. There was therefore a significant difference between mining workers' and partners of mining workers' depression scores and normal population statistics.

Figure 1

Comparison of Depression Scores Between Mining Workers, Mining Worker Partners and Australian Population (2014-2015) Averages



Australian Population Averages are from recent Australian Workplace Barometer data. Means are weighted for age, gender and state.

A reliability analysis conducted in SPSS revealed the RWLC scale had strong internal reliability. Previous recommendations for alpha values range between .70-.95 (Tavakol & Dennick, 2011). Streiner has additionally proposed alpha's exceeding .9 may suggest a scale has too much similarity in its items, and that some items may be redundant. Reliability analysis for the RWLC scale derived a Cronbach's alpha of .90, which matched the internal reliability found for Netemeyer et al.'s WFC scale ($\alpha = .90$). We therefore conclude that the RWLC scale has high internal reliability and no redundancy.

Table 2

Descriptive Statistics for Work-Life Conflict and Outcome Measures amongst Mining Workers and Partners

	Mining Workers (n =55)		Partners (n = 76)		Total Sample (n = 131)	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Depression	5.59	5.09	8.90	6.77	7.51	6.31
Sleep Quality	13.11	4.14	16.65	5.14	15.16	5.04
WFC	20.83	7.10	21.82	7.08	21.40	7.07
RWLC	19.89	5.60	15.78	6.72	17.50	6.58
Age	36.97	7.87	34.45	8.42	35.51	8.42

WFC = Work-Family Conflict, RWLC = Remote Work-Life Conflict.

3.1 Exploratory Factor Analysis

Supporting the internal validity of the Remote Work-Life Conflict scale, the principal component analysis (Table 3) yielded two distinct factors. As anticipated, the items loaded on each theoretical construct appropriately. Factor loadings for the Work-Family Conflict scale were optimal (MacCallum, Widaman, Preacher, & Hong, 2001), varying from .85 to .92. Factor loadings for the Remote Work-Family Conflict scale were also optimal, varying from .84 to .92.

Table 3.

Work-Family Conflict and Remote Work-Life Conflict Item Structure Matrix Amongst Mining Workers

Item	Component	
	1	2
WFC1	.85	.32
WFC2	.92	.43
WFC3	.88	.46
WFC4	.92	.42
WFC5	.87	.33
RWLC1	.38	.92
RWLC2	.42	.86
RWLC3	.35	.84
RWLC4	.40	.92

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization. WFC = Work-Family Conflict, RWLC = Remote Work-Life Conflict.

3.2 Confirmatory Factor Analysis

A Confirmatory Factor Analysis (CFA) was conducted to cross-validate the internal validity of the Remote Work-Life Conflict (RWLC) scale, as well as establish its divergent validity from Netemeyer et al.'s (1996) Work-Family Conflict (WFC) scale. To establish divergent validity two structural equation models were conducted: a 1 factor model with both scale items all loading to a single factor, and a two factor model loading each item to its respective scale. Table 4 shows fit indices for both the 1 factor and two factor models, as well as modelling the RWLC scale alone. Our fit indices suggest that the two factor model was an improvement, with a much lower chi square and improvements to both the TLI and CFI. These findings add further support to the divergent validity of this scale. An optimal TLI and CFI is .90, and therefore the TLI for the two factor model was a bit lower than anticipated. Modelling RWLC scale alone however showed an improvement on all fit indices to optimal levels.

Table 4

Goodness of Fit Indices for Stability and Causality Models Between Groups

Model	x^2	*Df*	*p*	TLI	CFI
1 Factor model	135.40	27	<.001	.685	.764
2 Factor model	72.33	26	<.001	.860	.899
RWLC	7.25	2	.03	.908	.969

x^2= chi square, df = degrees of freedom, p = probability, RMSEA = Root Mean Square Error of Approximation, TLI = Tucker Lewis Index, CFI = Comparative Fit Index. RWLC = Remote Work-Life Conflict.

3.3 Hierarchical Regression Analyses

Two hierarchical regression analyses were conducted to establish the predictive validity of the RWLC scale over and above the WFC scale, first, modelling depression as the outcome variable, and second, with sleep quality as the outcome variable. In both analyses WFC, and whether the participant was a mining worker or partner, were entered at stage one of the regression, and RWLC was entered at stage two. The hierarchical regression analysis for depression and sleep quality is summarised in Table 5 and 6 respectively.

Table 5

Summary of Hierarchical Regression Analysis for Variables Predicting Depression

Variable	β	*t*	sr^2	R	R^2	ΔR^2
Step 1				.49	.24	
Group	-.23	-2.99**	-.26			
WFC	.42	5.36***	.43			
Step 2				.60	.36	.12***
Group	-.39	-4.97***	-.40			
WFC	.17	1.90*	.14			
RWLC	.45	4.91***	.35			

****p = <.001, **p = <.01, *p= <.05. Group, 1= partner, 2= mining worker. WFC = Work-Family Conflict. RWLC = Remote Work-Life Conflict. β = standardised coefficient.*

The first hierarchical multiple regression showed that at stage one, WFC and group (partner = 1, mining worker =2) significantly predicted depression, F (2,128) = 20.05, p <.001 and accounted for 23.9% of the variation in depression. Adding RWLC to the model explained an additional 12.1% of the variation in depression with a significant R^2 change, F (3, 127) = 23.80, p <.01. Together, all three of the predictors accounted for 36.0% of the variance in depression.

Table 6.

Summary of Hierarchical Regression Analysis for Variables Predicting Poor Sleep Quality

Variable	β	*T*	sr^2	R	R^2	ΔR^2
Step 1				.47	.22	
Group	-.33	-4.16***	-.33			
WFC	.31	3.97***	.31			
Step 2				.58	.33	.11***
Group	-.48	-6.00***	-.44			
WFC	.07	0.79	.06			
RWLC	.44	4.66***	.34			

****p = <.001, **p = <.01, *p = <.05. Group = 1, partner; 2, mining worker. WFC = Work-Family Conflict. RWLC = Remote Work-Life Conflict. β = standardised coefficient.*

The second hierarchical multiple regression showed that at stage one, WFC and group (partner = 1, mining worker =2) significantly predicted sleep quality, F (2,128) = 17.77, p = <.001 and accounted for 21.7% of the variation in sleep quality. Adding RWLC to the model explained an additional 11.4% of the variation in depression with a significant R^2 change, F (3, 127) = 20.98, p = <.001. Together, all three of the predictors accounted for 33.1% of the variance in sleep quality.

4. Discussion

As businesses adapt to changes in technology, so too must the world of organisational psychology adapt to understand these changes in the way we work. The present paper tested the internal reliability, as well as the divergent and predictive validity of a new scale spurred by these changes: the Remote Work-Life Conflict (RWLC) scale. As anticipated, the factor structure showed a strong divergent validity from a prevailing work-life conflict measure, Netemeyer et al.'s (1996) Work-Family Conflict (WFC) scale, with optimal factor loadings. We conducted a CFA using the partners of mining workers to cross-validate the RWLC scale, which showed a good model fit and divergent validity from the WFC scale. Finally we conducted a hierarchical regression to test the predictive validity of the RWLC scale over and above the WFC scale, which showed it significantly added to the variance explained in both reported depression and sleep quality. Passing these tests, we believe this scale represents a unique construct that has both theoretical implications, and practical benefits.

Our findings support the role conflict perspectives of role theory (Cooke & Rousseau, 1984), that is, the conflict between two domains (work vs family or social domains) will lead to strain-based negative psychological health outcomes. Similarly, this adds support to COR perspectives of work-life conflict, as our sample which have very limited time-based resources experienced WFC and RWLC-related strain. This is also theoretically harmonious with other work stress theories (i.e. Job Demand Resources model), which propose unresolved strain created by work-related stressors (i.e. WFC) manifests into strain-related health outcomes.

However, our findings expand upon the local theory development in Chapter 4. In the previous chapter we discussed the effect of proximity on social relationships, showing that mining workers had a more alleviative social support from co-workers than the general working population. Remote mining workers are closer to their co-workers, and therefore their social bonds will be stronger than others. This too suggests a contrasting effect: that separation will degrade social relationships. The present study supports this proposition, in that RWLC significantly explained the variance in poor health outcomes in both mining workers, and partners, over and above what was explained by WFC.

The inability to commit time to two conflicting roles is an important assumption of the occurrence of conflict in role theory (Cooke & Rousseau, 1984), and extending

this reasoning, contexts with greater time restrictions will be associated with more negative consequences. Specifically, we proposed that during extended periods of absence there is little to no time available to attend to home roles, nor consistent time to commit to a personal routine. We argue this exacerbates conflict between the work and personal domains. Our findings support this proposition, which may be an important factor to consider in both research and job design, where an employee is exposed to these time constraints.

Employers, in particular mining employers using rotational work rosters, may also benefit from considering the implications of their employees roster structure and whether this places their employees at risk of health detriments. In our study, we observed an association between role conflict and poor sleep quality and depression, both of which are linked to cognitive impairment (Goodwin, 1997; Miller, Wright, Hough, & Cappuccio, 2014) and therefore pose a potential safety risk not just to the person's experience these symptoms, but to their co-workers as well. Considering the human error hazards on mining sites, mining employers may wish to focus on reducing RWLC among workers as a primary intervention strategy for reducing work accidents. Additionally, once RWLC was added to the model, WFC no longer significantly predicted sleep quality. In this regard, RWLC scale may be a more useful for mining employers or researchers examining mining samples.

Finally, the evidence of RWLC occurring for both groups adds support to the growing literature of crossover theory, and diverges from the predominant employee-centric focus of work-stress research. Finding RWLC occur for mining workers and partners also extends crossover theory by showing that crossover also effects non-family domains of partners as well. We explain this process due to the shared experience of non-work roles amongst workers and their partners. In a relationship, many activities become interdependent, and therefore disruption for one partner will affect the other. This is exacerbated with remote worker partnerships, where their shared time is restricted than the partnerships of non-remote workers.

4.1 Limitations

There were several limitations with the present study. First, the authors were limited in the available sample size. The on/off nature of remote mining work makes it difficult to reach participants, who have little time to participate when on-site, and

prefer to detach from work when off-site. This may also explain the current lack of research available on remote mining workers. We were therefore limited to cross-sectional data, and therefore cannot establish causal connections between study variables. However role theory and evidence suggests role conflict is an antecedent to strain-based health outcomes. Additionally, due to the limited data we were not able to collect data from both partners in a relationship, and therefore could not analyse data within the relationships simultaneously.

A final limitation was the gender disparity between the groups. Mining workers are typically male, and conversely their partners are typically female. It is possible that gender could influence the results, however the disparity between mining workers and partners was much higher than the means differences between men and women in Australian population data (Figure 1), suggesting that being the partner of a mining worker creates a risk for depression above the variance explained by gender.

4.2 Future research

Future research on role conflict should consider the work arrangement of the participants. Apart from employees who work rotational rosters (e.g. mining workers, offshore oil rig workers, fishermen on trawlers), many workers engage in seasonal work (e.g., agriculture), or employment with fluctuating workloads (e.g., tourism, teaching). Researchers should consider including measurement variables that capture fluctuating work patterns, or at least acknowledge the influence this may have on the data.

Future research could address some of the limitations of the present study. Future research could collect cross-matched data from mining workers and partners to more explicitly measure cross-over. Future researchers could also consider collecting data specifically from female mining workers and their male partners to better elucidate the role of gender.

4.3 Conclusion

The present industry focused study found evidence for a unique construct of Remote Work-Life Conflict, that added to the variance explained in depression and sleep quality by Work-Family Conflict. Our findings support a context-specific component of work role conflict, which affects remote workers through the unique time related strain aspects of remote work.

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Chapter 6

Epigraph

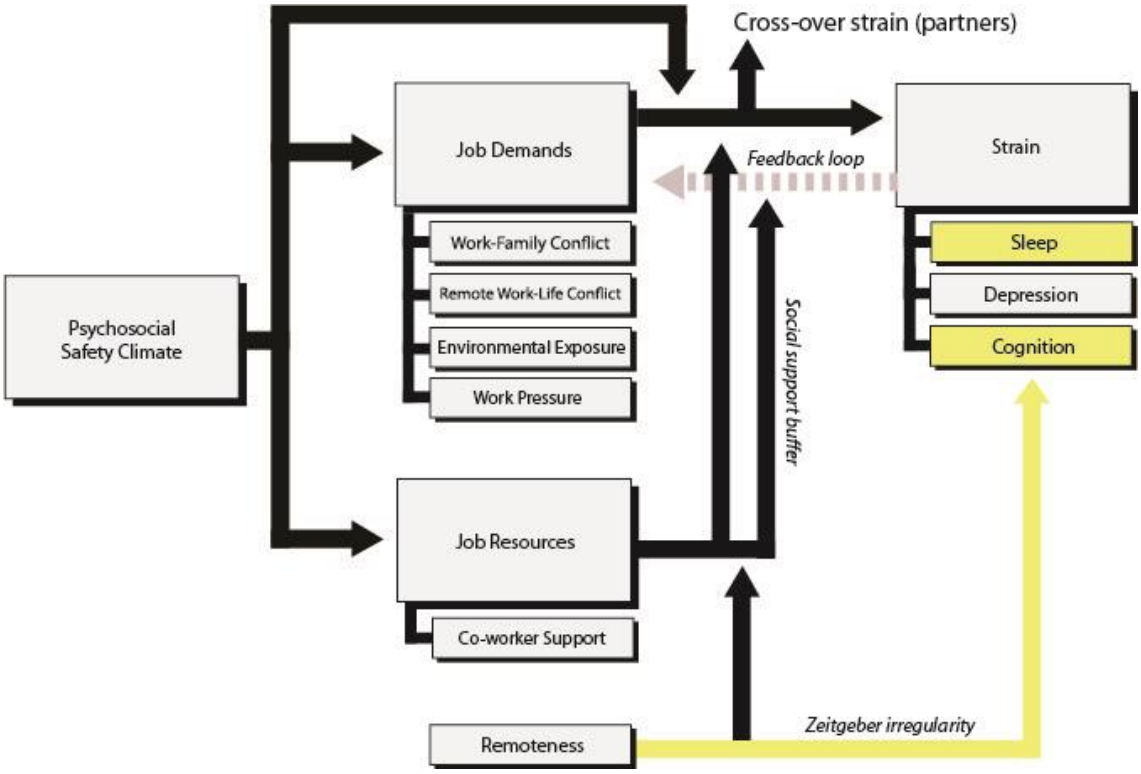
In the previous chapter we validated our measure of Remote Work-Life conflict, supporting our hypothesis that remote workers experience a unique form of work-life conflict. Supporting our qualitative findings in Chapter 3, this unique conflict construct strongly predicted sleep disturbances and depression. In Chapter 3 mining workers also reported cognitive fatigue, which we collected data on in our quantitative survey for mining workers.

In the present study we proposed that sleep and cognitive problems experienced by mining workers could be explained by difficulties with their circadian rhythm regularity. Their sleep/wake cycle is likely to differ substantially between when at home and when on site. *Zeitgebers*, the external cues we experience during the day that help entrain our circadian rhythms, are also likely to change. These include light exposure and time of meal consumption. In this regard experiencing irregular zeitgebers affects the ability to develop regular circadian rhythms.

To test if mining workers experienced greater cognitive and sleep problems, we compared the scores on a battery of cognitive tests and self-reported sleep measure taken by mining workers, to the scores of a general population sample previously collected by the principal investigator with partially matched data. We therefore hypothesised that mining workers would experience greater sleep problems and poorer cognitive performance due to circadian rhythm irregularity.

Figure A

Development of Local Theory of Work Stress in Chapter 6



Yellow boxes and arrows indicates variables and pathways introduced in Chapter 6.

Chapter 6

Fly-in/Fly-out, sleep and cognition

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Abstract

Fly-in/Fly-out rosters have become popular methods of deployment for companies operating in remote areas such as mining companies operating out of Australia and Canada. FIFO rosters require stark lifestyle changes on employees, and the potential psychological affects have been brought into question in recent decades. We proposed that the drastic change in differences in the external cues that entrain circadian rhythms: *zeitgebers*, work days create an irregularity in circadian rhythms, and affect sleep and cognition. To test our hypotheses, we compared two groups, remote Australian mining workers (n = 25), and a comparative sample (n = 37) recruited through university advertising and social media. We found mixed support for our hypothesis, finding mining workers reported significantly poorer scores on one item of sleep quality (awaking during the night) and one measure of cognitive performance (change detection). These findings suggest remote mining work may affect some aspects of sleep and cognition, which may be attributable to circadian rhythm irregularity.

Key words: mining, cognition, sleep, stress

1. Introduction

Fly-in/Fly-out (FIFO) rosters have become a popular employment method among mining companies, and have helped accommodate rapid industry growth in recent decades spurred by an increased demand for primary resources in Central and Southeast Asia. FIFO refers to roster structures where employees are flown in from large urban centres, to live and work at remote sites for a period of work days, and are then flown home for a period of rest days in a continuous cycle. Similar arrangements exist such as Drive-in/Drive-out (DIDO) rosters that may also be referred colloquially to as FIFO. Concerns however have been raised regarding the implications of FIFO practices on both personal relationships and the psychological wellbeing of FIFO employees, which we refer to as remote mining workers. One concern is the anticipated psychological strain that may occur by working short high intensity periods, as well as the rapid change between work and rest periods which may disrupt circadian rhythms. The present study aims to investigate the authenticity of these concerns through comparing remote mining workers and a general community sample in their reported sleep behaviours and cognitive performance. We use zeitgeiber theory to account for the differences experienced by remote mining workers.

1.1 Rise of FIFO practices

The practice of FIFO originated in offshore oil drilling in the 1950s (Gramling, 1995), however since then has become a popular deployment strategy amongst mining companies operating in Australia and Canada, due to several contributing factors. First, both countries have notably low population densities, and mineral deposits are typically inland and away from coastal urban populations. Second, FIFO practices are more adaptable to the lifespan of a mine, which can sometimes be as low as two to ten years depending on the resource being mined (Statista, 2015). Mining companies are reluctant to invest in permanent settlement that will become unsustainable when the site is no longer operational. Comparatively, on-site accommodation and offices are more economically viable through ‘transportables’, simple modular non-grounded structures that can be transported to a new site location if needed. Third, FIFO practices allow for a greater recruitment pool, as it increases the number of potential recruitment candidates. Furthermore, tertiary education and specialised training are typically

provided in major cities, and therefore skilled labour is likely to be easier to source from these locations.

Definitive figures on the exact number of remote mining workers in Australia is not well documented. However, according to Australian Bureau of Statistics (2013) records, by 2011 nearly 22% of mining workers in Australia lived in Perth, and therefore we can assume that 22% were predominantly on FIFO contracts to be able to work remotely inland. As a large number of mining workers are deployed from Australia's other major cities to meet employment demands outside of Western Australia (although WA is the largest mining state), it is likely that the overall proportion of mining workers on FIFO contracts is at least half or more of all Australian miners. Other mining countries rely on FIFO rosters less, as they have a higher population density and therefore do not need to deploy employees as remotely as Australia. FIFO practices are still popular outside of Australia however, particularly in Canada. Additionally, with continued growth in the technologies that facilitate FIFO practices, we can anticipate a continued shift towards FIFO contract arrangements in mining employment in the future, particularly in Australia.

1.2 FIFO Effects on employees

Despite a growing quantity of FIFO contracts occurring in Australian mining, the available literature as to how this may affect employees is limited. Statistics according to the Australian Workplace Barometer report however suggest that mining workers had the highest levels of Work-Family Conflict (McLinton & Bailey, 2014). Further, in the previous chapter we identified Remote Work-Life Conflict: a measure of work-life conflict due to FIFO contracts, to be associated with heightened levels of depression and poorer sleep quality, over and above the effect of WFC. This would suggest that that FIFO contracts have a negative effect on mental health and sleep quality.

Supporting this notion, a study by Muller, Carter and Williamson (2008) found longer FIFO rosters were associated with increased fatigue and decreased performance. The authors expressed a concern over the lack of available research on the effects of FIFO rosters, considering the potential health and safety risks that may arise due to number of hours worked and their irregularity. An argument can be made that the irregularity of FIFO roster structures may disrupt an employee's circadian rhythms.

FIFO mining employees typically start early in the morning and finish late in the evening. This may be exacerbated further for employees who are on FIFO contracts, and are also on shift work. Consequently, their sleep/wake patterns are prone to change back and forth from a regular cycle and the cycle adopted on work days, as the *zeitgebers* or external cues that influence our circadian rhythms, in each experience are likely to differ significantly. For example, a worker may wake at 6am on a work day so that they can have breakfast before starting at 7am. In contrast, on a rest day they are likely to sleep in, or wake at the same time as other members of the household.

It is also possible that poor sleep will be exacerbated by the on-site accommodation. The transportables that employees live in when on site lack the noise insulation of permanent accommodation. Sound permeating through the walls at night may disrupt their sleep, and present additional zeitgeber irregularity (i.e., we normally do not experience exposure to loud noises when resting at night).

1.3 Circadian rhythm regularity and health

Circadian rhythm regularity may be a concern for mining employers, as there is evidence that circadian rhythm regularity is important in wellbeing stability, sleep and cognitive function. A study by Monk, Reynolds, Buysse, DeGrazia and Kupfer (2003), found lifestyle regularity, measured by the consistency of zeitgeber occurrences such as sleep, wake, and eating times, was positively associated with sleep quality. An earlier study by Monk, Petire, Hayes and Kupfer (1994) found lifestyle regularity was associated with variations in alertness in addition to sleep quality. Moreover researchers have found lifestyle regularity predicted sleep efficiency and quality among elderly (Zisberg, Gur-Yaish & Schochat, 2010), but also lower prevalence of the the onset of affective disorder episodes amongst sufferers of major depression and bipolar disorder. This research implies that having stable routine and regular zeitgebers to entrain our circadian rhythms is important in mood stability (Shen, Alloy, Abramson & Sylvia, 2008).

Although there is a dearth of published research on the effects of FIFO roster structures on sleep behaviour, there is an abundance of research on sleep deficits amongst shift workers, who also experience irregular sleep/wake cycles associated with their work roster. Shift workers are also likely to experience irregularity in zeitgebers,

especially when they transition between working day and night shifts. A large body of research shows shift workers experience poorer sleep quality (Åkerstedt & Torsvall, 1981; Gold, et al., 1992; Härmä, Tenkanen, Sjöblom, Alikoski, & Heinsalmi, 1998; Phillips, Magan, Gerhardstein, & Cecil, 1991), as well as health impairments such as obesity (Karlsson, Knuttson, & Lindahl, 2001), an increased risk of type II diabetes (Pan, Schernhammer, Sun & Hu, 2011) and ischaemic heart disease (Knutsson, Jonsson, Akerstedt, & Orth-Gomer, 1986). Shift workers have also been found to have poorer wellbeing and greater abstenteeism than regular workers (Phillips, Magan, Gerhardstein, & Cecil, 1991).

Alarmingly, several studies have found a relationship between shift work and incidences of employee errors and accidents. A study by Smith-Coggins, Rosekind, Hurd and Buccino (1994) found night shift physicians were more like to commit errors as their shift progressed. Similarly, a study by Gold, et al. (1992) found rotating shift nurses were more likely to fall asleep at work or driving home from work, and were twice as likely to have caused a reported accident or error related to feeling sleepy at work. A study by Drake, Roehrs, Richardson, Walsh and Roth (2004) found shift workers who were considered having shift work sleep disorder (shift workers with excessive sleepiness and insomnia) had higher rates of ulcers (OR = 4.18) as well as sleepiness-related accidents, depression and absenteeism. The accumulative evidence from these papers raise concern over the potential health and safety consequences of irregular work rosters, which may translate to FIFO practices as well.

1.4 Cognition and Safety

Identifying safety risks associated with FIFO roster work is therefore an important area for investigation. However, research on accident and error rates in mining companies can be perceived as invasive research to both employee and employer. Additionally, high industry fatality rates (SafeWork Australia, 2011) create a barrier to organisation involvement. A less invasive method is to collect data on employee cognitive performance, which may be indicative of accident and error rates (i.e., risk).

One measure of cognitive performance is working memory, which is the cognitive process of holding and processing received information, and using that information to draw conclusions on tasks or solve problems. A person with impaired

working memory may have difficulty accurately assessing potential safety scenarios, such as reading and responding to signs appropriately, or keeping track of the number and location of employees working near heavy machinery. Research by Guerrier, Manivannan and Nair (1999) supports this, finding poor visual working memory was related to increased driver errors. Similarly, visual attention tasks have been shown to be highly predictive of driver accidents. Ball, Owsley, Sloane, Roenker and Bruni (1993) found performance on a visual attention task was a high sensitivity (89%) and specificity (81%) predictor of driver accident history among older adults.

Change detection is another measure of cognitive performance used as an indicator of accident risk. Change detection is particular common in driver safety studies (Caird, Edwards, Creaser, & Horrey, 2005; Lee, Lee, & Boyle, 2007; Strayer, Drews, & Johnston, 2003), as it reflects the ability to notice minute changes in one's visual field, i.e. a person crossing the road or a car changing lane. As remote mining workers frequently have to drive on site, as well as to and from camp, change detection could be important for minimising on-site vehicular accidents. These conditions are further exacerbated by environmental factors experienced by mining workers on site. Winds can pick up dust and obscure driver vision. Similarly, the noise of machinery can impair interpersonal communications, and roads on site may lack the traction of urban roads designed for permanency.

Processing speed is another popular measure of cognitive performance and may also be an indicator of accident risk. Like change detection, processing speed has been used as an indicator of driver safety (Ball, et al., 2006; Di Stefano & Macdonald, 2003), as high processing speed enables a driver to process new and unexpected information rapidly take appropriate recourse in the event of an accident or near-accident to minimise or avoid harm. In this same regard, processing speed would also be beneficial in avoiding other onsite accidents like reacting to falling equipment or noticing dangerous machinery behaving incorrectly.

Cognitive performance has been found to be impaired in shift workers. Research by Santhi Horowitz, Duffy and Czeisler (2007) found night shift workers had impaired performance on a visual attention task when transitioning to their first shift night. Considering circadian rhythm impairment due to irregular zeitgebers, it is likely that FIFO workers also experience some detriment in cognitive performance and sleep

quality like the relationships found with shift workers. We therefore propose the following hypothesis:

Hypothesis 1. Remote mining workers will experience poorer self-reported symptoms of sleep quality than the general population.
Hypothesis 2. Remote mining workers will experience poorer cognitive performance than the general population.

Sleep quality comprises several aspects related to sleep experience, such as ease of falling to sleep and waking during the night. Therefore the present study will also investigate differences on individual items of sleep quality. If a specific aspect of sleep quality is poorer amongst remote mining workers, targeting this specific component may be more effective in alleviate sleep problems and associated impairments.

1. Method

2.1 Procedure

The study data consists of two groups of participants (general population and remote mining workers) from cross-matched databases using the same research variables. Both samples were collected in the same year and from South Australia. Participants from the general population sample were invited to participate in a survey on health and cognition via social media posts shared with two of the authors' social network pages as well as student webpages in Adelaide-based universities, and via flyers posted across University of South Australia Adelaide campuses. The survey was deployed online via the University of South Australia's online survey tool *Tellus2*.

Participants from the mining group completed an online survey using a web-based questionnaire platform, *Fluidsurveys.com*. Data were collected between late 2013 and early 2014. Between 2012 and 2014 several mining organisations were approached for participation. Three agreed to provide a URL link to an online survey to their employees via their internal mailing lists. Additionally, an Australian family support group for mining employees and their partners, *Mining Family Matters*, was contacted, and provided an invitation of survey participation on their website and through their social media page on Facebook. Participants were invited to complete a short or long

form of the survey, where the long form contained a link to a battery of cognitive tests. Participants who completed this battery were included in the present study.

2.2 Sample

The total sample consisted of 62 Australian participants from two groups. Group 1 consisted of 25 participants employed in mining organisations operating in Australia in varying length FIFO contracts. All group 1 participants reported working day shifts. Group 2 consisted of 37 workers were not employed in the mining industry. Participants in the second group were employed in a range of industries including education, retail, hospitality and health services. Participating mining employees were predominantly male (94.44%) and were aged from 24 to 56 (M = 35.78, SD = 8.50). The comparative sample was 50% male and 50% female, and were aged 18 to 30 (M = 23.95, SD = 3.03).

2.3 Measures

2.3.1 Cognitive performance

Cognitive performance was assessed using a web-based battery of tests assessing the participants' performance in change detection, processing speed, and visual working memory. All three tests provided by Harvard's Vision Laboratory cognition testing website *testmybrain.org* (Germine, et al., 2012).

2.3.1.1 Change detection

Participants completed a five minute Flicker Change Detection task where they were shown a series of trials of a screen with flashing blue and yellow dots. Participants were required to successfully discriminate the one target dot that intermittently changes colour between flashes of blue and yellow. Participants are scored on their reaction time on successful trials. A higher score reflected both a faster time in discriminating the dot, as well as being able to discriminate the dot among a larger number of dots.

2.3.1.2 Processing speed

Participants completed a short Digit Symbol Coding task, where participants were provided with a key to match shapes and numbers, and were required to successfully press the correct number when shown the corresponding shape. Participants are scored on the number of successfully matched shapes in 90 seconds. A higher score indicated a higher number of successful matches in 90 seconds.

2.3.1.3 Visual working memory

Participants completed a 10 minute Visual Working Memory for Shapes task, where participants were provided a series of trials displaying four novel shapes arranged around a cross. Participants are then shown a shape in one of the four positions and must identify if the shapes match. After a successful trial, the display the shapes becomes incrementally shorter durations. Participants are scored on the overall percentage of correctly matched shapes. A high score indicated the participant could correctly recall the shapes after a very short display.

2.3.2 Sleep quality

Sleep quality was measured using the quality of sleep subscale from Schat, Helloway and Desmarais' (2005) Physical Health Questionnaire. Participants are asked to rate their quality of sleep in the previous three months. The Quality of Sleep scale (α = .74) contains 4 items ranging from 0 (*not at all*) to 7 (*all of the time*). Total sleep scores ranged from 0 to 28. An example item is, "how often have you woken up during the night?" A higher score reflected a poorer quality of sleep.

2.3 Analysis

A challenge of the present study was the polarised gender demographics of the mining work group. By having a low percentage of female workers (5.64%) it was difficult to ascertain if any of the perceived differences in the mining group were attributable to an occupational factor or gender. To help delineate the contribution of these variables, a preliminary Multivariate Analysis of Variance (MANOVA) was conducted, looking at gender differences in the observed outcome variables. In this

analysis we found no significant relationship between gender and sleep symptoms, but did find a significant difference on visual working memory, F = 8.21, p <.01. Similarly there was a notable difference in age between both groups (approximately 10 years). A preliminary analysis looking at age differences in outcomes showed a significant difference on sleep item 3, "how often have you had nightmares or disturbing dreams?" We discuss the role of gender and age in regard to these outcomes in our interpretation of the results and as study limitations in the discussion. To test the hypotheses that FIFO mining was related to differences in sleep quality and cognition, we conducted a Multivariate Analysis of Variance (MANOVA) including sample group (1 = remote mining workers, 2 = comparative sample) as the predictor variable, with each cognitive test and each quality of sleep item as outcome variables.

3. Results

Support for our study hypotheses was mixed. Providing mixed support for Hypothesis 1, group (1 = remote mining workers, 2 = general population) did not significantly explain the variance for three of the four indicators of sleep quality, or the overall measure of sleep (Table 1). Group did however significantly explain 8% of the variance explained in the second item: waking during the night, F (1, 61) = 5.10, $p < .05$, with remote mining workers scoring higher.

Providing mixed support for Hypothesis 2, group did not significantly explain the variance for two of the three measures of cognitive performance (Table 1). Group did however significantly explain 6% of the variance explained in change detection, F (1, 61) = 3.94, $p < .05$, with remote mining workers scoring lower.

Table 1.

Means and Effect Sizes from a Multivariate Analysis of Variance Examining the Differences Between Remote Mining Workers and a Comparative Sample in Sleep Quality and Cognitive Performance

Variable	Remote Miners Mean (SD)	Comparative Sample Mean (SD)	F	Partial Eta^2 (significance)
How often have you had difficulty getting to sleep at night?	3.71 (1.06)	3.84 (1.83)	.08	.001 NS
How often have you woken up during the night?	4.27 (1.49)	3.54 (1.56)	5.10*	.04
How often have you had nightmares or disturbing dreams?	2.29 (1.31)	2.47 (1.50)	.03	.00 NS
How often has your sleep been peaceful and undisturbed? (reverse coded)	3.84 (1.60)	3.89 (1.61)	.00	.00 NS
Change detection	9.76 (3.09)	11.69 (4.09)	3.94*	.06
Processing Speed	46.87 (7.27)	50.37 (10.36)	2.11	.04 NS
Visual working memory	34.60 (3.91)	33.11 (4.99)	1.54	.03 NS

*SD = Standard Deviation, F = Fisher–Snedecor distribution, *p = <.05.*

4. Discussion

The present study explored the differences between remote mining workers and a general population sample in their experience of sleep quality as well as their cognitive performance. We theorised that remote mining workers experience inconsistency in their exposure to daily zeitgebers. As an inconsistent exposure to zeitgebers disrupts circadian rhythm regularity which affects sleep and cognitive function, we hypothesized that remote mining workers would experience impairments to their cognitive performance and quality of sleep. Circadian rhythm irregularity has been hypothesised and found in shift workers, who are a similar cohort due to their irregular sleep/wake cycles.

We found mixed support for our hypotheses, as remote mining workers differed to the general population sample on one indicator of sleep quality (waking during the night) and one measure of cognition (change detection), but not significantly on the

other tested variables. Although support for our hypotheses was mixed, we propose several explanations for these findings.

A conservative explanation is that shift workers may experience a more drastic change in zeitgebers when transitioning off their night shift. A shift worker going from a day sleep/wake cycle to a night sleep/wake cycle may have to adjust their waking time by a greater number of hours (e.g. from 7.30am to 5 pm.). Alternatively a FIFO worker may not be required to transition between night and day, but to an early time of day (e.g. 7.30 am to 5am). However it is likely that remote mining workers will compensate and sleep in until later hours when on rest days. Similarly, transitioning between day and night shift means a more drastic change in exposure to sunlight, which is an important zeitgeber in circadian rhythm regularity. In this regard differences in zeitgeber consistency and their disruption to circadian rhythms may not be as severe for remote mining workers.

However, the significant findings of both a sleep quality indicator and a measure of cognition may add support to our initial hypotheses. The sleep item in question was, "how often have you woken up during the night?" Waking during the night may be indicative of a poor adjustment to their on-site sleep/wake cycle from their rest days wake cycle, or vice versa. For example, a remote mining worker may be waking in the early hours of the day on their rest days, as this is the time they would wake to get prepared for going to work. None of the participants in the present paper were working night shift rosters, and we could anticipate that this would be worse for those working both a FIFO and night shift rosters. Participants waking during the night on site may therefore be evidence of circadian rhythm misalignment due to the frequent transitions between different sleep/wake patterns that occurs between shifts, where they do not have enough time to completely transition, as a similar phenomenon has been found among shift workers.

An alternative explanation for the reported greater occurrences of waking during the night, is that FIFO workers may have their sleep disrupted from noises during their sleep. The non-permanent nature of transportable housing is accompanied by less sound insulation than typically found in permanent lodging. It is possible that sleep may be disturbed by the movements of other employees, especially if they are on a different type of shift. Additionally noise from the mine itself, such as processing and extraction

machinery, is often audible from within sleeping quarters. Although an employee may become acclimatised to this sound, they may also de-acclimatise during their rest days.

Poorer change detection scores by remote mining workers may be best explained by fatigue related to circadian rhythm misalignment. This has potential safety implications, as not noticing a change in their visual field may result in not detecting an emerging hazard. As mentioned earlier, change detection is a common measure of cognitive performance used in driver safety research. It reflects the ability of a driver to notice an objective transitioning into their visual field such as a car changing lanes or a person walking onto the road.

As vehicles are used regularly on mining sites, mining companies may benefit in investing in changes that improve circadian rhythm regularity. One possible approach is through bright light therapy, where an individual is exposed to a bright light in the morning to help reset their sleep/wake cycle. Bright light therapy has been found to be beneficial for shift workers and sufferers of sleep-related illnesses (Prasko, 2008). Further, a meta-analysis by Golden, et al. (2005) found bright light therapy to be effective in reducing mood disorders. As depression was identified as a health outcome experienced by mining workers in Chapter 4 and 5, bright light therapy may be additionally beneficial for these workers.

4.1 Limitations

A limitation of the present study is that it is difficult to ascertain the degree of the variance between groups on outcome variables that is attributable to age or gender differences. We conducted preliminary analyses to examine the variance of outcome measures attributable to age and gender. However, the outcomes explained by age and gender did not match the outcomes explained by group. This adds support to the notion that our findings were attributable to group differences and not gender or age, however we acknowledge that the age and gender differences between samples and the limited sample size, make it difficult to discern whether gender or age played a role in the findings.

There is evidence to suggest that cognitive performance decreases with age (Raz, 2000), and the remote mining worker sample is approximately 10 years older on average. Additionally, most of the FIFO participants were male (94.4%), and therefore

it is difficult to ascertain if there was a difference in performance attributable to gender. There is research to suggest that men typically perform better on spatial reasoning tasks, whereas women typically perform better on verbal tasks - however meta-analyses suggests these differences are relatively small (Hyde, 1981).

It is also possible sleep differences were attributable to gender however this isn't clear in the literature. Women tend to report better overall sleep quality (e.g. better sleep durations) however more sleep complaints (Zhang & Wing, 2006) and wakefulness (Reyner, Horne, & Reyner, 1995). Similarly, age is negatively related to sleep quality, however these differences become more prominent among the elderly (Reyner, et al., 1995). Future research could further delineate the contribution of FIFO contracts, gender and age to each variable by comparing with representative samples by age and gender, and with a greater sample size.

4.2 Conclusion

In conclusion, our study found mixed support for our study hypotheses that FIFO and non-FIFO workers differ in cognition and sleep quality. Our findings suggest that the irregularity of FIFO rosters may make it difficult to develop a stable circadian rhythm, which limits sleep quality and some cognition performance. The present study was limited in the disparity of gender and age between comparative groups, which could be addressed in a larger more representative sample in future research. Our findings add weight to the zeitgeber perspectives argued on the irregularity of shift work, which may be translatable to other disruptive roster patterns.

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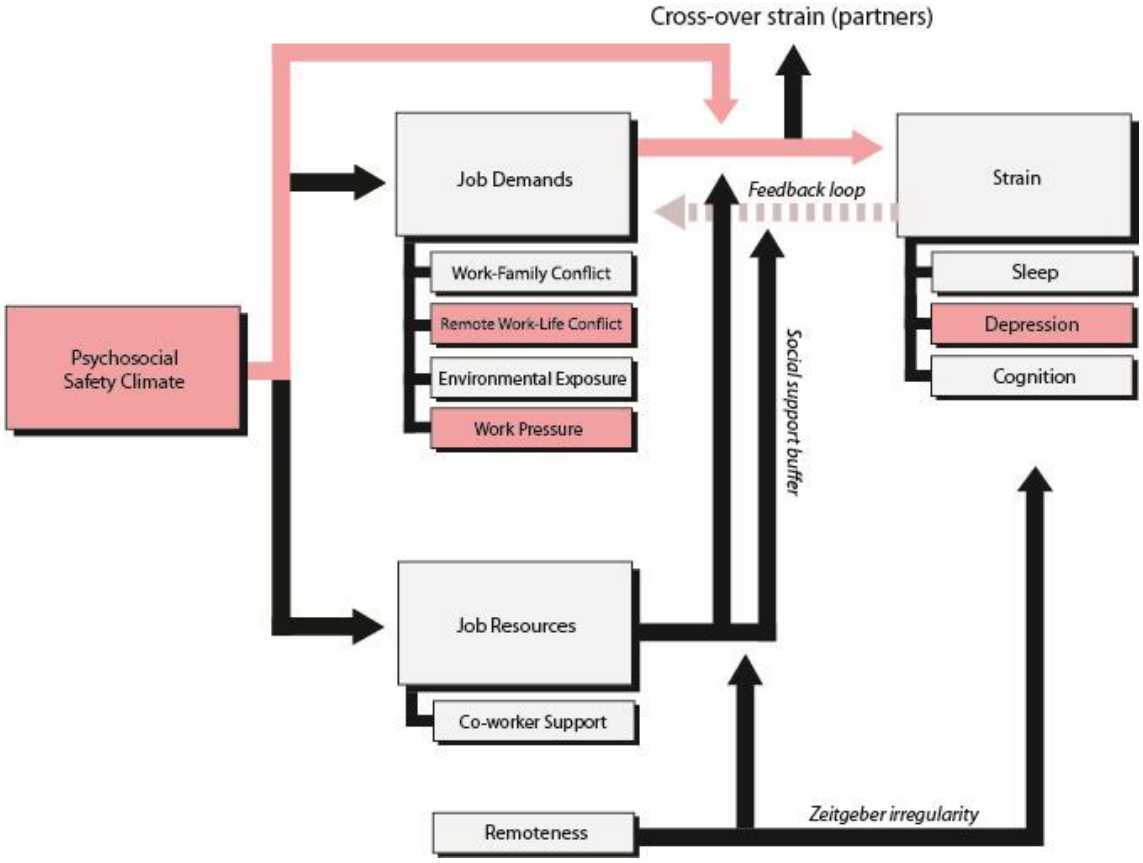
Chapter 7

Epigraph

In our final study paper we investigated the role of Psychosocial Safety Climate (PSC) in moderating the stress process in our theoretical model. PSC was a theme that emerged in our qualitative research (Chapter 3) as a potential organisational macro-resource in protecting employee psychological health. PSC plays an important role in employee psychological health, in that it influences policies, practices, and procedures that govern the demands and resources that employees experience. Further, PSC has been found to buffer stress, demonstrating a secondary action as well. This buffer process can be explained in that when PSC levels are high, employees have greater confidence in their ability to access organisational resources that are important in minimising stress. Having high levels of PSC is therefore important in protecting employee health.

Figure 1.

Development of Local Theory of Work Stress in Chapter 7



Pink boxes and arrows indicates variables and pathways introduced in Chapter 7.

Chapter 7

FIFO Rosters, Wellbeing and Psychosocial Safety Climate

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Abstract

During a recent Australian parliamentary inquiry into the mental health effects of FIFO rosters, Chevron Australia's general manager for human resources denied claims of a link between FIFO and mental health. In response to this enquiry and the garnered public interest, we examined the effect of FIFO contracts on depression through two FIFO related stressors: swing length (time away on site) and remote work-life conflict (RWLC). We additionally propose psychosocial safety climate (PSC) as an organisational resource that may minimise the associated psychological strain from FIFO contracts. To test our hypotheses, we conducted two hierarchical regressions on a small sample of Australian mining workers (n = 53) engaged in various lengths of FIFO contracts. In each analysis we found swing length and RWLC significantly predicted depression. In each analysis we additionally modelled PSC as a predictor which significantly predicted depression, and buffered the strain from RWLC but not swing length. Our findings build upon previous PSC theory, as well identifying an avenue for reducing FIFO-related strain.

Key words: mining, stress, psychosocial safety climate, work-life balance, wellbeing

1. Introduction

A recent Australian parliamentary inquiry (Education and Health Standing Committee, 2015) into the mental health effects of FIFO arrangements, concluded that greater attention needed to be given into the effects of FIFO rosters on the mental health of mining workers, and that these workers were at a greater risk of suicide. During this enquiry, Chevron Australia's general manager for human resources Kaye Butler denied a link between the length of fly-in fly-out (FIFO) rosters and the risk of mental illness amongst workers. Butler suggested that rates of mental illness were much lower amongst Chevron's FIFO workers at the site of operation in question, than Australia's general population based on consultations with medical staff. Butler's comments are concerning considering the growing climate of uncertainty regarding the psychological effects of FIFO roster arrangements, which have been spurred by high media exposure of employee suicide and family erosion in Australia's remote mining industry.

Low mental health-related consultation rates for Chevron's employees are therefore promising, and do serve to quash some concern. However there are some limitations with Butler's reasoning. First, there is an assumption that the number of consultations reflects the occurrence of the mental health problems. Although figures may be indicative, the figures are likely much higher than the number of consultations for numerous reasons. We know from previous research that there is a strong stigma towards mental health and help seeking among Australia's rural and remote communities (Rost, Smith, & Taylor, 1993) where these remote site are located. Mining workers are also not representative of the normal population in terms of gender. Mining workers are predominantly male, and men are much less likely to seek help if they are experiencing problems with their mental health (Mackenzie, Gegoski, & Knox, 2006; Oliver, Pearson, Coe, & Gunnell, 2005).

Another concern is that the number seeking help may be restricted by employee's perception of their job security – a concern also raised by committee members during the inquiry. Although there is a lack of peer-reviewed articles on job security in Australia's mining industry, a poll of 7,000 Australian mining workers showed nearly 35% of workers were worried about their job security (Validakis, 2014). This lack of job security may also be explained by a recent decline in economic growth in China (Smits, et al. 2015); a major consumer of Australia's primary resources.

In Chapters 4 and 5 we found evidence for a positive relationship (longitudinally and cross-sectionally, respectively) between both Work-Family Conflict (WFC) and Remote Work-Life Conflict (RWLC), and depression, among remote mining workers, suggesting remote rosters exacerbate work-life conflict related depression. We attribute this phenomenon due to the disruption to support from primary support groups, which is beneficial in protecting psychological health and wellbeing. In the present study, we build upon this research by examining the length of FIFO rosters, as indicative of the time away from friends and family for work, effects depression. Further, we examine the effect of psychosocial safety climate as a protective organisational construct that we propose will minimise psychological strain (i.e. depression) associated with FIFO contracts.

1.1 FIFO rosters and swing length

FIFO rosters are marketed as a beneficial employment arrangement to workers, as they represent an alternative to relocating to remote communities adjacent to work sites. Relocation unquestionably creates disruption to a worker's personal life, as they are likely required to sell their house and move their family. Their partners may also need to find new employment, and their children will need to find new schools. Alternatively, mining employers could limit their recruitment to workers in nearby communities who would not experience this depth of disruption, however this would greatly limit their talent pool. Building on the latter, workers with necessary tertiary qualifications such as engineers and geologists are less likely to already be living in these remote areas. In this regard, FIFO rosters offer a conceivably amicable solution to maximising an employer's recruitment pool, while potentially minimising the disruption on employee's personal lives.

However, the implications of a FIFO roster on an employee's wellbeing has been brought into question, in particular the length of the rosters (Education and Health Standing Committee, 2015). There is no true *typical* FIFO roster, however arguably the most common in Australia are either two weeks on and one week off, or eight days on and six days off. Both however, are inadequate however according to the Construction, Forestry, Mining and Energy Union, who recommend that FIFO rosters should be structured so that the time away does not exceed the time at home (CFMEU, 2011).

Literature specifically looking at FIFO rosters and wellbeing is scarce, and therefore we draw inferences from comparable research. In the previous chapters (5 & 6) we identified a link between work-family conflict, and the specific work-life conflict (remote work-life conflict) experienced by mining workers, and depression. In terms of the length of FIFO rosters, in an unpublished manuscript, Voysey (2012) found a marginal negative relationship between roster length and roster satisfaction among Australian FIFO mining employees. However Voysey's findings may not necessarily be indicative of the effects on employee wellbeing. Employees may experience satisfaction due to the financial reimbursement in spite of any associated strain, as mining jobs have on average much higher wages in Australia than other industries (ABS, 2011). Further roster satisfaction may reflect a comparison of their roster to other rosters common within the industry, rather than with a traditional nine to five "roster". Another study by Beach and Cliff (2003) compared turnover rates between different mining sites that they observed, and found that FIFO roster length, that is the time spent on site commonly referred to as *swing length*, was positively associated with a higher rates of turnover. These findings may provide more insight into swing length and well-being that the job satisfaction research since employee wellbeing has been shown to strongly relate to employee intention to leave (Brunetto et al. 2013; Scanlan, Meredith, & Poulsen, 2013; Van Katwyk, Fox, Spector, & Kelloway, 2000).

An interesting finding in Beach and Cliff's report was that one of the mining companies observed with a longer swing length had their turnover rates offset by management commitment to organisational culture. Extrapolating on Beach and Cliff's study, organisational climate may be beneficial in off-setting the negative effects of long rosters. A particular type of organisational climate, Psychosocial Safety Climate (PSC), has been shown to be beneficial for the psychological health of employees both as an upstream organisational factor that precedes workplace stressors and resources, but also as a resource that can buffer the stressor-strain pathway. In this regard, PSC may function as a potential buffer of the strain associated with FIFO rosters (length of roster, RWLC), and may minimise any resulting strain-related manifestations (such as depression).

1.2 Psychosocial Safety Climate and wellbeing

Psychosocial Safety Climate (PSC) refers to the policies, practices and procedures within an organisation that promote a safe environment for employees in terms of their psychological health and wellbeing (Dollard & McTernan, 2011). PSC emerged as a theoretical counterpart to, and was influenced by, Zohar's (1980) Safety Climate theory pertaining to the physical health and safety of employees. Like Zohar's Safety Climate theory, PSC functions as an antecedent of work stressors in that the policies, practices and procedures within an organisation influence the design and implementation of job tasks in which stressors are experienced.

Despite its recent development, PSC theory has been widely validated as a precursor to workplace stressors and the stress process. PSC has been found to precede Karasek and Theorell's (1990) Job Demand Control model of work stress (Dollard, et al., 2012), and Demerouti, Bakker, Nachreiner and Schaufeli's (2001) Job Demands Resources model (Law, Dollard, Tuckey, & Dormann, 2011) and Siegrist, Siegrest and Webber's (1982) Effort-Reward Imbalance model (Owen, Bailey, & Dollard, 2016). PSC theory has also been confirmed across difference populations and countries: in a national population based Australian sample (Dollard & McTernan, 2011), a Malaysia population based sample (Idris & Dollard, 2011) and among Iranian hospital workers (Amiri, et al., 2015).

Dollard and Bakker (2010) offer two mechanisms for PSC's upstream influence on job conditions. First, organisations lacking in PSC (and therefore lacking in how worker psychological health is valued) may pay inadequate attention to the design of job tasks, in regard to the risk they may present to the psychosocial safety of employees. Second, poor PSC may discourage communication within the organisation regarding psychosocial safety, limiting the awareness of management to their presence, allowing the risk to accumulate. As PSC theory addresses the antecedents of work stressors, it is compatible with the varying work stress theories that focus on the process and manifestation of stress.

In addition to functioning as a precursor of work stressors, PSC has also been found to have a *secondary* function in reducing stress. A study by Dollard and Bakker (2010), found that PSC buffered the stressor-strain pathway between emotional demands and emotional exhaustion. Similarly, Hall, Dollard, Winefield, Dormann and Bakker (2013), found PSC buffered the effects of job demands on depression. Hall et al.

explain PSC as a buffer of work stress, by functioning as a safety signal. When experiencing a stressful event at work, an employee with high PSC is less likely to have an aversive stress response, as they perceive having ample levels, access to, and can use psychosocial resources to address the stressor. In this regard PSC operates as a safety signal inhibiting the stress process.

Dollard and Bakker (2010) propose PSC as a logical point of intervention for workplace stress reduction due to its role in reducing the stressor-strain pathway. This idea echoes the implications of Beach and Cliff who found evidence of management commitment to organisational culture, to potentially reduce the negative effects of longer FIFO rosters on turnover.

Considering the relationship between RWLC and depression previously identified in Chapter 5, and the relationship between swing length and comparable outcomes indicative of employee wellbeing, we propose RLWC and swing length will be positively related to depression. Considering the buffering effect of PSC found by Dollard and colleagues, we propose that PSC will buffer the stressor-strain created by swing length and RLWC. To test this buffer interaction we propose the following hypotheses:

Hypothesis 1. Swing length will be positively related to depression.

Hypothesis 2. Psychosocial safety climate will buffer the positive relationship between swing length and depression.

Hypothesis 3. Remote work-life conflict will be positively related to depression.

Hypothesis 4. Psychosocial safety climate will buffer the positive relationship between remote work-life conflict and depression.

1.3 Aims and significance

This study of Australian mining workers aims to identify the role of FIFO rosters, in particular swing length, in relation to worker health. The present study adds to the growing body of PSC literature, in particular the area of research examining the secondary action of PSC in buffering stressor effects. The study also extends the previous body of literature on the psychological effects of FIFO rosters, which has gained significant media attention, but lacks empirical evidence. By identifying the

alleviating role of PSC on the impact of FIFO-related stressors, the present study may benefit future organisational policy and workplace design.

2. Method

2.1 Procedure

The study employed a cross-sectional design using an online questionnaire platform, *Fluidsurveys.com*. Data were collected between late 2013 and early 2014. Between 2012 and 2014 several mining organisations were approached for participation. Three agreed to provide a URL link to an online survey to their employees via their internal mailing lists. Additionally, an Australian family support group for mining employees and their partners, *Mining Family Matters*, was contacted, and provided an invitation of survey participation on their website and through their social media page on Facebook.

2.2 Sample

The total sample consisted of 55 employees working in mining organisations operating in Australia. The study participants were predominantly male (79.5%) and were aged from 24 to 56 (M = 37.26, SD = 8.59).

2.3. Measures

2.3.1 Psychosocial Safety Climate

Psychosocial Safety Climate (PSC) was measured using the 12 item PSC-12 tool (α = .98) developed by Hall, Dollard and Coward (2012). The twelve items reflect the policies, practices and procedures within an organisation that protect the psychological health and safety of employees, such as "senior management show support for stress prevention through involvement and commitment." Item responses were on a 5-point Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), with a total scale range from 12 to 60.

2.3.2 Depression

To measure depression we used the nine item Patient Health Questionnaire (PHQ-9, α = .86) developed by Kroenke, Spitzer and Williams (2001). The nine items reflect the criteria for major depressive disorder used in the DSM-IV, such as "during the last two weeks, how often were you bothered by feeling down, depressed or hopeless?'" Item responses were on a 4-point frequency response scale that ranged from 0 (*not at all*) to 3 (*nearly every day*), with a total scale range from 0 to 27.

2.3.3 Remote Work-life Conflict

To measure the type of work-life role conflict associated with remote work, we used the 4-item Remote Work-Life Conflict (RWLC) scale (α = .91) developed in Chapter 6. Participants were asked to rate their agreement with a statement on the conflict between their work and personal life, reflecting time-based conflict associated with remote work, for example: "my job makes it difficult to maintain social relationships outside of work". Responses were on a 7-point Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with a total scale range from 4 to 28.

2.3.4 Swing Length

To measure the effect of the length of FIFO or DIDO rosters, participants were asked how long they were required to work on site, or *on swing*, as well as their number of rest days, *off swing*. Participants were provided with three common roster structures to choose from: 3 days on 4 days off, 8 days on 6 days off, 14 days on 7 days off, as well as the option to detail their roster if it did not fall into these categories. As there was not much variation in the ratio of days on and days off reported by workers (typically varying from 4/3 to 6/3) we instead examined the total length of time *on swing*. Due to the skewness in participant responses, we recoded swing length to: less than or equal to 5 days, 6-10 days and 11+ days.

2.4 Analyses

Two hierarchical multiple regression analyses were conducted to test our hypotheses. In the first analyses, PSC and RWLC were entered. In the second step the interaction term between the two predictor variables was entered. In the second analyses PSC and swing length were entered at the first step, and the interaction term between the two variables was entered at step two. As recommended by Cohen, Cohen, West and Aiken (2013), predictor variables were standardised before creating interaction terms.

3. Results

Table 1
Correlation matrix of study variables for Australian Mining Workers

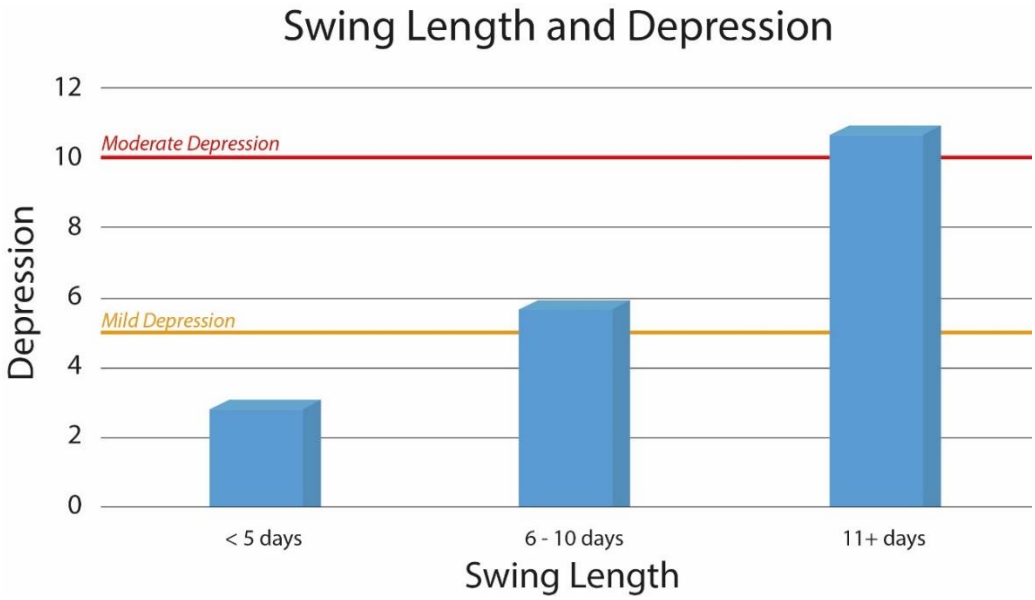
Measure	M	SD	1	2	3	4
1. RWLC	19.89	5.60	–			
2. Swing Length	8.14	4.22	0.31*	–		
3. PSC	39.67	12.30	-0.47*	-0.34*	–	
4. Depression	5.59	5.09	0.58*	0.40*	-0.42*	–

**, p < 0.05 or less. Swing length is categorized as 1=less than or equal to 5 days, 2 = 6 to 10 days, 3 = 11 or more days).*

Hypothesis 1 proposed that Swing Length will be positively related to Depression. As shown in the correlation matrix in Table 1, and step 1 of the regression model in Table 2, Swing Length was significantly positively related to Depression. Hypothesis 1 was supported. Mean differences in Depression scores by Swing Length are displayed in Figure 2, and show considerable differences in mean Depression scores between short (M = 2.85), medium (M = , 5.67), and long rosters (M= 10.63).

Figure 2.

Mean Differences in Reported Depression by Swing Length



Hypothesis 2 proposed that Psychosocial Safety Climate (PSC) would buffer the positive relationship between Swing Length and Depression. A direct effect between PSC and depression was observed (Table 2) and together PSC and Swing Length significantly contributed to Depression, F (2,37) = 3.12, p = .04. However adding the interaction term between PSC and Swing Length at the second step of the regression model did significantly add to the explained variance in Depression. Hypothesis 2 was therefore not supported. Swing length and PSC together accounted for 23.3% of the variance in Depression.

Table 2

Summary of Hierarchical Regression Analysis for Variables Predicting Depression

Variable	β	*t*	sr^2	R	R^2	ΔR^2
Step 1				.48	.23	.07
PSC	-.29	-1.80**	-.28			
SL	.28	1.77**	.28			
Step 2				.49	.24	.00
PSC	-.27	-1.61*	-.26			
SL	.29	1.76**	.28			
PSC*SL	-.05	-0.33	-.06			

****, p < .01, **, p < .05, *, p < .1. PSC = Psychosocial Safety Climate. SL = Swing Length.*

β = standardised coefficient.

In Hypothesis 3, we proposed that Remote Work-life Conflict (RWLC) would be positively related to depression. As shown in the correlation matrix in Table 1, and step 1 of the regression model in Table 3, RWLC was significantly positively related to Depression. Hypothesis 3 was supported.

In Hypothesis 4, we proposed that PSC would buffer the positive relationship between RWLC and depression. At step 1 of our second hierarchical regression analysis PSC and RWLC significantly contributed to Depression, F (2, 51) = 14.47, $p < .001$. The addition of the interaction term between PSC and RWLC at step 2 explained an additional 5.3% of the variance in Depression, F (3,50) = 14.467, $p < .05$. Hypothesis 4 was therefore supported. This interaction is plotted in Figure 1. Together all three predictors accounted for 41.4% of the variance in Depression.

Table 3

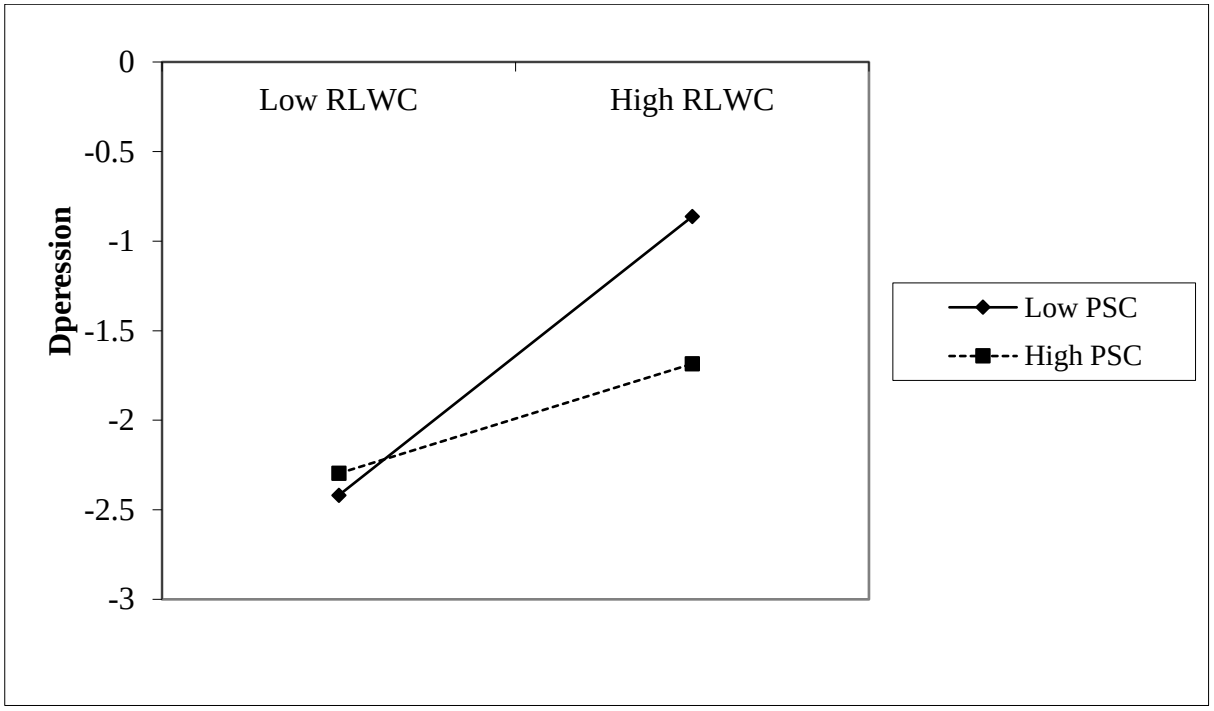
Summary of Hierarchical Regression Analysis for Variables predicting Depression

Variable	β	*T*	sr^2	R	R^2	ΔR^2
Step 1				.60	.36	.18
PSC	-.20	-1.55*	-.212			
RWLC	.48	3.80***	.470			
Step 2				.64	.38	.05
PSC	-.18	-1.42*	-.20			
RWLC	.54	4.30***	.52			
PSC* RWLC	-.24	-2.12**	-.29			

****, p < .01, **, p < .05, *, p < .1. PSC = Psychosocial Safety Climate. RWLC = Remote Work-Life Conflict. β = standardised coefficient.*

Figure 1.

Interaction Effect of Psychosocial Safety Climate and Remote Work-Life Conflict on Depression



RWLC = Remote Work-Life Conflict. PSC = Psychosocial Safety Climate.

4. Discussion

The objectives of the present study paper were twofold. First, to extend our understanding of the underlying work stress processes we examined the association between FIFO rosters and depression as a function of PSC. Second we expanded the work-life conflict literature by considering it specifically in terms of remote work-life conflict, and its relationship with depression as a function of PSC. We based these study aims on the stressor-strain hypothesis central to contemporary work stress theories discussed in previous chapters, and the secondary stress-buffer assumption of PSC theory (Dollard & Bakker, 2010; Dollard, Tuckey, & Dormann, 2012). We hypothesised that PSC would buffer the relationship between detrimental relationship between remote work-life conflict and depression, as well as the relationship between swing length (time away from home) and depression.

We found mixed support for our hypotheses. Supporting Hypothesis 1 and 3, both swing length and remote work-life conflict were positively related to depression. We anticipated RWLC would be positively related to depression due to our findings in in chapter 5, which gave credence to the hypothesis that the actual length of time away (swing length) would also be a substantial contributor. Similarly, in Chapter 3, interviews with workers suggested that some workers found working a remote roster psychologically demanding. Contemporary work stress theories such as the Job Demand Control and the Job Demand Resources theories of work stress propose that strain may manifest in the form of depression. These findings therefore add to the body of literature on the relationship between stressors and strain outcomes, a hypothesis central to contemporary work stress theories.

The relationship between swing length and depression is concerning, as the mean difference between the different categories of swing length were considerable. On average, participants with swing lengths between 6-10 days experienced depression score of 5.67, which is considered a mild level of depression (Kroenke, Spitzer, & Williams, 2001). Roster lengths of 11 or more days on average had a depression score of 10.63 fall, which is considered a moderate or clinical level of depression (Figure 2). These levels are significantly higher than workers on short rosters, who had a prevalence similar to the national average (McTernan, Dollard, & Lamontagne, 2013).

We found mixed support for the operationalisation of PSC as a safety signal, finding PSC buffered RWLC-related but not swing length-related strain. This may be attributable to the way the two stressors are perceived by the worker. Swing length may be perceived as an unmodifiable constraint by the employee. If this is the case, it is plausible that the elicited stress may also be perceived as immutable – the stressor and the stress are perceived as a 'fixed' part of the job, and therefore not subject to change. Similarly, the length away is also a formal part of an employee's contract which they agreed upon. Employees may therefore have a more passive response to swing length-related stress. This perception would limit the ability for PSC to function as a safety signal against the swing length, as they could not perceive having resources to address the stressor as it is perceived as an undeterrable constant.

In contrast, RWLC may be perceived as a modifiable construct. Employees may envision certain actions they can perform at work or at home that may minimise conflict between domains. Further, an employee may feel more comfortable discussing conflict between work and family with their supervisor – who may also be experiencing this conflict. However they may be less inclined to discuss strain resulting from the length of swing - either out of perception it is not something that can be changed, or out of fear of reprimand.

These findings may therefore offer light into the mechanism of the PSC safety signal. Whereas it has been considered as a signal to utilise resources to reduce strain, these findings suggest that it may provide a signal to tackle the stressor head on. A potential mechanism for the safety signal is that it may be important for the employee to perceive the stressor as something that is changeable, and for them to be able to perceive having resources that can modify their experience of the stressor.

Although not a direct study hypothesis, we found PSC was negatively related to depression in our analyses. The correlation between PSC and depression was strong ($r = -0.42$), and substantial considering PSC is typically modelled as a precursor to the conditions that antagonise psychological wellbeing. This is possibly indicative of a direct effect of PSC on depression. Employees who feel that they do not have ample resources to protect their psychological safety may experience greater depression as stress is occurred in anticipation of not having important safety resources when they are needed.

This is the first study of its kind to examine the effect of roster length (a proxy for time away from home) on the psychological wellbeing of employees, and the findings contradict the statements given during the parliamentary enquiry on FIFO rosters and wellbeing (Education and Health Standing Committee, 2015). Considering the high scores of depression associated with longer rosters, these findings are a cause for concern for employers. PSC appears to be a potential avenue for reducing FIFO related strain, not as a secondary measure but as a primary measure. Employers, now with the evidence that shift length is related to depression, may implement new management policies and procedures that restrict roster length and therefore time away from home. An action so implemented should be seen as improvement in PSC within the workplace.

4.1 Limitations

A limitation in the present study was the reliance on cross-sectional data, and therefore we could not establish a causal pathway between the predictors and depression. Additionally, it would have been beneficial to examine the relation over several waves to identify if the strain compounds over time. The sample was also limited in sample size, however the effect sizes observed were very high. These strong effect sizes are worthy of future research, especially if as the findings suggest, the strain can be reduced.

4.2 Conclusions

The present study builds upon the previous body of published literature, as well as the local model of this dissertation. We add additional support to the secondary buffering effect of PSC, but propose that this may not be as effective for some stressors. We build upon the local model of work stress of this dissertation by demonstrating that the swing length is associated with employee depression, which we contribute to the decreased access to social relationships outside of work and the social support that they provide. We propose that increasing PSC at work may stand to offset some of the associated conflict that arises due to FIFO work, but not the strain that occurs due to greater swing length, perhaps due to employee perceptions of the stressor as an unmodifiable constant. Employee perceptions of their work environment may therefor

play a key role in the way the process stressors and access resources. Mining employers should endeavour to both minimise swing length where possible, and maximise PSC, as ways of minimising psychological strain in the workplace.

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Chapter 8

Discussion and Conclusions

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"For without friends no one would choose to live, though he had all other goods."

Aristotle (384-322BC)

1. Opening remarks

When embarking on this project I had many preconceived ideas as to what the final product would be. My expectations were based upon assumptions that had arisen both through personal experiences and through education, about my experience as a worker. In writing my thesis my perspectives on work and life have shifted, in that I now believe it is less about *what* we do, and more about *who* we do it with. The bonds we share with others define us, and shape our identity beyond the influences of our biology. However, the social structures that govern our relationships with one another are changing.

I argue that what has been lacking attention, is that many great changes are occurring in the way we work (one of which being remote work) in what appears to be a pattern of ever-increasing work-centricity, facilitated by technological development. Advancements in technology have made it easier for society to communicate and for people to move around. This increased mobility has made it easier for employers to access labour, and subsequently an employee's life to reshape to suit their work duties. Migratory workers travel across China from rural towns to work seasonally in metropolitan areas. Many workers across the globe can now complete their work tasks from home, or even in a completely different country to their employer. We live in a globalising society where businesses now operate outside of traditional working hours, across time zones, and on days formerly reserved for rest. For better or worse the boundaries between our work and personal lives are changing, changing our relationships, changing us. Understanding this transition is an imperative if we are to have informed theory for the future, and the development of work and social policy.

2. Major findings

2.1 Summary of aims

Remote mining work through FIFO and related rosters, represents a unique and previously unknown characteristic of the modern era of work practice, and sits at the frontier of a series of changing work dynamics spurred by social and technological changes. The adoption of FIFO rosters is a relatively recent and rapidly growing work phenomenon, and remains largely under-examined despite social concern regarding the implications of isolation and separation that comes with these rosters. What has resulted is subsequent public scrutiny, media attention and a call for investigation into the effects of these rosters. Traditional paradigms of work stress and health however may not be entirely applicable, as they are based on working populations under more traditional working arrangements. The present thesis represents a reaction to public concern, and broadly aims to extend the current theoretical paradigm of work stress to account for the emerging work structures and the role of remoteness and isolation from FIFO rosters. In addition to identifying a local theory of work stress to the mining industry, we aim to construct a means of measuring this unique stress, and offer suggestions for its management and reduction. This thesis adopted a mixed-methods design: first collecting qualitative research to account for the lack of empirical research in the area, and subsequently to generate informed hypothesis for quantitative investigation: via primary and secondary datasets.

Aim 1 – Identify the role of remote working arrangements on employee health

The principal aim of this thesis was to identify the unique role of remote working arrangements, typically referred to as FIFO rosters, on employee health. Mining work inherently involves arduous working hours as well as working within dangerous environments, therefore representing an occupation prone to psychological stress. Social support is vital for managing this stress, where upon remote work stands to limit the availability and regularity of the personal relationships in which we derive

our support. In the absence of this support, we therefore anticipate greater stress-related psychological strain.

We initially conducted interviews on site with a population of mining workers on FIFO contracts (Chapter 3), as well as an additional sample collected online that contained non-remote workers, to better delineate the contributing role of remote contracts on the experience of stress process. We adopted the PSC-JDR theoretical framework (also referred to as the Psychosocial Safety Climate model; Dollard & McTernan, 2011) to guide our interview questions, which allowed for the development of our local theory (theory that pertains to the unique population). From this qualitative data, depression and sleep were two prominent manifestations of poor psychological health that emerged from our analysis. These variables and their contributors were further investigated in subsequent chapters.

Aim 2 – Identify the role of remote working arrangements on employee relationships

An underlying assumption of this thesis was that remote working arrangements, i.e. FIFO rosters, would impede an individual's ability to receive and provide social support from their primary support groups (i.e. friends and family). We explored this disruption in Chapter 3, and found not only did FIFO employees report disruption to their personal social relationships because of their rosters, but a novel bilateral-effect occurred: in the absence of social support from friends and family at home, remote mining workers would seek and derive social support from their co-workers. Interviewees described this relationship as *family* like, and important in managing their mental health. We tested both of these related phenomena in the Chapter 4. Using AWB data we found co-worker social support buffered the relationship between work-family conflict and depression amongst mining workers, but not the general population, thus supporting our hypothesis.

This stressor-strain buffer effect supports the overarching PSC-JDR framework, but also provides evidence of a proximity effect on social support. We explain this phenomenon as a result of the proximity principle: that social relationships are instigated and strengthened through proximity. Further, this enhances group saliency and social identity derived from this employment group, leading to more supportive social relationships that play an alleviating role in stress management. We refer to this

unique interaction as the support-proximity effect, and believe it is of increasing importance in understanding employee health given the changing landscape of organisational practices and increase in migratory-style work (work that requires travelling great distances from home) arrangements such as remote FIFO work, which are facilitated by advancements in transport and communication technologies, but ultimately disrupt familial relationships.

Aim 3 – Develop and validate a measure to capture the conflict between work and life associated with remote working rosters

In conjunction with the previous aim, we aimed to develop and validate a measure that reflects the unique work-life conflict associated with remote work. During our qualitative investigation, it was evident that remote work disrupted both the *availability* of personal time, and the *regularity* of this time. This created considerable disruption for employees, as it restricted their ability to attend events which would normally be accessible under a traditional roster, as well as participate in activities that require periodic availability of time, such as certain sports and hobbies. This tool was developed and validated in Chapter 5, and was found to have stronger predictive power of our key study outcomes, depression and sleep quality, than the more commonly used measure of work-family conflict.

Aim 4 – Develop a local theory of work stress for the mining sector

Our final study aim was to develop a local theory of work stress, which provides a theoretical model to account for and to contextualise the previous thesis aims. In Chapter 2 we discussed the history and trajectory of work stress theories, noting the broadening hierarchical contexts and the influence of transport and communication – wherein a more integrated society requires increasingly macro-level perspectives to encompass the broadening of influences from organisational structures and external factors. In this regard we considered how work stress theories have been developed, to make sound judgement on the development of our own local theory pertaining to the mining sector. We chose the PSC-JDR model, which is one of the most recent theoretical developments in work stress. The PSC-JDR model has rigorous empirical support, as well as being a theory that is adaptive to unique work environments and

stressors. In Chapter 3, we used the PSC-JDR model to guide the qualitative data collected, leading to our local model of work stress situated within the greater model. We tested these relationships in subsequent chapters, finding empirical support for our local theory.

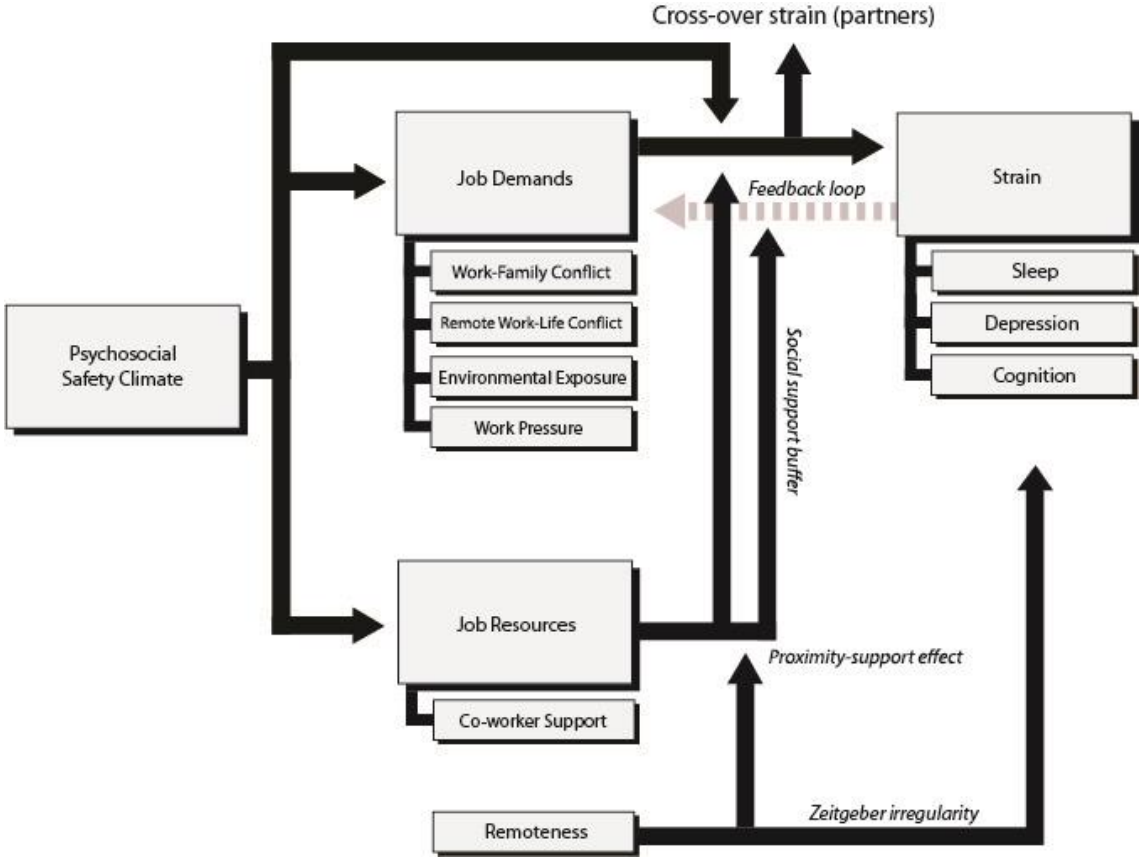
3. Summary of Major Findings

3.1 Local theory of work stress

The findings of this thesis integrate into our local theory of work stress for the mining industry (Figure 1). The development of local theory is beneficial as unique populations have unique characteristics pertinent to their experience of stress, as well as the way unique manifestations of strain. In particular local theory is beneficial for informing organisational policy and practice. For example, co-worker support alleviated stress, identified in Chapter 4, for the mining population but not the general sample. It is therefore more important for mining businesses to foster healthy co-worker relationships than typical businesses. This advice could also be applied to other organisations that require remote work: such as the military and off-shore oil and gas. Similarly, organisations in the future that adopt similar structures may wish to invest resources into developing co-worker social relations to mitigate stress. Our local theory contexualises the subsequent findings below.

Figure 1.

Local Theory of Work Stress in the Mining Industry



3.2 Roster-related depression and sleep disruption

During our qualitative interviews (Chapter 2), mining workers were asked to express in their own words how occupation-related strain may manifest. Interviewees reported that impaired wellbeing, specifically depression, was a manifestation of occupation-related strain. Additionally interviewees reported difficulty with their sleep. Both of these issues were reportedly contributed to, in part, by working a FIFO roster.

According to the miners, depression was caused by difficulties with their personal relationships at home. Specifically, the difficulties related to being away from their usual social networks (especially family) for large periods of time when at work, which limited their ability to communicate with people in these networks. This also limited their ability to participate in social activities and meet family duties. Further, in

their absence family duties were increased for family members at home, adding further strain to family relationships.

Several perspectives can explain why depression occurred when working a FIFO roster. First, work-life conflict can be viewed as a work demand within the overarching theoretical model adopted for this thesis, the PSC-JDR model. In this regard, a stress process occurs when a worker is not able to balance both their work and personal life domains: that is to say their body responds by producing stress hormones that helps them become more alert to respond to the demand of this conflict. If unresolved, the stress can manifest into strain-related outcomes such as depression. Although this can be explained by our adopted theoretical model, we can also elaborate on the specific ways the conflict occurs by exploring specific social processes.

We know that personal relationships are important in maintaining mental health. People in romantic relationships appear to have fewer mental health problems (Braithwaite, Delevi, & Fincham, 2010; Proulx, Helms, & Buhler, 2007). It is possible that people with better mental health find it easier to maintain relationships, or are more desirable for these relationships. Another explanation is that personal relationships improve mental health by providing both greater life satisfaction, and through the resources that personal relationships provide, i.e. emotional support, and the sharing of domestic duties. As remote mining work requires being away for extended periods of time, access to the resources these relationships provide, that may be relied upon for maintaining wellbeing, may be compromised. Additionally, people at home can no longer rely on the mining worker to the same extent as otherwise, therefore placing additional strain on their relationship. Considering both of these plausible pathways, it is likely that there is some degree of reciprocity between relationship status and mental health.

When explaining the sleep difficulties experienced by remote mining workers, there were two aspects of FIFO rosters that are likely contributors. First is the disruption, or inability to establish regular routine. When an employee is home during their rest period of their work roster, they may be inclined to over sleep as a way of compensating for a sleep debt that accumulates during their swing. Additionally, they may be inclined to try and readjust to the sleep/wake cycle of other household members. In either case their sleep/wake cycle will be irregular, changing between work and rest periods of their roster. Research by Yamada, Takahashi and Okawa (1996) supports this

explanation, finding in a sample of 121 participants with sleep-wake rhythm disorders, that environmental change was a substantial contributor. As remote miners are caught in a cycle of environmental change, this would account for their sleep difficulties.

Another factor associated with remote work was residing in temporary living quarters, also referred to as transportables (or dongas), at remote mining sites. Transportables offer an affordable solution to on-site living as; they can be moved relatively easily between locations, and they can be redeployed at a different location after a mine has passed its viable lifespan. The temporary nature of the lodgings however also means limited furnishings and soundproofing. This means an employee's sleep is at the whim of the movements of their co-workers in adjacent transportables. Although this is particularly problematic for employees working differing times of day, it is still problematic for employees working similar hours. Waking during the night for toilet breaks for example stands to potentially wake others in adjacent rooms. Even in the event that an employee does not wake there is still a biological response, such as raised blood pressure (Carter, et al., 2002). In this regard, the impact of environmental noise may be underestimated. Several studies have found environmental noise to be a significant contributor to sleep problems (Freedman, Gazendam, Levan, Pack, & Schwab; 2001; Miedema, & Vos, 2007), adding support to this explanation.

3.3 Support-proximity interaction

One of the most unique and interesting findings to come out of the thesis was the interaction between proximity and social support in buffering strain. We found in a sample of 2,793 Australian workers in our Chapter 4 study, those that were mining workers (n = 112) experienced a strong buffering effect of work-family conflict (WFC) related depression, that was not present in the remaining non-mining working sample (a three-way interaction of mining, co-worker support and WFC). This buffering effect was also present on the reverse, depression leading to WFC, suggesting that co-worker social support was an important moderator of the reciprocal paths. This finding could offer an explanation regarding previous incongruences in the literature on the efficacy of co-worker support as a stressor-strain buffer, as different occupational groups may have notably different experiences of proximity and group saliency that prime co-worker social support for miners.

We explained this phenomenon as an extension of the proximity principle: that is group saliency, and the strength of social relationships, are affected by geographical proximity due to the increased social interactions that occur. We also argued that a bilateral effect is also in action: that separation will limit an individual's ability to rely on a relationship for support, thus explaining both the enhanced co-worker social support buffer efficacy as well as the greater rates of conflict between work and family domains reported by mining workers. This proximity-support interaction therefore reflects a dichotomy: proximity lead to enhanced support in relationships, whereas separation inhibits support.

What is particularly important about the proximity-support interaction is that our social environments are changing because of technology. We are capable (to some degree), and expected to maintain relationships across greater distances. For example, advances in aviation technology have made air transportation practices far more fiscally viable than previously. For comparison, the cost per ton-kilometre for all air traffic between 1955 and 2004 fell from $3.87 to $0.30 using 2000 US dollars (Hummels, 2007). As technology progresses, technology-dependent employment strategies are likely to become increasingly appealing to employers. These technology dependent contracts affect our ability to interact with friends and family. As technology continues to shape the way we work and our social relationships which are altered by these working arrangements, the proximity-support interaction will have continuingly greater importance in understanding worker relationships and subsequently, health and wellbeing.

3.4 Unique work-life conflict associated with remote work

In Chapter 2 remote workers reported that their work interfered with their personal lives in atypical ways. In particular, mining workers reported that they could not attend personal commitments such as birthdays or weddings, as well as commit to a personal routine such as regular exercise or being a part of a sport team. These conflicts represent a time-based conflict between work and personal life domains, but are unique in that they are a product of an *absence* of time as opposed to a *limitation* of time. We used these responses to create a four item Likert-type scale of Remote Work-Life

Conflict (RWLC), and compared it to a commonly used pre-existing work-life conflict scale, Netemeyer, Boles and McMurrian's (1996) Work-Family Conflict (WFC) scale.

We found our RWLC scale to be a better predictor of sleep quality and depression in both mining workers and the partners of mining workers than Netemeyers WFC scale. In the latter sample, we reworded it to reflect the absence of *person's* partner (the mining worker). That our tool was a more effective predictor among both samples shows remoteness plays a significant role in the conflict experienced by remote workers, and also affects their families. The scale also had a high internal reliability, with a Cronbach's alpha of .90. Considering the efficacy of the scale, we intend to make it freely available for researchers and the public, so that workers and partners can monitor their own experience of RWLC as a preventative tool.

3.5 Bidirectional relationships

We also found support for a bi-directional relationship between depression and work-family conflict. This is an interesting finding with epistemological implications. The proposition of unidirectional causality is ubiquitous among the sciences, and has reason given the phenomenon observed by the natural sciences which predate the psychological (and social) sciences. Psychology has adopted this assumption of unidirectional causality, which may not be as applicable given the constructs observed. The phenomenon observed in the natural sciences typically involve a stimuli that alters a variable through the transition of energy. Energy can pass from the sun to a plant to create cellular growth – but this energy cannot pass back to the sun. These rules do not apply to human behaviour and psychological dispositions. Theoretically, we explained this phenomenon using loss spiral theory (Hobfoll, 1989), which proposes that stressors can contribute to the event of one another in a spiral due to a continual depletion of resources needed to address these stressors. Considering the growing body of research supporting bi-directionality among psychological phenomenon (see Chapter 4), perhaps it is time for the psychological sciences to re-evaluate assumptions within its scientific paradigm.

It is interesting to note that in the case of the spiral between depression and WFC evident in Chapter 4, it is not possible to determine which of the two variables initiated the spiral. Further, it is just as plausible that neither variable started the spiral,

as both depression and WFC have been observed to be caused by a myriad of other contributing factors. The onset of depression for example can be influenced by diet (Sanchez-Villegas & Martinez-González, 2013) or experiencing a traumatic life event (Vranas & Lauterbach, 1994) and conversely WFC can also be instigated by having a long commuting time to work or having dependent children (Jansen, Kant, Kristensen, & Nijhuis, 2003). It is possible then that a spiral could be caused by separate stimuli that are no longer present at the point of observation, or perhaps wasn't given due consideration in the initial study design. This raises a rather vexing problem for primary intervention research, as identifying the true initial cause of a loss spiral may be very difficult.

Bidirectional relationships also present a challenge to research design. Longitudinal research typically collects time points of data at *equal* distances, however the length of time for stress to compound, or the point of allostatic load, may differ between each path of a spiral. To address this future research on loss spiral theory could examine spirals using a diary study, utilising the large number of data waves to identify the time of onset of each path.

3.6 Strain cross-over to partners

In Chapter 5 we validated our RWLC measure with partners of mining workers. We observed that partners reported a similar experience of strain, both in terms of a decline in sleep quality and depression associated with the conflict with their partners work and their personal lives to that of the conflict experience by mining workers themselves. This has considerable implications for the field of crossover research: that is the investigation of inter-individual transmission of stress to strain, and challenges the employee-centric perspective of work stress.

Mining work has a substantial risk for cross-over to partners, as remote rosters create a far greater amount of separation from partners than a traditional working arrangement. The separation affects the partner at home in as much the same way that it affects the worker, or perhaps arguably more, as they have the same disruption to their relationship but take on greater family and domestic duties at home in the workers absence. If technology continues to facilitate remote work or other migratory style work structures, then cross-over between partners is likely to increase in frequency among

other occupations. It may be beneficial then for organisations to consider investigating cross-over when deploying a new work structures that change the mobility of its employees.

3.7 Remote Work-Life Conflict in the context of Work-Life Conflict Theory literature

Within the context of this thesis we have principally discussed Remote Work-Life Conflict within the theoretical framework of the Psychosocial Safety Climate - Job Demand Resource model, however it is worth mentioning its compatibility within the literature on work-life conflict and through extension work-life balance. By and large, RWLC is a congruous construct with the prevailing theoretical body of work-life conflict and the, however deviates in certain theoretical assumptions, principally spatial and temporal boundaries. These conformities and deviations I explore below.

3.7.1 Spill over theory

One of the earliest theoretical perspectives to articulate the interaction between work and non-work domains is Staines' (1980) Spillover theory. Spillover theory postulates that an employee who experiences negative or positive emotions through events and behaviours in one domain will carry that emotion over to the other domain. For example, an employee may experience a decline in mood after being reprimanded for missing an important deadline at work, and in turn will be in a bad mood when they arrive home. That decrease in mood may affect their interactions with a spouse or partner, therefore demonstrating an influence of one domain onto the other.

The bulk of the research on spillover has focused on the negative influence of the work domain onto a person's family life (Stevens, Minnotte, Mannon, & Kiger, 2007). This in part can be explained by the more concrete nature of work parameters. Staines (1980) proposes that as the work environment lacks the flexibility of the time we choose to allocate to say, leisure activities, the non-work sphere has less latitude in its ability to influence the work domain. In part the trend in research on negative over positive spillover, may be attributable to psychology having an ostensible history of investigated adverse phenomena. It's also reasonable to assume that the competition of resources (i.e. time and energy) between domains results in negative spillover being a

more frequent occurrence than positive spillover, or having perhaps having a greater overall effect on a worker's quality of life.

RWLC arguably fits within the conceptual framework of Spillover theory, as it is a measure of the influence that actions and events that occur in one domain have upon another. It is also in line with the prevailing direction of spillover research, which examines the negative spillover from work to non-work-life. In this regard, we could use Spillover theory to explain the RWLC experienced by remote workers, however there are also some prominent points of conceptual deviation.

RWLC diverges from Spillover theory principally on the assumption of boundaries. Spillover theory conceptualises work and personal life domains as separate spheres that cast influence upon one another. Arguably, the work and life experience of a remote mining worker may be more analogous with a Venn diagram: work and non-work being represented by two heavily converging spheres. For example, when a remote worker is having dinner at camp after finishing a shift, they are neither truly away from work, nor at work. A company lunch room is typically considered a work space, which in reality shares many qualities with a camp dining area. In this regard new working structures, such as remote work, are challenging the conceptual boundaries of work and personal life spheres.

Similarly our measure of RWLC deviates from many previous measures of work-life conflict in that it places less emphasis on the spatial and temporal boundaries between work and life domains as these are less defined for remote workers. The item "I find I miss a lot of social activities and opportunities because of my work (such as birthdays and playing sports)" places an emphasis on the inability perform roles within their personal life, but does not contextualise this in terms of the boundaries between these domains. Comparatively, an item used to measure spillover adopted by Hill, Hawkin, Ferris and Weirzman (2001), "How often do you feel drained when you go home from work because of work pressures and problems" does place emphasis on the spatial and temporal boundaries of work and home domains. This item may be challenging for a remote worker to answer. When a worker is off swing they have an extended period of time where they are not "coming home from work". Conversely, when they are on swing, they do not go home after finishing work. This question would therefore not only be very difficult to respond to, but also their response to this item would be highly dependent on their time of taking the measure within their work cycle

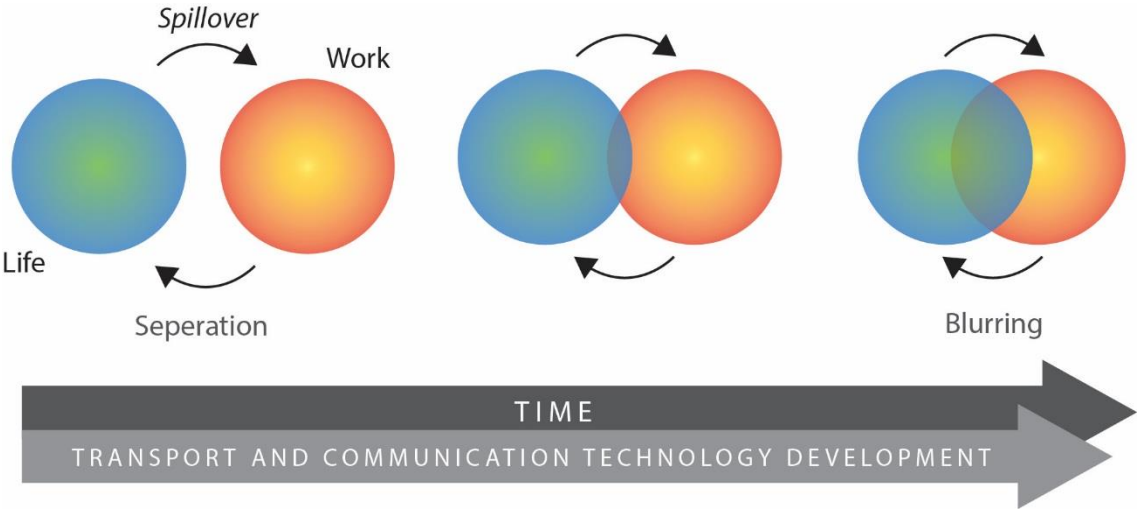
(i.e. on or off swing). The assumptions of boundaries within Spillover theory, and previous measures used to capture spillover, are therefore less applicable for remote working populations.

3.7.2 Role blurring theory

RWLC may instead be more homogenous with recent perspectives of role blurring, or *border blurring* theory. Role blurring has conventionally be used to discuss the blurring of roles within the workplace, however has recently been used to discuss the blurring roles between work and non-work domains (Schieman & Glavin, 2008). According to role blurring theory, some workers have greater flexibility, meaning their work can be performed outside of regular work boundaries as well as greater permeability, meaning parts of one domain intrude into another (Schieman & Glavin, 2016). According to role blurring theory, role blurring has arisen due to technologies that facilitate this crossing of borders. Particular technological contributors are the internet, which facilitates work communication and the completion of work tasks outside of work spaces and work times, and the development and accessibility of mobile phones, which allows workers to respond to phone calls outside of work hours. Interestingly, scholars have noted that technology development actually facilitated the separation of work and non-work spheres. Pre-industrialised households relied greater on agriculture, and were frequently also a person's place of work (Glavin & Schieman, 2012; Zaretsky, 1976). Ironically, technology has now facilitated the re-integration of these spheres (Figure 2).

Figure 2.

The Blurring Boundaries of Work and Life



Although space and temporal boundaries have been useful to conceptualise work and life in the past, they are not as applicable to new labour era. Historically, the boundaries between work and non-work have been markedly clear. For example, an officer worker in the late 80s would be unlikely to communicate with a co-worker or client outside of their place of work and designated work hours. Comparatively now, that same worker may be expected to take calls or respond to emails when at home. We see then that although remote work is a prominent example of the blurred boundaries of modern work, this blurring of boundaries is pervasively occurring across industries and occupations. Ultimately, research methodologies that confine work and personal life domains by spatial and temporal based parameters will have diminishing applicability over the next course of human history.

4. Project Limitations

There were several limitations in the project that could be improved upon. The main limitation was the quantity of participating mining employees. Our experience liaising with industry members was that organisations were hesitant about participating in psychological research, both because of concerns for confidentiality, and that if a significant risk to the psychological health of employees was identified there would be

an obligation for it to be addressed. In this regard discussing the risks and benefits was difficult with prospective organisations. We were aware of these risks embarking on this project, and for the most part navigated the concerns raised by participating employees and organisations, however it still limited the final availability of participants. On numerous occasions, planned data collection was cancelled with a prospective company due to highly publicised incidents in the media regarding the psychological health of their employees. Considering the number of organisations approached, it is also possible that some of the unhealthiest organisations did not participate in this research and other organisational psychology research, creating a selection bias. Although this issue potentially applies to all industry research, it is worth noting that means identified in the present thesis may be lower than the true population averages.

Another limitation with the present study was that it was not possible to determine the number of participants in the AWB dataset that were on FIFO contracts. Considering the effects identified, it is reasonable to postulate that those not on FIFO contracts, as some mining sites have a mix of local employment and FIFO employment, still experience the same work culture which is affected by FIFO practices. Specifically, co-worker relationships are stronger due to isolation, which creates a supportive culture that non-FIFO workers benefit from as well. Future research, given an ample sample size could investigate all of these contributing factors (FIFO/non-FIFO, length of contract, etc.) to the experience of social support.

Another limitation is that our quantitative data was collected exclusively from Australian workers. It is possible then that other cultures differ in their experience of social support and mental health. Australia has a distinct work culture that encompasses both relaxed organisational hierarchies, and informal co-worker relations. These factors could contribute to more personal disclosure, and the the efficacy of co-worker support in mitigating stress.

5. Practical Implications and Recommendations

Stress-related interventions can be divided into two classes: organisational level interventions, which aim to restructure organisational processes that influences the occurrence of stressors in the work environment or job design; or individual level interventions, which aim to address the individual's reaction to stressors in the work environment or job design. In a review of 16 case studies of organisational intervention, Karasek (2004) noted that organisational level interventions, with employee participation, had greater efficacy than individual level intervention strategies in improving employee health. Considering the broad range of stressors and challenges facing the mining industry, there is no true panacea that will address all of these concerns. We therefore advocate for the adoption of a range of intervention strategies by employers where possible. Employers should priories the adoption of organisational level interventions, but may find individual level interventions additionally beneficial.

5.1 Reducing or restructuring work hours

A number of studies exist that examine the efficacy of reducing work hours on employee wellbeing. A review of 54 studies by Fletcher et al. (2005) on medical residents who had hours reduced showed improvements to sleep and mood. Further, a study by Lockley et al. (2004) found medical interns who had their hours reduced by an average of 19.5 hours per week (down from an average of 84.9 hours per week) had significant improves to sleep, and halved their number of attentional failures during an on-call shift at night. Considering remote mining employees typically work 12 hours or more in a day over 8 or more days, they may have comparable improvements to sleep and attention under a reduction in work hours.

This presents a challenging paradox to employers, as reducing work hours will likely lead to an increase in wellbeing and decline in at-work errors, however also result in less time to achieve work targets. An amicable middle ground that may benefit employers and employees is to consider if any of the employee's tasks (e.g. report writing), particular for those that are professional staff (e.g. geologists), can be done off site. In this regard employees may be able to opt-in to a roster with reduced working hours on-swing, in turn for one or two half days off-swing either at a corporate office or working remotely. This would also aid in creating a more stable routine for the employee.

5.2 Enhancing co-worker support

Literature on social support intervention has currently been largely limited to non-work support networks (i.e. family, friends and partners), and of this literature the types of strategies with the *most* efficacy is unclear (Hogan, Linden, & Najarian, 2002). Conversely, this suggests a number of approaches are effective. One study by Laschinger, leiter, Day, Gilin-Oore and Mackinnon (2012), did target social support within a workplace setting, and was found to be effective at improving workplace social support. The authors implemented an intervention strategy of providing information on social support goals (in particular employee civility), and periodic exercises run by external facilitators that encouraged the adoption of supportive behaviours. Similarly, mining companies could consider surveying co-worker support levels within teams, and consider introducing external facilitators to run workshops targeting the improvement of supportive behaviour for teams with low levels of support. Alternatively, implementing changes to workplace design that foster co-worker relationships (such as the provision of recreational areas) may also be effective at enhancing co-worker support.

5.3 Improving sleep

Mining organisations may wish to conduct a noise audit of their lodgings to ensure that the amount of environmental noise does not present a risk to employees. The World Health Organisation recommends to avoid any sleep disturbances, at any given time, noise within a bedroom during sleeping hours should not exceed 45 decibels, and on average should not exceed 30 decibels (Hurtley, 2009). Considering that a flushing toilet can range from 44 to 76 decibels (Hilton, 1987), it is possible that a substantial volume of that noise will permeate through the lodging walls. Environmental noise at work is a prevalent and widely documented issue experienced by mining populations (for a review published literature, see McBride, 2004) however to the best of the authors knowledge there is yet to be a study reviewing the environmental noise that remote mining workers are exposed to when sleeping. This also therefore represents a potential area for future sleep research. Should an audit reveal high levels of noise during the night, employers may wish to consider strategies that reduce these environmental noises: such as increased lodging noise insulation, or the installation of quieter bathroom facilities. As a minimum, employers should try to separate employee's rooms by shift type so that a night shift worker is not next to a day shift worker. Employers could also consider the provision of white noise devices to employees having greater

sleep difficulties than others, however the former suggestions are likely to have more efficacy as they remove the underlying cause.

Another potential avenue for improving employee sleep behaviour may be through the use of light therapy. Light therapy is the exposure to a bright light for a period of time that mimics exposure to nature light, thereby acting as a synchronising agent to help align sleep/wake patterns. Light therapy has been found to improve circadian rhythm alignment of shift workers, evident in both of core body temperature and salivary melatonin cycles (Boivin & James, 2002). A similar study by Ross, Arendt and Haston (1995) also found improvement in sleep behaviours of shift workers working remotely in Antarctica exposed to bright light therapy. Organisations could consider an informal program of monitoring employee sleep behaviour, and if an employee is reporting difficulty with their sleep they could consider opting into a routine of light therapy. The efficacy of this within a mining cohort – who do not experience as extreme disruption to their circadian rhythms as shift workers – is unknown. Future research could consider investigating the efficacy of light therapy within mining workers, to identify if it is beneficial in improving the sleep and wellbeing of afflicted workers.

5.4 Reducing depression

Depression has a diverse aetiology, but three causes frequently discussed together are diet, exercise and sleep (Lopresti, Hood & Drummond, 2013). In contrast to addressing biological and genetic causes, sleep, diet and exercise are behaviour-based and therefore more mutable, making them more achievable targets for intervention. They also have more tangible inputs (i.e. sleep times are easier to measure) than psychosocial contributors such as work-life conflict. Although we advocate for reducing the work-life conflict experienced by workers, the aforementioned contributors already have a substantial body of published literature on observational and intervention research.

The effect of diet on depression has been the subject of several meta-analysis finding significant causal effects (Lai, et al., 2014; Psatlopoulou, et al., 2013). However in practicality, diet may be a difficult area to address as employees will have differing dietary needs. Tailoring meals that reflect the energy needs of both sedentary jobs (such

as office work or vehicle operation) and physically active jobs (e.g. drill operation) is challenging, and it is not practical for a kitchen to prepare a range of meals that suit differing needs en masse. Further complicating the problem is that the literature on diet and depression is inconsistent. For example, Sánchez-Villegas and colleagues (2009) advocate a diet of vegetables, fruits, nuts, cereals, legumes and fish in reducing and preventing depression, but low in red meat. In contrast Jacka et al. (2010) propose red meat, in conjunction with a diet of fruit, grains and vegetables is associated with lower rates of depression.

Although the specific dietary recommendations vary greatly between dietary studies, there is a general consensus for moderate calorie consumption. With this in mind, a more effective approach for employer intervention may be to adopt a program that encourages sensible eating habits in terms of calorie consumption and nutrition (i.e. rich in necessary vitamins and minerals), instead of focusing on specific quantities and ratios of macronutrients.

Exercise is another avenue for reducing depression. Several meta-analysis by (Craft & Landers, 1998; Lawlor & Hopker, 2001; Rethorst, Wikfli & Landers, 2009) have been conducted to examine the relationship between exercise and depression, finding strong alleviative effects. Differing exercise strategies appeared to be better at reducing depression depending on the severity of depression. In Rethorst, Wikfli and Landers (2009) meta-analysis they found that a mixture of both aerobic and resistance exercise was the most effective for clinically depressed populations in contrast one type on its own, but not for non-clinical populations. Effectiveness of duration also differed between clinical and general population samples. Rethorst et al. found shorter durations (20 to 29 minutes) were the most effective for the general population, however longer durations (45 to 49 minutes) was most effective for clinical samples.

In this regard employee wellness programs could provide tailored exercise advice depending on the worker's physical activity and current mental health state. Employees with job tasks that require frequent manual labour such as heavy lifting may find aerobic exercise to be the most effective, in that it complements the exercise they already are experiencing in daily tasks. In contrast, an employee with a largely sedentary role may benefit from both aerobic and resistance exercise routines. Similarly employees who are experiencing greater difficulty with their mental health may benefit

from a longer workout. Having both this type of tailored information, and adequate exercise facilities on site, may be beneficial in reducing employee depression.

The relationship between sleep and depression has been widely investigated across various populations. A meta-analysis by Cole and Dendukri (2003) found sleep disturbances to be an important risk factor for depression among the elderly. Similarly Kaneita et al. (2006) investigated the relationship between depression and sleep amongst a nationwide survey in Japan, finding both too little and too much sleep were associated with depression. Strategies for improving sleep have already been discussed, and therefore may also stand to reduce employee depression.

An interesting study by García-Toro and colleagues (2012) tested an intervention strategy that targeted all of the above correlates simultaneously: with an experimental group prescribed behaviour changes to improve sleep, increase physical activity, light exposure and diet. On average, participants in the experimental condition saw nearly a 50% decline in depression scores across three inventories (HAM-D, Beck, GCI) at a 6 month follow-up. Considering the multifaceted aetiology of depression, a mixed intervention strategy should be the most effective, however it is difficult to then ascertain which of the individual intervention strategies had the greatest efficacy. Considering the consistent reduction in depression scores found by the researchers, a similar strategy could be encouraged by employers in an opt-in health and wellbeing program.

In general psychological health interventions appears to be fiscally beneficial for organisations. A report by Beyond Blue (2014) found on average that for every dollar spent on psychological health intervention there was a return in investment of $2.30 in terms of reduced absenteeism and presenteeism. This estimate does not encompass turnover costs, which can be high considering the resources dedicated to recruitment, training and skill acquisition. Intervention therefore stands to improve both the wellbeing of employees, and the financial health of company. As more workplaces adopt remote employment strategies, these recommendations stand to be of continuing relevance to future enterprise.

Finally, an additional option remains for employers in reducing employee depression and may be simplest. Mining employers could consider reducing the length of FIFO rosters, that is to say the time employees are required to spend away from home. This is perhaps the most challenging as it likely imposes direct financial costs to

employers in that the shorter the swing, the more flights will be required each year for staffing remote sites. We would argue however that companies have an ethical obligation to minimise the number of employees on long rosters (swings of 11 days or more) due to the relatively high rates of depression among workers on long rosters identified in Chapter 7, which were on average moderate levels of depression.

6. Summary and Conclusions

In this thesis we set out to identify the unique experience of work stress to mining workers, in particular remote mining workers. We created a local theory of work stress situated within the PSC-JDR framework, to explain this unique experience of stress. This theoretical approach governed our research methodology, initially through exploratory qualitative research to generate our local theory and specific hypotheses, and later through quantitative research to test these hypotheses.

We found evidence of a unique experience of stress among mining workers, in particular through the role of separation and isolation on personal relationships. We found evidence suggesting that mining workers and their partners experienced strain on their relationships due to separation. However we also found that the increased interaction that remote workers experience on site, increased the quality of their relationships with one another in terms of social support. Our findings suggest that when a person is removed from their primary support groups, they will seek to develop these types of bonds with peers in their new surroundings. We refer to this phenomenon as the proximity-support interaction.

We also developed a new measure, the Remote Work-Life Conflict (RWLC) scale, which had excellent internal reliability and predictive validity. The RWLC conflict differs to previous work-life conflict scales in that it captures the unique time related strain associate with remote work: that is a lack of regular personal time as opposed to a limitation. We believe this scale will be beneficial for remote mining workers, and their partners, in monitoring their risk of poor psychological health. We intend to make this tool freely available to businesses and the public for personal use.

We found psychosocial safety climate to be a beneficial safety signal in reducing work-life conflict experience by mining workers, however it could not buffer the strain attributed to the length of a FIFO roster. In this regard, some aspects of mining work

may be difficult to mitigate that are associated with poor psychological health outcomes. Finally, we provide a range of recommendations for employers to minimise the strain associated with work stress in the mining industry.

Remote work in the mining industry is a unique work structure, facilitated by advancements in technologies that help surpass geographical boundaries. These work structures are becoming increasingly more viable with the continual progression of technology, and society needs to adapt if we are to create safe organisational policy and practices for the future of work. These new work structures appear to be evident of a broader social trend in diminishing temporal and spatial boundaries between work and life. The progression of technology is unavoidable, but how we respond as a society to these technologies will shape the future of work, relationships and the health of generations to come.

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Glossary

ANOVA

Acronym for analysis of variance. A type of statistical analysis used to compare the variance of two groups in a particular condition(s) or outcome(s).

ANZSIC

Acronym for the Australian and New Zealand Standard Industrial Classification. A standardised list of broad industry classifications used in Australia and New Zealand.

APC-WHS

Acronym for the Asia Pacific Centre for Work Health & Safety. A research centre located at the University of South Australia's Magill campus.

AWB

Acronym for the Australian Workplace Barometer. A national surveillance project of psychosocial factors in Australian workplaces.

Burnout

A state of excessive stress arousal with symptoms of psychological and emotional exhaustion.

Camp

The place of living for mining workers typically temporary in nature, adjacent to a site of operation. Camps' usually contain lodgings, a dining or mess hall, administration/site management areas, and in some instances recreational areas.

Circadian Rhythm

A cycle of psychological and physical behaviours over a 24 hour cycle, such as the times of day we choose to eat and sleep.

COR

Acronym for Conservation of Resources theory. According to COR theory, we are motivated by the acquisition and maintenance of resources. When our resources are depleted or threatened, a stress response occurs.

Cronbach's Alpha

A measure of internal consistency within a scale, or set of variable items. A higher score indicates the items share a common factor.

DCM

See JDC.

DIDO

Similar to FIFO, except employees drive to the remote worksite.

Donga

A transportable building, typically used for accommodation.

ERI

Acronym for the Effort Reward Imbalance model. The ERI emphasises the need for a balance between effort in a job role and the rewards received in return, as well as the ambiguity of informal contracts that inform us of anticipated rewards.

Ethnographic

Research where the data is collected within the environment, such as interviewing a worker at their place of work.

FIFO

Acronym for Fly-in/Fly-out. A process where an employee flies to a remote location to work, and lives in onsite accommodation. Typical contract lengths vary from eight days at the work site with six days off, to longer contracts of four weeks on and one week off.

F-Test

Fisher-Snedecor distribution, often denoted as just *F*. A statistical measure of the difference between populations.

Information Criterion

A criterion used to compare the goodness of fit between statistical models.

JDC

Acronym for the Job Demand Control Model. The JDC model emphasises the buffering role of job control on stressors. Also referred to as the Demand-Control Model (DCM).

JDR

Acronym for the Job Demand Resources model. The JDR model is a work stress theory that emphasises two pathways of health erosion and motivation. Excessive stressors or demands trigger a health erosion pathway. Conversely high resources trigger a motivational pathway.

Macroscopic

Refers to a level of analysis that is focuses on large population level factors such as national culture and policy.

MAQOHSC

Acronym for South Australia's Mining and Quarrying Occupational Health and Safety Committee.

Mesoscopic

Refers to a level of analysis that is focuses on group level factors such as bullying and co-worker interactions.

Microscopic

Refers to a level of analysis that is focuses on individual level factors such as psychological wellbeing and stress.

MPlus

A statistics software program typically used for testing Structural Equation Models.

Primary resources sector

A collective term for industries that are involved in the production of natural resources, such as mining, agriculture, forestry and fishing. In contrast, secondary industries create products from these materials, and tertiary industries are involved in the distribution of these products to consumers.

Prototypical behaviour

Behaviour that exemplifies the characteristics of a group.

Proximity Principle

The proximity principle refers a sociological phenomenon where the closer people are related the more likely they are to form personal bonds.

PSC

Acronym for Psychosocial Safety Climate. Psychosocial Safety Climate reflects shared perceptions and behaviours amongst a working population towards psychosocial safety at work.

Regression

An analysis of the relationship between the mean values of two or more variables. In particular, a regression analysis examines the way one or more outcome variables change when or more predictor variables are changed.

Resource

A component of an employees work or environment that helps perform their job or cope with job strain. Not to be confused with primary resources (see primary resources sector).

Self-categorisation theory

A theory of which the way people choose to identify with, or distinguish themselves from, a particular group, and the effects this has on relationships.

Social Support

A measure of how supportive our personal relationships are. Sources of social include friends, partners, family or co-workers.

SEM

Acronym for Structural Equation Modelling. A structural equation model is an analyses of regression paths to test a theoretical model.

SES

Acronym for Socioeconomic Status. A person's position in society in terms of social and economic status.

Spillover

When an event or behaviour from one life domain (e.g. work) has an influence, positive or negative, on another domain (e.g. family).

Stressor

An aspect of an activity or environment that elicits stress arousal.

Stress arousal

A physiological response where stress hormones are released into the bloodstream that trigger in physical and psychological responses of increased arousal. This reaction can lead to increased arousal and vigilance in moderation, and health impairment in excess.

Stress theory

A class of psychological theories typically applied to the work context, with an underlying assumption that excessive stress leads to strain-related health outcomes.

Swing

Swing is generally used to refer to the length of days away and home for a FIFO or DIDO worker. It can also refer specifically to the period of time away, for example the phrase ‘I just got back from my swing’.

Transportables

See *donga*.

WFC

Work-Family Conflict. The negative spillover from the work to the home domain.

Yerkes-Dodson Law

Typically referred to as a proposed U-shape relationship between stress arousal and performance. An underlying theoretical assumption in many contemporary work stress perspectives.

Zeitgeber

Cues in our environment that help entrain circadian rhythms, such as daylight.

Appendix A – Semi-structured Qualitative Interview Questions

Demographics:

Age: Gender: Time working in the industry:

Occupation: Interview Code:

1) **What are some of the physically and mentally straining aspects of mining work?**

   - Have you experienced it personally? [*others if they spoke about themselves]*

   - - Could you give me an example of a time this occurred and tell me about where you were, and what happened?

2) **So sometimes certain groups of people can be more prone to strain at work, such as international employees having difficulty communicating with co-workers, and certain age groups having difficulty with some physical tasks. Do you think there any particular types of people you think might be more prone to experiencing _____ (the strain they mentioned above)?**

3) **If someone was having difficulty coping with _____ your workplace, what might be the signs?**

4) **What aspects of your job or workplace help workers cope with _____?**

5) **What are some of the strengths of your workplace? What things do you like or do you think make it a good workplace?**

6) **In what way might _____ affect people working in the mines do their job or affect their health or how they feel?**

   - Have you experienced it personally? [*others if they spoke about themselves*]

   - Could you give me an example of a time this occurred and tell me about where you were, and what happened?

7) **What do you think could be done to reduce _____at your workplace, or reduce some of the negative effects it has on employees?**

8) **You mentioned workers experienced _____, is it easy or difficult to talk to managers or co-workers about these issues?**

9) **Well thanks for talking to me about your experiences, it has been really helpful, was there anything else important you wanted to add that you think we might not have discussed, or anything you wanted to ask me?**

Appendix B – Online Survey

Mining Health & Wellbeing Survey

The following URL will take you to three short cognitive tests. Please click on the following URL which will open in a new window, and then write your scores for each test in the boxes below.

http://www.testmybrain.org/setup_restart?b=107

Test 1 (Flicker dot test) ☐

Test 2 (Matching shapes and numbers) ☐

Test 3 (Visual working memory) ☐

What country were you born in?

- ○ Afghanistan
- ○ Albania
- ○ Algeria
- ○ Andorra
- ○ Angola
- ○ Antarctica
- ○ Antigua and Barbuda

- ○ Argentina
- ○ Armenia
- ○ Australia

... 170 additional choices hidden ...

- ○ United Kingdom
- ○ United States
- ○ Uruguay
- ○ Uzbekistan
- ○ Vanuatu
- ○ Venezuela
- ○ Vietnam
- ○ Yemen
- ○ Zambia
- ○ Zimbabwe

What best describes your current relationship status?

- ○ Single, never married
- ○ Married
- ○ Living with partner
- ○ Not living with partner

- ○ Separated
- ○ Divorced
- ○ Widowed
- ○ Prefer not to answer

How many hours do you work in a typical day at work?

What time do you typically start work?

I'm filling out this survey

- ○ Before work
- ○ During work
- ○ After work
- ○ I don't have work today
- ○ Other _____

My type of work roster can best be described as:

(TICK ALL THAT APPLY)

- □ FIFO
- □ DIDO
- □ 3/4 day swing

□ 8/6 day swing

□ 2/1 week swing

□ Other _____

The following questions focus on how you have been feeling physically during the past three months

	Not at all	Rarely	Once in a while	Some of the time	Fairly often	Often	All of the time
How often have you had difficulty getting to sleep at night?	○	○	○	○	○	○	○
How often have you woken up during the night?	○	○	○	○	○	○	○
How often have you had nightmares or disturbing dreams?	○	○	○	○	○	○	○
How often has your sleep been peaceful and undisturbed?	○	○	○	○	○	○	○
How often have you experienced headaches?	○	○	○	○	○	○	○
How often did you get a headache when there was a lot of pressure on you to get things done?	○	○	○	○	○	○	○
How often did you get a headache when you were frustrated because things were not going the way they should have or when you were annoyed at someone?	○	○	○	○	○	○	○

How often have you suffered from an upset stomach (indigestion)?	○	○	○	○	○	○	○
How often did you have to watch that you ate carefully to avoid stomach upsets?	○	○	○	○	○	○	○
How often did you feel nauseated (“sick to your stomach”)?	○	○	○	○	○	○	○
How often were you constipated or did you suffer from diarrhea?	○	○	○	○	○	○	○
How often have you had minor colds (that made you feel uncomfortable but didn’t keep you sick in bed or make you miss work)?	○	○	○	○	○	○	○
How often have you had respiratory infections more severe than minor colds (such as bronchitis sinusitis, etc.) that “laid you low”?	○	○	○	○	○	○	○
When you have a bad cold or flu, how often does it last longer than it should?	○	○	○	○	○	○	○

The following questions are about how work can affect your home and personal life.

How well do you agree with the following statements?

	Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree
The demands of my work	○	○	○	○	○	○	○

interfere with my home and family life							
The amount of time my job takes up makes it difficult to fulfil family responsibilities	○	○	○	○	○	○	○
Things I want to do at home do not get done because of the demands my job puts on me	○	○	○	○	○	○	○
My job produces strain that makes it difficult to fulfil family duties	○	○	○	○	○	○	○
Due to work-related duties, I have to make changes to my plans for family activities.	○	○	○	○	○	○	○
My job makes it difficult to maintain social relationships outside of work	○	○	○	○	○	○	○
I find I miss a lot of social	○	○	○	○	○	○	○

activities and opportunities because of my work (such as birthdays and playing sports)							
My job makes it difficult to form new friendships or romantic relationships	○	○	○	○	○	○	○
My work arrangement makes it difficult to fulfil social responsibilities (such as helping a friend move house or attending a funeral)	○	○	○	○	○	○	○

The following statements are about how engaged you feel at work

Please select the most applicable

	Never	1-3 times per year or less	Once a month	A few times a month	Once a week	A few times a week	Every day
At my work, I feel bursting with energy	○	○	○	○	○	○	○
At my job, I feel strong and vigorous	○	○	○	○	○	○	○

When I get up in the morning, I feel like going to work	○	○	○	○	○	○	○
I am enthusiastic about my job	○	○	○	○	○	○	○
My job inspires me	○	○	○	○	○	○	○
I am proud of the work I do	○	○	○	○	○	○	○
I feel happy when I am working intensely	○	○	○	○	○	○	○
I am immersed in my work	○	○	○	○	○	○	○
I get carried away when I am working	○	○	○	○	○	○	○

The following environmental conditions you are exposed to at your work could best be described as:

	Low	Mild	Moderate	High	Severe	Not applicable
Heat on site	○	○	○	○	○	○
Cold on site	○	○	○	○	○	○
Wind on site	○	○	○	○	○	○
Noise on site	○	○	○	○	○	○
Dust/particles on site	○	○	○	○	○	○
Heat at camp	○	○	○	○	○	○
Cold at camp	○	○	○	○	○	○

Wind at camp	○	○	○		○	○	○
Noise at camp	○	○	○		○	○	○
Dust/particles at camp	○	○	○		○	○	○

How much do you agree with the following statements about the facilities at your work?

	Strongly disagree	Disagree	Agree	Strongly agree	Not applicable
At work I have sufficent exercise facilities	○	○	○	○	○
At work I have sufficient opportunities to exercise	○	○	○	○	○
At work I have enough food so I have energy throughout the day	○	○	○	○	○
The meals provided have variety and are enjoyable	○	○	○	○	○
At work they cater to my dietry needs	○	○	○	○	○
I have adequate lodging on site	○	○	○	○	○
I have adequate telecommunications and internet access at camp	○	○	○	○	○

How often do you experience the following?

Please select the most applicable

	Never	A few times a	Once a month or less	A few times a month	Once a week	A few times a week	Every day

		year or less					
I feel emotionally drained from my work	○	○	○	○	○	○	○
I feel used up at the end of the workday	○	○	○	○	○	○	○
I feel tired when I get up in the morning and have to face another day on the job	○	○	○	○	○	○	○
Working all day is a strain for me	○	○	○	○	○	○	○
I feel burned out from my work	○	○	○	○	○	○	○

During the last 2 weeks, how often were you bothered by any of the following problems?

Please select the most applicable

	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious or on edge	○	○	○	○
Not being able to stop or control worrying	○	○	○	○
Worrying too much about different things	○	○	○	○
Trouble relaxing	○	○	○	○
Being so restless that it is hard to sit still	○	○	○	○

Becoming easily annoyed or irritable	○	○	○	○
Feeling afraid as if something awful might happen	○	○	○	○

During the last 2 weeks, how often were you bothered by any of the following problems?

Please select the most applicable

	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things	○	○	○	○
Feeling down, depressed, or hopeless	○	○	○	○
Trouble falling or staying asleep, or sleeping too much	○	○	○	○
Feeling tired or having little energy	○	○	○	○
Poor appetite or overeating	○	○	○	○
Feeling bad about yourself - or that you are a failure or have let yourself or your family down	○	○	○	○
Trouble concentrating on things, such as reading the newspaper or watching television	○	○	○	○
Moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual	○	○	○	○
Thoughts that you would be better off dead or of hurting yourself in some way	○	○	○	○

How well do you agree with the following statements about your work

	Strongly disagree	Disagree	Agree	Strongly Agree
My job requires lots of physical effort	○	○	○	○
I am often required to move or lift very heavy loads on my job	○	○	○	○
My work requires rapid and continuous physical activity	○	○	○	○
I am often required to work for long periods with my body in physically awkward positions	○	○	○	○
I am required to work for long periods with my head or arms in physically awkward positions	○	○	○	○
My job requires working very fast	○	○	○	○
My job requires working very hard	○	○	○	○
I am not asked to do an excessive amount of work	○	○	○	○
I have enough time to get the job done	○	○	○	○
Some demands I face at work are in conflict with other demands at work	○	○	○	○
I have to work through my breaks and lunch/dinner in order to catch up at work	○	○	○	○

How well do you agree with the following statements about your work

(Continued)

	Strongly disagree	Disagree	Agree	Strongly Agree

My job requires that I learn new things	○	○	○	○
My job involves a lot of repetitive work	○	○	○	○
My job requires me to be creative	○	○	○	○
My job requires a high level of skill	○	○	○	○
I get to do a variety of different things in my job	○	○	○	○
I have an opportunity to develop my own special abilities	○	○	○	○
My job allows me to make a lot of decisions on my own	○	○	○	○
In my job, I have very little freedom to decide how I do my work	○	○	○	○
I have a lot to say about what happens in my job	○	○	○	○
In my job I must supervise others	○	○	○	○
My job security is good	○	○	○	○

How well do you agree with the following statements about your work

(Continued)

	Strongly disagree	Disagree	Agree	Strongly Agree
Considering all my efforts and achievements, I receive the respect and prestige I deserve at work	○	○	○	○

Considering all my efforts and achievements, my job prospects are adequate	○	○	○	○
Considering all my efforts and achievements, my salary/income is adequate	○	○	○	○
My job security is poor	○	○	○	○

How well do you agree with the following statements about your work

The following statements are about the people you work with

	Strongly disagree	Disagree	Agree	Strongly Agree
People I work with are friendly	○	○	○	○
People I work with are helpful in getting the job done	○	○	○	○
I am treated with respect by my co-workers	○	○	○	○
My supervisor/manager is concerned about the welfare of those under him/her	○	○	○	○
My supervisor/manager is helpful in getting the job done	○	○	○	○
I am treated with respect by my supervisor/manager	○	○	○	○

How often have you been subjected to the following negative acts at work during the last three months?

Please select the most applicable

	Never	Now and then	Monthly	Weely	Daily

Someone withholding information which affects your performance	○	○	○	○	○
Being humiliated or ridiculed in connection with your work	○	○	○	○	○
Being ordered to do work below your level of competence	○	○	○	○	○
Having key areas of responsability removed or replace with more trivial or unpleasant tasks	○	○	○	○	○
Spreading of gossip and rumours about you	○	○	○	○	○
Being ignored or excluded	○	○	○	○	○
Having insulting or offensive remarks made about your person (i.e. habits and background), your attitudes or your privatelife	○	○	○	○	○
Being shouted at or being the target of spontaneuous anger (or rage)	○	○	○	○	○
Intimidating behaviour such as finger-pointing, invasion of personal space, shoving, blocking/barring the way	○	○	○	○	○
Hints or signals from others that you should quit your job	○	○	○	○	○
Repeated reminders of your errors or mistakes	○	○	○	○	○
Being ignored or facing a hostile reaction when you approach	○	○	○	○	○
Persistent criticism of your work and effort	○	○	○	○	○
Having your opinions and views ignored	○	○	○	○	○

Practical jokes carried out by people you do not get on with	○	○	○	○	○
Being given tasks with unreasonable or impossibloe targets or deadlines	○	○	○	○	○
Having allegations made against you	○	○	○	○	○
Excessive monitoring of your work	○	○	○	○	○
Pressure not to claim something which by right you are entitled to (e.g. sick leave, holiday entitlement, travel expenses)	○	○	○	○	○
Being the subject of excessive teasing and sarcasm	○	○	○	○	○
Being exposed to an unmanagable workload	○	○	○	○	○
Threats of violence or physical abuse or actual abuse	○	○	○	○	○
Have been bullied at work	○	○	○	○	○

The following statements are about the physical health and safety at your workplace.

How well do you agree with the following:

	Strongly disagree	Disagree	Neither disagree or agree	Agree	Strongly agree
In my workplace senior management acts quickly to correct problems/issues that affect employees' safety	○	○	○	○	○
Senior management acts decisively when a concern of an employees' safety is raised	○	○	○	○	○

Senior management show support for injury prevention through involvement and commitment	○	○	○	○	○
Safety of staff is a priority for this organisation	○	○	○	○	○
Senior management clearly considers the safety of employees to be of great importance	○	○	○	○	○
Senior management considers safety to be as important as productivity	○	○	○	○	○
There is good communication here about safety issues which affect me	○	○	○	○	○
Information about workplace safety is always brought to my attention by my manager/supervisor	○	○	○	○	○
My contributions to resolving safety concerns in the organization are listened to	○	○	○	○	○
Participation and consultation regarding safety occurs with employees', unions and health and safety representatives in my workplace	○	○	○	○	○
Employees are encouraged to become involved in workplace safety matters	○	○	○	○	○
In my organization, the prevention of workplace injury involves all levels of the organisation	○	○	○	○	○

The following statements are about the psychological health and safety at your workplace.

How well do you agree with the following:

	Strongly disagree	Disagree	Neither disagree or agree	Agree	Strongly agree
In my workplace senior management acts quickly to correct problems/issues that affect employees' psychological health	○	○	○	○	○
Senior management acts decisively when a concern of an employees' psychological status is raised	○	○	○	○	○
Senior management show support for stress prevention through involvement and commitment	○	○	○	○	○
Psychological well-being of staff is a priority for this organisation	○	○	○	○	○
Senior management clearly considers the psychological health or employees to be of great importance	○	○	○	○	○
Senior management considers psychological health to be as important as productivity	○	○	○	○	○
There is good communication here about psychological safety issues which affect me	○	○	○	○	○
Information about workplace psychological well-being is always brought to my attention by my manager/supervisor	○	○	○	○	○

My contributions to resolving occupational health and safety concerns in the organization are listened to	○	○	○	○	○
Participation and consultation in psychological health and safety occurs with employees', unions and health and safety representatives in my workplace	○	○	○	○	○
Employees are encouraged to become involved in psychological safety and health matters	○	○	○	○	○
In my organization, the prevention of stress involves all levels of the organisation	○	○	○	○	○

Please provide the following details about your employment

(This information will not be linked to your individual scores)

Name of employer: _____

Name of work site: _____

Number of years with employer: _____

Occupation: _____

Are you male or female?

○ male

○ female

What is your current age?