Walden University

College of Management and Human Potential

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Walden University
2024

Abstract

Examining the Influence of Demographics on Workers' Experiences of Psychosocial Risk in the Canadian Construction and Extractive Industries

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MPhil, Walden University, 2023

MBA, Athabasca University, 2019

B Mgmt, Athabasca University, 2016

Dissertation Submitted in Partial Fulfilment

of the Requirements for the Degree of

Doctor of Philosophy

Management

Walden University

February 2024

Abstract

Workers in the Canadian construction and extractive industries (CEIs) are exposed to psychosocial risk factors (PRFs) and experience a greater prevalence of mental health issues than the public. Managing PRFs requires the use of risk management theory; however, there is little research on PRFs in the Canadian CEIs, especially as it relates to workers' views. The problem is that the lack of knowledge of the importance of PRFs, from the perspective of Canadian CEI workers, is impairing effective risk management and having a deleterious effect on workers' mental health. The purpose of this quantitative, nonexperimental, correlational study was to examine the relationship between five demographic control factors of age, gender, residence type, employment arrangement, and rotation status, and 15 measures of Canadian CEI workers' perspective of PRFs using the theoretical foundation of risk management theory. Using a cross-sectional design, a 90-question survey was administered to 174 workers over the age of 18 to obtain demographic data and scores for the PRFs using the Copenhagen Psychosocial Questionnaire – Canadian version. Analysis of variance was used to compare means across groups to determine if there is a difference in views of PRFs. The findings revealed that while workers' experiences are largely unique, there is often a stark difference between the experiences of workers based on age, gender, and employment arrangement. The study helps to provide a more complete assessment of the nature of PRFs within the CEIs and could help leaders to establish more effective risk management strategies for the betterment of workers, employers, and the broader communities in which they live and operate.

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Acknowledgments

Pursuing a Ph.D. is a team effort, and I am fortunate to have had a special group of people by my side throughout it all. An enormous thank you must first be given to Dr. Branford McAllister who went far beyond his assigned role of committee chair to become my champion, mentor, and friend. I will be forever grateful to have had the guidance of such a stellar human and academic. Thank you to Dr. William Shriner and Dr. Raghu Korrapati for their support as committee members, and to Dr. Sheryl Kristensen who flamed a spark at the exact right time. I would like to express extreme gratitude to my close family and friends who rallied around me over the past several years in support of my academic pursuits. Thank you to my daughter, Arcana Shanks, whose insight and wisdom never fails to improve the situation; my brother Shawn Leask who has always been an unwavering guardian and patron of my happiness; my sister, Lor, for always believing in me just a little more than I did; and my dear friend, Christina Seitz, who acted as a creative catalyst and therapist. Thank you to my husband, Keith McDonnell, who curated our life in such a magical way so that I could commit myself almost exclusively to this goal. Thank you for loving me so fully, patiently, and wonderfully. Finally, I would like to express deep appreciation to all the other individuals who contributed to the successful completion of this dissertation in their own way. Every act of kindness was fuel for my fire, and I thank you.

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Chapter 1: Introduction to the Study

Workplace mental health (WMH) has become a global issue that affects an estimated 15% of the working population and costs the global economy more than 1 trillion dollars (USD) each year (World Health Organisation [WHO], 2022). To help employers address the issue, the Canadian Standards Association (CSA, 2013) and the International Organization for Standardization (ISO, 2021) developed protocols for managing psychological health and safety in the workplace that require the use of risk management theory to effectively identify and mitigate threats to workers and their organizations. Both protocols specify the importance of including workers' perspectives as part of risk management strategies. Manuele (2010) stated, "If an employer does not take advantage of the knowledge, skill, and experience of workers close to the hazards and risks, opportunities are missed to improve safety management systems and reduce injury and illness potential" (p. 147). Employee involvement is an essential component of the risk management process that has been emphasized in national and international standards as well as academic research.

Although the body of scholarly knowledge on psychosocial risk factors (PRFs) and psychosocial hazards (PHs) in the construction and extractive industries (CEIs) has grown substantially in recent years, no Canadian studies have examined workers' perspectives of PRFs and PHs. Alomari et al. (2020) addressed U.S. construction workers' perspectives of risk and found that organizational factors have the greatest impact on risk perception while work trade did not affect risk ratings. Ramkissoon et al. (2019) included Canadian workers from a wide range of industries to find that quality

leadership, social support, vertical trust, and organizational justice were the most important factors for WMH. Together, these studies demonstrate a gap in knowledge and the need to conduct further research that offers insight to the perspectives of Canadian CEI workers.

My study was needed because previous research had not addressed the issue of PRFs from the perspective of workers in the Canadian CEIs. Understanding those perspectives may facilitate more effective policies, procedures, and programs. In turn, that could improve workers' mental health, and represent a significant and positive social change. Chapter 1 provides the foundation for the study by first discussing the background of the problem, problem statement, research questions, and hypotheses. The chapter includes a discussion of risk management which is the theoretical foundation used throughout the study. I conclude the chapter with a description of the significance of the study and how the new knowledge will help CEI leaders to effectively manage psychosocial risks in the workplace for the betterment of employee mental health.

Background of the Study

The body of literature on mental health in the CEIs continues to grow with most of the research occurring in Australia, China, Hong Kong, the UK, and the United States (see, for example, Sun et al., 2022; Tijani, Osei-kyei., & Feng, 2020). Scholars have identified a common set of concerns within the CEIs, such as the nature, context, and culture of the work (see, for example, Frimpong et al., 2022; Sun et al., 2022; Tijani et al., 2023), but few researchers have focused on these hazards within the Canadian CEIs. The identification of hazards is the first step in risk management theory which uses a

systematic and iterative process of hazard identification, risk assessment, risk mitigation, and risk monitoring (Godfrey, 1996; ISO, 2018b). The next step, risk assessment, requires evaluation of the likelihood and consequences of the harm stemming from the hazard; and is best done with input from a wide range of stakeholders, including workers (Godfrey, 1996; ISO, 2018b). However, research on the psychosocial impacts of resource development rarely includes the perspective of workers.

Previous research has identified PRFs within the CEIs and established a negative relationship between them and workers' mental health (see, for example, Chan et al., 2020; Sun et al., 2022; Tijani, Jin, & Osei-kyei., 2020). Chan et al. (2020) found that studies lacked consideration for work-life stressors. Further, they found a lack of risk management for PRFs in the industry which leads workers to use coping strategies that have a negative impact on overall mental health. Tijani, Osei-kyei, and Feng (2020) explored work-life balance in the construction industry, finding that most studies were produced in Australia, UK, China, and India. They also called into question the suggestions of scholars to address poor work-life balance through flexible work time due to the inappropriateness of the solution given the project-driven nature of construction work. This challenge underscores the importance of applying risk management strategies which, according to ISO (2018b), should include consideration of not only what mitigations *could* be applied, but what mitigations are practicable. Sun et al. (2022) identified 13 PHs that have a statistically significant association with mental health issues. The greatest effect sizes were observed with role conflict, organizational injustice,

role ambiguity, job insecurity, and interpersonal conflict. Together, these studies provide scholarly consensus on the PRFs and PHs important to the CEIs.

Several studies have investigated the experiences of different worker subgroups within the CEIs, including the experiences of young construction workers (see, for example, Dong et al., 2022; Frimpong et al., 2022), women in trades (see, for example, Lekchiri et al., 2020; Murphy et al., 2021), miners in Quebec (Bouchard-Bastien & Gervais, 2017), and leaders in construction (see, for example, Ajay et al., 2019; Dorow et al., 2021). Young, typically male, construction workers have higher rates of distress and suicide risk than their older counter parts (Dong et al., 2022; Frimpong et al., 2022). The experience for women is somewhat unique because while they face significant challenges because of gender bias and the typical challenges of industrial work (Lekchiri et al., 2020; Murphy et al., 2021), they also feel a strong sense of pride (Murphy et al., 2021). Leaders struggle in the dual role of managing their own mental health and supporting workers with many leaders feeling insufficiently prepared to deal with the challenges (Ajayi et al., 2019; Dorow et al., 2021). These studies provide evidence of the variability in experiences that workers in CEIs have despite being exposed to the same types of PRFs and PHs.

The gap in scholarly research pertaining to assessment of risk stemming from PRFs and PHs in the Canadian CEIs has been pointed out by authors who recommended further study (Dorow et al., 2021; Murphy et al., 2021; Wright & Griep, 2019). These studies indicated there was a lack of worker involvement in assessment of risk which

could impair effective risk mitigation. I aimed to address that gap in knowledge through the examination of workers perspectives on PRFs in the Canadian CEIs.

Problem Statement

In Canada, 43% of industrial workers are experiencing mental health issues and 83% have experienced them in the past (Liu et al., 2021). Canadian trade organizations are concerned over the prevalence and severity of the issue (BC Building Trades, 2020). Workers in these industries have a higher prevalence of anxiety, stress, depression, suicidal ideation, and other mental health issues as compared with the general population (Asare et al., 2021; Asare-Doku et al., 2020; Chan et al., 2020). The nature of work within these industries exposes workers to high levels of PRFs, including home-work conflict, poor working environment, long work hours, unfair reward and treatment, harassment and discrimination, and gender inequality, among other stressors which contribute collectively to increase occupational stress (Tijani, Jin, & Osei-kyei, 2020; Tijani, Osei-kyei, & Feng, 2020). Understanding the likelihood and severity (risk) of PRFs within these settings is complicated by differences in work factors such as trade or occupation, schedule, and employment arrangement; and individual factors such as age, gender, and residence type (Dorow et al., 2021).

Although researchers have investigated this issue, there is no literature examining how Canadian CEI workers view the importance of PRFs in the workplace; nor is there research investigating how membership in different worker subgroups (demographic factors) might influence workers' perspectives. Little research has been done to understand how organizational practices related to human resources and construction

business strategies influence PHs in the workplace (Tijani, Jin, & Osei-kyei, 2020). Where research on workers' perspectives has been conducted, it pertained to non-Canadian construction workers (Carvajal-Arango et al., 2021; Fordjour et al., 2020); or Canada's general worker population (Ramkisoon et al., 2019). The gap was recognized by Dorow et al. (2021) who called for further research in Canada to understand the perspectives of workers to facilitate more effective risk management by leaders. Key considerations to explore, according to Dorow et al. (2021), were how different worker groups experience psychosocial risks because of gender, residence type, schedule, trade or occupation, and employment arrangement.

The research problem was that the lack of knowledge of the importance of PRFs from the perspective of Canadian CEI workers is impairing effective risk management and having a deleterious effect on workers' mental health. Without an understanding of the how workers view PRFs, risk mitigation efforts are likely to be unsuccessful because leaders cannot discern which mitigations would be most effective (CSA, 2013; ISO, 2018b). My study was needed because CEI leaders have not implemented risk management strategies to address the growing concern of mental health within their industries.

Purpose of the Study

The purpose of this quantitative study was to examine the relationship between 15 measures of Canadian CEI workers' perspective of PRFs (response variables [RVs]) and five demographic, categorical control factors (CFs). The CFs were based on Dorow et al.'s (2021) and Ramkissoon et al.'s (2019) recommendation to further investigate the

views of subgroups of workers. PHs within the CEIs have been well identified through research (see, for example, Chan et al., 2020; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020). The five CFs are listed in Table 1. The 15 RVs are continuous numerical measures of PRFs and listed in Table 2.

Table 1

Control Factors

Factor	Factor ID	Levels	Level IDs
Age	A	3	18-30, 31-45, over 45
Gender	*B*	2	Male, Female
Residence Type	*C*	3	Self-provided accommodation, Employer-provided accommodation: camp/lodge, Employer-provided accommodation: other
Employment Arrangement	*D*	3	I work for the project/operation owner, I work for a prime contractor, I work for a subcontractor
Rotation Status	*E*	2	On rotation, Off rotation

Table 2

Response Variables

Description	Label
Quantitative demands	*F1*
Work pace	*F2*
Emotional demands	*F3*
Influence at work	*F4*
Possibilities for development	*F5*
Meaning of work and work commitment	*F6*
Predictability and rewards	*F7*
Role clarity	*F8*
Role conflict	*F9*
Quality of leadership	*F10*
Social support from supervisor	*F11*
Social community	*F12*
Job insecurity and satisfaction	*F13*
Work life conflict	*F14*
Vertical trust and organizational justice	*F15*

Research Question and Hypotheses

To address the purpose of the study, I designed the following research question (RQ) and associated null and alternative hypotheses for each of the 15 RVs.

RQ: What is the relationship between five demographic CFs and PRFs in the Canadian CEIs as measured by 15 RVs?

The data were analyzed using analysis of variance (ANOVA) using IBM's statistical package for social sciences (SPSS). For each of the RVs (*F1* through *F15*), the following are the ANOVA hypothesis pairs for each CF (*A*, *B*, . . .) and for each two-factor interaction (2FI: *A*B*):

The hypothesis of no difference in the RV due to factor A:

H_{A0}: $\mu_1 = \mu_2 = \cdots = \mu_i \cdots = \mu_m$ (the means for all levels of *A* are equal)

where the number of levels of factor $A = m$

H_{A1}: not all μ_i are equal.

The hypothesis of *no difference in the RV due to factor B* (which, as an example here, has two levels):

H_{B0}: $\mu_1 = \mu_2$ (means for both levels of *B* are equal)

where the number of levels of factor $B = 2$

H_{B1}: $\mu_1 \neq \mu_2$ (general form: not all μ_i are equal).

The hypothesis of no *interaction* between factors *A* and *B*:

H_{AB0}: the interaction of *A* and *B* is equal to zero.

H_{AB1}: the interaction of *A* and *B* is not equal to zero.

Theoretical Foundation

The theoretical foundation for this study was risk management which posits that through risk analysis and mitigation, organizations can better estimate and guard against potential losses that may result through normal operations, negligence, or criminality (Gallagher, 1956). Risk management originated in the insurance industry post-World War II and quickly expanded from only managing physical asset loss to consider technological risk, operational risk, and political risk (Crockfort, 1982). Mehr and Hedges (1963) and Williams and Heins (1964) published the first academic books on the topic of pure risk management, which is risk with a downside loss only. Modern day risk management theory uses a systematic and iterative process of hazard identification, risk assessment, risk mitigation, and risk monitoring to reduce threat levels to a subjective state of tolerability (Godfrey, 1996; ISO, 2018b; Roughton et al., 2019). Risk management is relevant to my study given it is a fundamental characteristic of a health occupational safety management system (see Roughton et al., 2019) and it is prescribed as an appropriate approach by Canadian and international standards for managing occupational health and safety risk and psychosocial risk in the workplace (CSA, 2013; ISO, 2018a, 2018b, 2021).

Key concepts within risk management theory are risk analysis and risk mitigation which are briefly discussed here and reviewed more fully in Chapter 2. Risk analysis is a process in which stakeholders are engaged to understand the nature of a hazard and the probability and consequence of potential risks (CSA, 2019a, 2019b; ISO, 2018a, 2018b).

Risk mitigation relates to the selection of risk treatment and ongoing monitoring of efficacy (CSA, 2019a, 2019b; ISO, 2018a, 2018b).

PRFs are workplace factors that increase the risk to worker health. They have been identified by the CSA (2013) as organizational culture, growth and development, psychological and social support, recognition and reward, balance, clear leadership and expectations, involvement and influence, psychological protection, civility and respect, workload management, protection of physical safety, psychological demands, and engagement. These factors were investigated collectively because they influence worker mental health collectively (Tijani, Jin, & Osei-kyei, 2020) and Dorow et al. (2021) suggested that the worker experience may vary depending on factors such as gender, employment type, and accommodation.

The logical connection between the framework presented and the nature of my study is that PHs can explain nearly one third of workers' mental health problems in the CEIs (see Sun et al., 2022). Also, the impact of PHs is best managed through application of risk management theories including worker-informed risk analysis as a precursor to the development of effective mitigations (CSA, 2013; Carvajal-Arango et al., 2020). Therefore, the theory of risk management and concept of risk analysis are critical to the development of effective mitigations which are needed to address the research problem.

Nature of the Study

I used a nonexperimental, correlational design that examined the relationship between the CFs and PRFs in the Canadian CEIs (RVs). Because the CFs were categorical, and the RVs were numerical, I used ANOVA and predictive mathematical

model-building to test the hypotheses and assess the relationships among the variables. The design type cannot determine causality, but it can provide insight to the strength and direction of the relationships.

This quantitative, correlational study was nonexperimental as the aim was to examine the relationship among the CFs and the RVs and not to ascertain causality (Asenahabi, 2019). The CFs were not controlled because the data were collected from a questionnaire completed by a random sample of participants. The design type was selected based on Fitzgerald et al. (2004) who recommended correlational studies when there is an interest in explaining or predicting an outcome using variables that are not manipulated. Importantly, although correlation provides evidence of a relationship between variables, it is insufficient for determining causality and can only make causal inferences (Fitzgerald et al., 2004; Shadish et al., 2002).

I collected data from workers within the Canadian CEIs using an electronic questionnaire that used the Canadian version of the Copenhagen Psychosocial Questionnaire (COPSOQ) which is an instrument that was validated by Ramkissoon et al. (2019). Demographic questions were used to collect information at a nominal level and the instrument's 82 questions addressed PRFs. Of the 82 questions, 74 collected information using Likert-type response options, and eight collected information at the nominal level. The questionnaire was disseminated electronically using the survey platform service SurveyMonkey. Invitation to participate was communicated to workers through social media, including LinkedIn, Instagram, Facebook, and Reddit.

Definitions

Canadian Standards Association (CSA): A nonprofit membership association serving industry, government, consumers, and other parties through the development of standards, testing, inspection, and certification that aim to improve safety, health, the environment, and economic efficiency in Canada and internationally (CSA, 2023).

Construction and extractive industries (CEIs): A group of industries including industrial construction and resource extraction, including mining, oil and gas, and hydroelectricity.

Control factor (CF): A categorical independent variable that is held constant or limited in a research study because it is postulated to influence the response (adapted from Montgomery, 2020; Warner, 2013).

Demographic control factors: Characteristics that define a segment of a population such as age, gender, residence type, employment arrangement, and rotation status.

Employment arrangement: The contractual relationship between a worker and the party that engages their services in which the parties may be the project or operation owner, a prime contractor, a subcontractor, or a sub-subcontractor.

International Organization for Standardization (ISO): An independent, nongovernmental organization with membership of 167 national standard bodies. The ISO is the largest developer and publisher of standards in the world (ISO, 2023).

Mental health: A state of well-being in which an individual realizes their own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to contribute to their community (CSA, 2013).

Psychosocial hazard (PH): A specific potential source of psychological harm to a worker (CSA, 2013). Examples of PHs include bullying, harassment, violence, discrimination, and exposure to traumatic events.

Psychosocial risk factors (PRFs): PHs and elements of the work environment, management practices, and organizational dimensions that increase the risk to health (CSA, 2013). This study investigates 15 PRFs as defined by Ramkissoon et al. (2019), including quantitative demands, work pace, emotional demands, influence at work, possibilities for development, meaning of work and work commitment, predictability and rewards, role clarity, role conflict, leadership and social support, colleague social support, social community, job insecurity, work life conflict, and vertical trust and organizational justice.

Psychosocial risk management (PRM): Application of traditional risk management techniques to PRFs.

Residence type: The agreed upon style of accommodation between a worker and their employer; it may include worker- or employer-provided accommodation in a camp/lodge style housing unit or other, such as hotel, apartment, or house.

Risk: The combination of the likelihood of the occurrence of harm and the severity of that harm (CSA, 2013).

Rotation: A schedule or pattern in which workers alternate between days of work and days of nonwork.

Rotation status: A worker's current place within their rotation as either on-rotation or off-rotation.

Assumptions

This study was based on several assumptions. First, there is a postulated relationship between the independent and RVs. I also assumed that participants would be intellectually capable of understanding and responding to questions, and that they would answer questions honestly and in a manner that reflects their true experience. Another assumption was made that the use of Likert-type questions would be an effective means of collecting data and that there would be enough participants to form a sufficient sample size.

Scope and Delimitations

In this study, I addressed the perspectives of current or recent workers within the Canadian CEIs. I focused on the workers' perspectives of the importance of psychosocial risks within the workplace. Three important delimitations of the study are noted. First is that the research was focused on workers' views of psychosocial risks within the workplace and not their individual mental health status. Second, I addressed onshore oil and gas operations and not offshore work. The rationale for delimiting offshore work from this study was that offshore work is limited in Canada. Third, there are many potential influences on measurements or perceptions of psychosocial risks. However, my focus was on workers' perspectives; and my intent was to determine if their demographic

attributes are associated with their self-assessment of psychosocial risks. Several CFs studied by Ramkissoon et al. (2019; e.g., province or territory of employment, workplace size, level of education, shift schedule) were not included in this study because they were outside the scope of my research.

Limitations

Nonexperimental correlational designs are limited in several ways when compared to experimental designs. These limitations can include a lack of control over the CF which prevents determination of a causal link between the dependent and CFs (Fitzgerald et al., 2004; Shadish et al., 2002). The same lack of control may lead to confounding variables that affect the RV (Shadish et al., 2002). A further limitation is a potential of limited generalizability which may occur if the sample is not representative of the population (Fitzgerald et al., 2004; Shadish et al., 2002). To manage these limitations, Shadish et al. (2002) advised researchers to increase attention towards external validity which largely depends upon obtaining a representative sample of the larger population.

There are inherent limitations that arose from the scholarly body of knowledge upon which this dissertation was developed. Studies of PRM have been found to use a range of terms and definitions to discuss similar concepts (Carvajal-Arango et al., 2021). To address this limitation, I analyzed and grouped similar concepts together. A further limitation was that although I excluded studies pertaining only to offshore workers in my literature review, some studies, such as Derdowski and Mathisen (2023), included

offshore workers in their research and disaggregated information was not provided. To manage that limitation, I used data pertaining only to onshore workers when possible.

Significance of the Study

Significance to Theory

The main benefit from the study is new knowledge about how workers in the Canadian CEIs perceive psychosocial factors which addresses the information shortage discussed by Dorow et al. (2021). A second benefit is the consideration of gender as a predictor of workers' evaluations of psychosocial factors which addresses a gap identified by Asare-Doku et al. (2020) and Dorow et al. My research addressed other gaps identified by Dorow et al. regarding examination of differences related to fly-in-fly-out (FIFO) or residential workers and employer type. Another benefit of this study is the inclusion of a complete set of PRFs in the analysis which helps to address the gap identified by Dorow et al. and Ramkissoon et al. (2019). I built upon prior research, but addressed gaps related to the shortage of information on workers' view of PRFs and their risks.

Significance to Practice

The research supports psychosocial health and safety risk management in practice by investigating workers' perspectives, a step recommended by the CSA's (2013) psychosocial health and safety management standard but missing within scholarly research. The new information may help organizational leaders to better understand the nature of PRFs in the CEIs and promote improvement in risk management practices with a direct benefit to the CEI workforce. The information may also be helpful as the CEIs

seek to bridge labour shortages through recruitment of a broader demographic of workers (CIBC, 2023).

Significance to Social Change

The results of this study have potential implications for positive social change. The process of participation may increase leaders' awareness of mental health and the challenges they face in managing risks and lead to changes in the leaders' approach. The new knowledge created through the research will build on the work of Quinane et al. (2021) who researched leadership and mental health risk management from a tension-centered approach and help government and industrial leaders to make important improvements in their approach to mental health risk management. More effective policies, procedures, and programs related to worker mental health may effect positive social change by improving workers' performance and improving the quality of their and their families' lives.

Summary

In this chapter, I provided an overview of the connection between risk management, PRFs, and workers' perspectives within the CEIs. Previous research provides evidence that a common set of PRFs has been identified appropriate to the unique settings with CEIs and indicates that although factors are well identified, they are not yet well managed. The CEIs in Canada and globally face significant impact because of poor worker mental health which could have a devastating impact to workers and the economy if left unmitigated. An overarching research question and related hypotheses

were presented and will be evaluated to better understand how workers view the importance of PRFs based on their membership in subgroups.

The knowledge generated from this study has the potential to contribute to the body of research by connecting practical risk management theory with scholarly inquiry, thereby making the body of knowledge more meaningful to the decision makers responsible for risk management within CEIs. The practical implications of the study have the potential to make a meaningful contribution to social change by empowering CEI leaders with information specific to their industry and allowing for more effective risk management strategies to be implemented. The potential outcome of better risk management is improvement to worker mental health and minimization of financial impact to organizations and global economy. Chapter 2 provides an extensive literature review that focuses on risk management, PRFs, and the Canadian CEIs.

Chapter 2: Literature Review

The social and management problem was that WMH is a global issue that costs the global economy more than 1 trillion dollars (USD) annually and affects an estimated 15% of the working population (WHO, 2022). The research problem was that the lack of knowledge of the importance of PRFs from the perspective of Canadian CEI workers is compromising risk management practices and having a negative effect on workers' mental health. The purpose of this quantitative study was to examine the relationship between measures of Canadian CEI workers' perspective of PRFs (RVs) and the CFs of age, gender, residence type, employment arrangement, and rotation status.

Recent research related to WMH in the CEIs covers the relationship between mental health and PRFs, identification of specific hazards within the CEIs, perspectives of leaders accountable for the management of PRFs, and to a lesser extent, the efficacy of risk mitigation efforts. Scholarly research has provided evidence that PRFs have a negative effect on workers' mental health (see, for example, Frimpong et al., 2022; Ross et al., 2022; Sun et al., 2022). Research has also explored the unique characteristics of work in the CEIs and identified additional PRFs associated with travel, time, and distance away from home, communal living, and the exacerbated culture of masculinity (see, for example, Dorow et al., 2021; Dorow & Jean, 2022; Tijani et al., 2023). Finally, studies aimed at understanding organizational approaches to PRM have identified employee assistance programs (EAPs) as having some beneficial impact on worker mental health in a general setting (see, for example, Attridge, 2019; Milot, 2019); but unclear benefit in a

male-dominated setting where workers prefer to seek support from friends, family, or peers (Asare-Doku et al., 2020).

Despite the growing body of knowledge related to PRM in the CEIs, there is limited research on PRFs in the Canadian CEIs and virtually no studies addressing workers' views on managing PRFs in these industries. As a result, there is a lack of understanding of Canadian CEIs workers' perspectives of PRFs as they relate to age, gender, residence type, employment arrangement, and rotation status which are not yet sufficiently informed to institute policies, procedures, programs, and responses that effectively manage the risks to workers' mental health. In Chapter 2, I provide details on my literature search strategy and the theoretical foundation upon which this study is built, and a discussion of the literature relevant to PRM in the Canadian CEIs.

Literature Search Strategy

To conduct a thorough literature review, I first performed an electronic search using the Thoreau multi-database search engine to search in the Academic Search, APA PsycInfo, CINAHL, Directory of Open Access Journals, Education Source, Emerald Insight, ERIC, IEEE Xplore, MEDLINE/PubMed, ProQuest Ebook Central, SAGE Journals, ScienceDirect, Social Sciences Citation Index, and SocIndex databases; the Discover multi-database search engine to search the Business Source Complete and Complementary Index databases; and the Google Scholar web search engine to identify additional, relevant publications dated 2018 or later and seminal works published by reputable authors at any time. The search used three groups of search terms related to risk management, psychosocial risk, and the CEIs. An additional geographic limiter was used

to identify studies specific to Canada. Risk management search terms included *risk management*, *risk assessment*, *risk analysis*, *loss control*, and *safety management.* Psychosocial risk search terms included *psychosocial*, *psychological*, *mental health*, *wellness*, and *well-being*. Search terms for CEIs included *construction industry*, *mining industry*, *resource extraction*, *oil and gas*, *fly-in fly-out*, and *FIFO*. Studies specific to Canada were identified using the search terms *Canada*, *Canadian*, *Canadians*, *or in Canada*. The main groups of terms were combined using *AND*, and the terms within each group were combined using *OR*. I then screened the literature to determine eligibility for inclusion based on the publication being relevant to the research problem topics of risk management, psychosocial risk, and CEIs, a seminal work authored by a reputable contributor to the field or a peer-reviewed scholarly article, published in 2018 or later, and written in English.

Literature searches performed electronically often retrieve only a small portion of available information (Randolph, 2009). To ensure my literature search was exhaustive, I also conducted a manual search by reviewing the references lists of relevant articles and publications to identify further sources to include in my study. This process was repeated until no new literature was identified and the point of saturation was reached. The search revealed a lack of adequate research on psychosocial risk in the Canadian CEIs. Although a greater number of studies on the topic were available within an international context, few studies addressed workers' perspectives of PRFs within these industries. The sources identified through the literature review provide a comprehensive background to the context and issues related to the management of PRFs in the CEIs. The literature served

as a basis of support for this study to further develop knowledge and provide practical benefits to CEI leaders and risk managers seeking to improve PRF management in the workplace for the betterment of worker health and organizational performance.

Theoretical Foundation

Risk management was synonymous with insurance until after World War II when there was a shift in both society and technology that changed the profile of risk for corporations (Crockford, 1982; Dionne, 2013; Harrington & Niehaus, 2003). New threats emerged with the development of concepts related to workers' compensation law, rising costs for equipment and insurance, and increasing liability for occupational disability and death through both insurance and jury verdicts (Gallagher, 1956). Until that time, protection of physical assets was the focus of loss prevention and literature of the day was almost exclusively focused on insurance related controls (Crockford, 1982).

Canada began adopting health and safety risk management legislation at a provincial level in the 1970s after pressure from worker safety activists (Foster et al., 2022). Risk management has remained focused on physical injury rather than PHs until recently (Foster et al., 2022; Wilson & Sharples, 2015). Today, risk management is a core element within occupational health and safety standards published by the ISO (2018a, 2018b), the American Society of Safety Professionals (2011), and the CSA (2019a, 2019b). Further, risk management has been incorporated into the more specific standards for PRM that have been published by the ISO (2021) and the CSA (2013).

My research relied on the concepts and models of modern risk management as its theoretical foundation and draws upon the work of Mehr and Hedges (1963) who

published the first text on the topic and proposed a framework for risk management in which risks are identified, assessed, evaluated, mitigated, monitored, and managed through an iterative process. Mehr and Hedges incorporated two decision-making theories into their framework: expected utility theory and the safety-first principle. Expected utility theory was put forward by Bernoulli (1738, as cited in Mongin, 1998) as a way of understanding how individuals make decisions under threat of risk and it is often used as a basis for risk evaluation. The safety-first principle discussed by Roy (1952) suggests that individuals and organizations should prioritize safety over other objectives, such as profitability and growth, when making decisions in uncertain situations. The principle assumes a level of rationality and similarity among decision makers; however, risk perception theories have demonstrated that individuals evaluate risk differently based on internal and external factors (Slovic et al., 1985; Slovic, 1987).

Collectively, the theories of risk management, including the risk management framework and risk perception theory, form the theoretical foundation from which the research problem is explored. Application of these theories is helpful because they are relevant for scholars and practitioners alike and offer a systematic approach from which to examine the issue. Additionally, use of the theories can help to further harmonize the investigations of academia and the implementations in practice for the betterment of workers' mental health and organizational productivity.

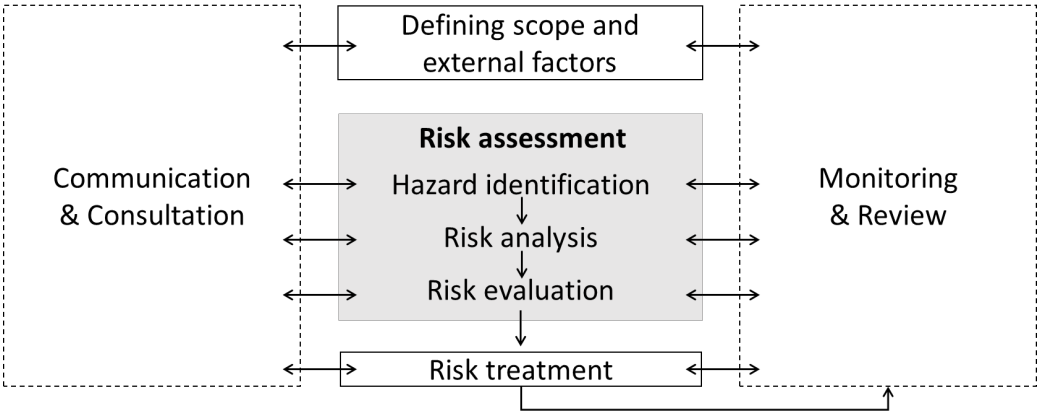
Risk Management Framework

Early contributors to modern risk management theory called for the development of systematic risk management practices and a general improvement to management

through better integration (Gallagher, 1956; Mehr & Hedges, 1963). Mehr and Hedges (1963) presented and argued for a structured management approach that included the identification, assessment, evaluation, treatment, and monitoring and review of risks. The fundamental process of risk management described by Mehr and Hedges has persisted within academic literature (see, for example, Alfreahat & Sebestyén, 2022; Clarke & Cooper, 2004; Godfrey, 1996); and is evident within the current standards and practices guiding PRM in the Canadian CEIs (see, for example, CSA, 2013; ISO, 2018, 2021; Project Management Institute [PMI], 2019). Modern risk management approaches have refined the risk management framework to include organizational aspects such as management and systems integration (CSA, 2013; ISO, 2018, 2021). A typical risk management process is illustrated in Figure 1.

Figure 1

Typical Risk Management Process



Note. Typical risk management process (adapted from ISO 31000:2018).

Risk Assessment

Risk assessment collectively refers to the three individual elements of hazard identification, risk analysis, and risk evaluation (ISO, 2018). The terms *hazard* and *risk* are often used interchangeably; however, it is important to note that a hazard is a source of risk whereas risk is an effect that results from the hazard (CSA, 2013; ISO, 2018; Roberts & Graves, 2020).

Hazard Identification. The identification of hazards has traditionally been an exercise focused on finding physical hazards; however, managing psychosocial risks in the workplace requires the identification of nonphysical threats (Clarke & Cooper, 2000, 2004). Psychosocial threats are part of a group of natural hazards which are largely unaddressed in risk management theory today but are becoming more important because of the increasing applicability of ethics in risk management (Doorn, 2015). Many tools may be used to identify hazards and analyze their risks, including the COPSOQ, the Effort Reward Imbalance (ERI) questionnaire, the Risk Assessment and Management Tool (RAMP), among others (Oakman et al., 2022).

Risk Analysis. Risk analysis is the qualitative and quantitative assessment of risk to understand the likelihood and potential impact of identified risks (ISO, 2018). The assessment process is somewhat subjective because of inherent individual differences in estimation of risk (Clarke & Cooper, 2000; Siegrist & Árvai, 2020); however, Clarke and Cooper (2000) stated that subjectivity is desirable to account for the human element of managing workplace psychosocial issues. Risk analysis may be approached in several different ways, including as a hazard-based or task-based activity (Roberts & Graves,

2020). Clarke and Cooper suggested that aggregating risk across workgroups or whole organizations may be a more effective way of assessing risk as compared to individual assessments for each worker. When estimating quantitative levels of risk, multiplying exposure and consequences is a generally accepted approach (Clarke & Cooper, 2000; ISO, 2018).

Risk Evaluation. Risk evaluation is a leadership decision-making process that involves subjective determination of the significance and prioritization of risks based on their potential impact (ISO, 2018). Clarke and Cooper (2000) described the decision as a comparison between the cost of reducing the risk against the benefits of a lower level of risk.

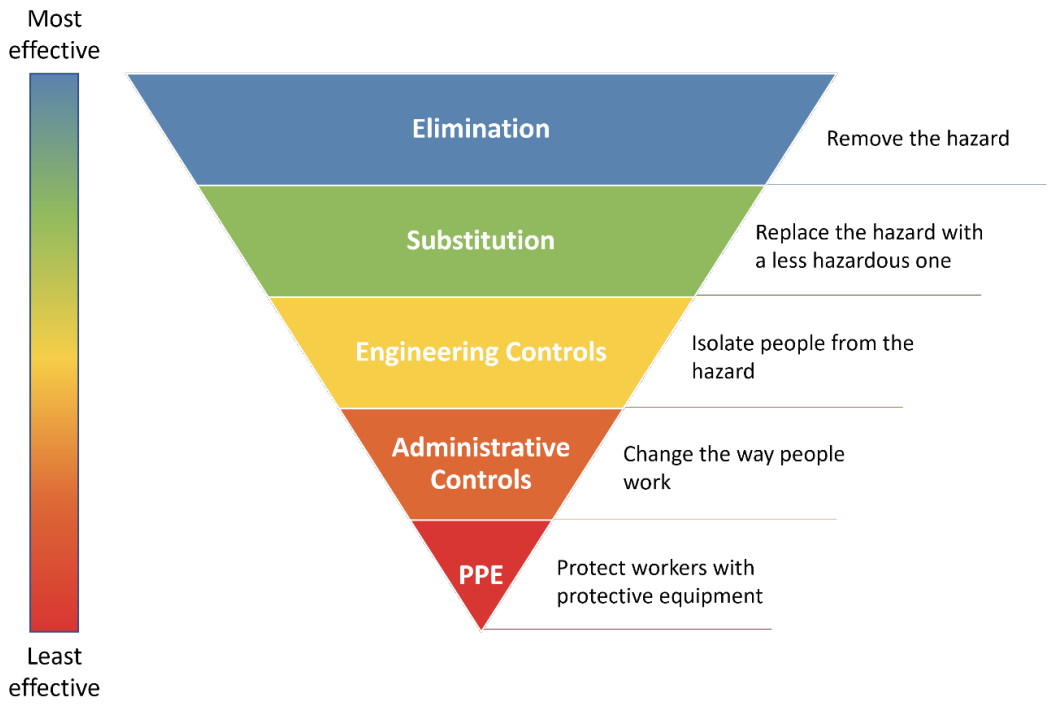
Risk Treatment or Mitigation

Risk treatment, or mitigation, involves developing and implementing strategies to manage identified risks (ISO, 2018). ISO (2021) advised organizations that to be effective in managing risk, there must first be a solid understanding of the sources of harm. Based on the risk evaluation, organizations may choose to do nothing (i.e., accept the risk), consider mitigation options, take mitigation options, maintain current mitigations, or reconsider objectives (ISO, 2018). In the CEIs, contract agreements are a risk mitigation technique used to shift risk from one organization to another (Assaad et al., 2020). Individual mitigations typically fall into one of three categories: organizational level mitigations, stress management strategies, and worker lifestyle changes; and more than one mitigation is often required (Cooper & Cartwright, 1994). To address the root causes, the CSA (2013) recommended that PRFs be managed using the traditional

hierarchy of risk controls (shown in Figure 2) which suggests that elimination of a hazard is the most effective method of control followed by substitution, in which a hazard is replaced with a less hazardous one, engineering controls which separate people from the hazard, administrative controls which change the way work is done, and protective equipment as a last line of defense.

Figure 2

Traditional Hierarchy of Risk Controls



Note. This figure demonstrates the efficacy of hazard controls from most effective to least effective. Adapted from *Hierarchy of control,* by CSA (2022). (https://www.csagroup.org/wp-content/uploads/Hierarchy_of_Controls_Infographic.pdf). In the public domain.

Risk Monitoring and Review

Risk monitoring and review is the ongoing management of risks and the effectiveness of risk management strategies, as well as periodic review and reassessment of the risk management process (ISO, 2018; Mehr & Hedges, 1963). The process of risk management requires organizations to establish, implement, and maintain processes to mitigate threats to psychological safety iteratively and proactively (ISO, 2021).

Communication and Consultation

Mehr and Hedges (1963) stressed the importance of clear communication and collaboration among all stakeholders involved in the risk management process. Drawing from the expertise and insight of a wide range of stakeholders is critically important to the overall success of the risk management process (ISO, 2021; Leka & Cox, 2008). Participation in risk management requires participation from a range of stakeholders and may include consultation with unions, the public, or others (ISO, 2021).

Defining Scope and External Factors

Mehr and Hedges (1963) emphasized that risk management requires a holistic, integrated approach that involves all levels of an organization and considers both internal and external factors; a concept now supported in practice (ISO, 2018, 2021; Leka & Cox, 2008). Additionally, communication and collaboration are critical for upholding the integrity of the risk management system (ISO, 2018, 2021; Leka & Cox, 2008; Mehr & Hedges, 1963). Without sufficient consultation with workers and other affected parties it is unlikely that efforts to identify, assess, prioritize, and mitigate risks will be effective (ISO, 2021; Leka & Cox, 2008; Manuele, 2010).

Risk Perception Theory

Perception of risk is an important consideration for risk management because risks are assessed differently by laypeople, who offer subjective views on risk, and experts, who provide objective views on risk (Alrawad et al., 2022; Slovic et al., 1985). Other factors have been shown to impact perception of risk, including gender (Brown et al., 2021); safety climate, and demographic and occupational characteristics (Chaswa et al., 2020). Further, the social amplification of risk, a concept that suggests that social, cultural, and psychological factors can intensify or attenuate perceptions of risk, can lead to an amplification of the perceived severity and importance of a risk (Kasperson et al., 1988).

The psychometric paradigm developed in the 1970s by Slovic (1985) helps to explain and understand differences in perception of risk. A strength of the psychometric paradigm is that it helps to explain why individuals view hazards differently by considering them collectively (Siegrist, 1996; Siegrist & Árvai, 2020). A drawback to studies using the psychometric paradigm is difference in data; some studies use aggregated data while others use non-aggregated data which impacts whether knowledge is understood at the group level or individual level (Siegrist & Árvai, 2020).

Literature Review

This section provides a critical, comparative review and synthesis of the current literature. The review uses the risk management framework previously discussed in a theoretical context to understand how the concepts of identification, assessment, evaluation, and treatment of PRFs and PHs within the CEIs have been explored in the

current research. This approach to organization of the literature based on the theoretical proposition relates to Cooper's taxonomy and is supported by Randolph (2009). In this review, I analyze researchers' approach to investigation of PRM and the strengths and weaknesses inherent in those approaches. The discussion provides rationale for the selection of variables within my study and provides a comprehensive rhetoric of the variables, how they have been discussed by researchers, and what remains to be studied.

Psychosocial Risk Factors and Workers' Mental Health

Psychosocial risk, like other types of business risk, is best managed through comprehensive organizational practices related to management, leadership, and social responsibility (Roussos, 2023). PRM theory guides practitioners to first identify sources of harm before considering control measures (CSA, 2013; ISO, 2021). Although psychosocial risks have been explored within the literature, there are challenges to understanding and interpreting the information because of inconsistent use of terms and definitions related to PRM. In this section, I provide a synthesis of the key terms used in the body of literature to allow for the establishment of a common language to help facilitate the communication of ideas related to PRM within this study which is followed by a discussion of PHs and PRFs applicable to the CEIs and how they have been researched and discussed within the literature.

Distinguishing Between Hazards and Psychosocial Risk Factors

The CSA (2013) distinguished between *hazards*, sources of potential psychological harm, and *PRFs*, which are both hazards and "elements of the work environment, management practices, and/or organizational dimensions that increase the

risk to health" (p. 5). The ISO (2018) did not differentiate between sources of hazards and amplifiers of risk; instead, it considered PHs as potential sources of injury and ill health that are related to aspect of the work, work environment, and social factors at work (ISO, 2021). Similarly, in academic literature, terminology is varied, as noted by Derdowski and Mathisen (2023). Four recent systematic reviews of PHs in the construction workplace each used different terms to discuss their findings: Sun et al. (2022) used the term *PH* in reference to factors that increase the risk of work-related stress, Frimpong et al. (2022) used *PRF* in their study of young construction workers, Chan et al. (2020) initially introduced the same concept as PRFs but then used the term *risk factors* to discuss threats to mental health, and Tijani, Jin, and Osei-kyei (2020) opted for the term *stressors* to describe potential threats to worker well-being. These studies provide evidence of the lack of consensus in literature on key terms used in risk management theory.

Given that PRM is an emerging topic of relevance in occupational health and safety, and in scholarly research, the inconsistency of terminology used in literature is understandable; however, it must be addressed to allow for a fulsome understanding of the current body of literature. Three approaches to terminology were identified in the literature review. One approach, taken by the CSA (2013), Chan et al. (2020), and Frimpong et al. (2022) is to use the term *PRFs* as an overarching reference to both a potential source of harm (PHs) and potential amplifiers of risk (other aspects of the work environment, management practices, or organizational dimensions that increase risk to health). A second approach is to view PHs as inclusive of both the potential source of

harm and amplifiers to risk without differentiation between the two, as done by the ISO (2021) and Sun et al. (2022). A third approach is to use alternative terms such as *stressors* (Tijani, Jin, & Osei-kyei, 2020) to describe threats to mental health. In this study, the first approach has been adopted and the term *PRFs* is used to discuss a broader category of hazards and amplifiers, the term *PH* is used to discuss a specific hazard, and the term *amplifier* is used to discuss non-specific threats to worker well-being with the potential to increase risk potential of a PH.

Categorization of PRFs

Studies of PRFs have been conducted to better understand how they affect workers within the construction industry (see, for example, Bergh et al., 2018; Carvajal-Arango et al., 2021; Chan et al., 2020; Frimpong et al., 2022; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020), workers in high-risk industries such as resource extraction (see, for example, Bergh et al., 2018; Derdowski & Mathisen, 2023), and workers who do FIFO work (see, for example, Dorow et al., 2021; Labra et al., 2022). Investigation of PRFs often takes a thematic approach to make discussion and analysis of the multitude of threats more manageable and to better identify possible mitigations (Tijani, Jin, & Osei-kyei, 2020). A notable exception was Sun et al.'s meta-analysis in which 14 different types of PHs were identified within 48 studies and no further classification was done.

The more common approach taken in academia is to group PRFs into categories determined by the research approach and theoretical underpinnings. For example, Frimpong et al.'s (2022) meta-aggregation identified an initial set of 50 PRF categories which were thematically analyzed and synthesized to a final set of 10 domains within

three broader categories of personal, socio-economic, and organizational/industrial factors. Systematic literature reviews have also further categorized PRFs in different ways: Derdowski and Mathisen (2023) used the job demand-resources (JDR) model to categorize over 40 PRFs as either a job demand or a job resource; Chan et al. (2021) organized their 32 PRFs into eight categories that included lack of job control, welfare concerns, work hazards, job demand, workplace injustice, family, lack of work support, and coping; and Tijani et al.'s (2022) thematically organized 49 PRFs into five groupings that included organizational, physical, task, personal, and gender-related stressors.

Within the relevant standards and guidelines pertaining to PRM, a similar approach has been taken. The CSA (2013) considers PRFs as belonging to one or more of 13 categories of *workplace factors*: organizational culture, psychological support, clear leadership and expectations, civility and respect, psychological job demands, growth and development, recognition and reward, involvement and influence, workload management, engagement, life/family/work balance, psychological protection, protection of physical safety; and allows for the identification of chronic stressors by workers. Comparatively, the ISO (2021) first distinguishes PRFs as belonging to one of three categories, *aspects of how work is organized*, *social factors at work*, and *work environment, equipment, and hazardous tasks*, before grouping specific examples of PHs together in a manner that largely aligns with the CSA's *workplace factors*. The evolutionary relationship between the two standards, discussed by Samra (2017), is evident in the way the CSA's standard is written at a strategic level with organizational objectives in mind and uses positive statements of control to frame workplace factors, compared with the ISO's approach

which is aimed more to the practitioner through its provision of specific examples of PHs and guidance on practical risk management.

Organizational Culture. Organizational culture is a critical factor in establishing and maintaining a psychologically safe work environment (CSA, 2013; ISO, 2021; Kunyk et al., 2016). Multiple PRFs have been associated with organizational culture in CEIs. Interpersonal conflict is a threat to mental health (Chan et al., 2020; Derdowski & Mathisen, 2023; Frimpong et al., 2022; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020), as is organizational injustice (Derdowski & Mathisen, 2023; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020). Poor working environments also play a role (Derdowski & Mathisen, 2023; Frimpong et al., 2022; Tijani, Jin, & Osei-kyei, 2020), as does a sense of community (Chan et al., 2020; Derdowski & Mathisen, 2023; Dorow et al., 2021; Tijani, Jin, & Osei-kyei, 2020) and trust (Derdowski & Mathisen, 2023; Dorow et al., 2021). A prominent threat to mental wellness of all workers is the pervasive culture toxic masculinity (Dorow et al., 2021; Eyllon, et al., 2020; Labra et al., 2022; Miller et al., 2020); and hegemonic masculinity (Eyllon et al., 2020; Seaton et al., 2019).

Psychological and Social Support. Psychological and social support involves the organizational provision of services, creation of a supportive and trusting work community, and the workers' perceptions of the adequacy of support (CSA, 2013). Low job support is a prominent PRF (Bergh et al., 2018; Chan et al., 2020; Derdowski & Mathisen, 2023; Frimpong et al., 2022; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020), as is relationship with coworkers (Bergh et al., 2018; Chan et al., 2020; Derdowski & Mathisen, 2023; Dorow et al., 2021; Tijani, Jin, & Osei-kyei, 2020), and to a lesser

extent, lack of human resources (Derdowski & Mathisen, 2023). Although social support is often lacking, and poses a barrier to mental health, it can also be sufficient and offer benefit through close relationships with colleagues (Bouchard-Bastien & Gervais, 2017).

Clear Leadership and Expectations. The importance of clear leadership and expectations resonates throughout the literature and several PRFs have been identified as prominent within CEIs, including role conflict and role ambiguity (Derdowski & Mathisen, 2023; Dorow et al., 2021; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020), poor organizational structure and poor communication (Derdowski & Mathisen, 2023; Tijani, Jin, & Osei-kyei, 2020), and low job support (Chan et al., 2020; Derdowski & Mathisen, 2023; Frimpong et al., 2022; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020).

Civility and Respect. Civility and respect are workplace factors that extend from the workers and management through to customers and the public (CSA, 2013). Interpersonal conflict and low job support are widely agreed upon as important PRFs in this regard (Chan et al., 2020; Derdowski & Mathisen, 2023; Frimpong et al., 2022; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020). Other threats to health stem from gender discrimination and lack of respect from subordinates (Chan et al., 2020; Tijani, Jin, & Osei-kyei, 2020); and organizational injustice (Derdowski & Mathisen, 2023; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020).

Psychological Demands. The psychological demands of work relate to the work structure aspects such as time demands, breaks and rest periods, incentivization, and monotony (CSA, 2013). PRFs that arise from psychological demands are varied and include low job control and low job support (Chan et al., 2020; Derdowski & Mathisen,

2023; Frimpong et al., 2022; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020), and job insecurity and role overload (Chan et al., 2020; Derdowski & Mathisen, 2023; 2022; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020). Other PRFs include lack of career development, organizational injustice, and role conflict (Derdowski & Mathisen, 2023; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020). Though 78% of workers reported high levels of stress from financial concerns, daily stress was considered high by roughly one third of participants (Dorow et al., 2021).

Growth and Development. Work environments that encourage workers to grow and develop interpersonal, emotional, and job skills enable workers to become more adept at their current job and better prepare them for future positions (CSA, 2013). Within this work factor, several PRFs have been identified such as lack of career development, low reward and recognition, and organizational injustice (Derdowski & Mathisen, 2023; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020). Additionally, job insecurity is a threat (Chan et al., 2020; Derdowski & Mathisen, 2023; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020), as is lack of career development (Derdowski & Mathisen, 2023; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020).

Recognition and Reward. Recognition and reward includes fair, timely, and regular acknowledgement of the efforts of workers (CSA, 2013). Low levels of recognition and reward are a PRF (Derdowski & Mathisen, 2023; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020), as well as unfair reward and treatment (Derdowski & Mathisen, 2023), and overpromotion concerns (Chan et al., 2020).

Involvement and Influence. Involvement and influence relate to workers' ability to speak with supervisors about how their work is done, and it gives workers some control over the organization of their work (CSA, 2013). PRFs that threaten worker health in this way are low job support (Bergh et al., 2018; Chan et al., 2020; Derdowski & Mathisen, 2023; Frimpong et al., 2022; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020); little opportunity to participate in decision making (Chan et al., 2020; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020); and inadequate room for innovation (Tijani, Jin, & Osei-kyei, 2020).

Workload Management. Workload management is a nuanced work factor that means having enough time to do the work requested and the resources to do it successfully (CSA, 2013). Researchers have identified role overload as a significant PRF (Bergh et al., 2018; Chan et al., 2020; Derdowski & Mathisen, 2023; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020), along with increased work speed and pressure (Chan et al., 2020; Derdowski & Mathisen, 2023; Dorow et al., 2021; Tijani, Jin, & Osei-kyei, 2020), long work hours (Chan et al., 2020; Frimpong et al., 2022; Tijani, Jin, & Osei-kyei, 2020; Tijani, Osei-kyei, & Feng, 2020), and work underload (Chan et al., 2020; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020).

Engagement. Worker engagement is when workers are connected to their work and feel motivated to do their job well (CSA, 2013). Engagement was not widely included in systematic literatures reviews of PRFs in the CEIs. Where engagement PRFs were discussed, threats were identified as arising from job detachment, job dissatisfaction, and low organizational commitment (Derdowski & Mathisen, 2023).

Family, Life, and Work Balance. Maintaining balance between life, family, and work allows workers to meet the demands they face in their different roles (CSA, 2013). The nature of work in the CEIs is prohibitive to balancing the demands of work and life because of extended work hours (Kotera et al., 2020; Tijani, Osei-kyei, & Feng, 2020; Tijani et al., 2022), role overload (Chan et al., 2020; Derdowski & Mathisen, 2023; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020), and low job control (Chan et al., 2020; Derdowski & Mathisen, 2023; Frimpong et al., 2022; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020). Other factors include the competitive nature of the industry (Tijani et al., 2022); inability to control or manage schedule (Chan et al., 2020; Derdowski & Mathisen, 2023; Tijani et al., 2022) and struggle to transition between work and home (Ajayi et al., 2019; Dorow et al., 2021; Gardener et al., 2018; Martin, 2020; Ryser et al., 2016; Sun et al., 2022). The impact of poor work-life balance is an increased risk of mental health problems, decreased productivity, lower rates of work and life satisfaction, marital distress, and higher rates of psychological distress (Kotera et al., 2020). The challenge of balancing time and distance away from home and family is the most stressful aspect of FIFO work (Dorow et al., 2021; Gardner et al., 2018).

Psychological Protection. Psychological protection in the workplace enables workers to ask questions, seek out information, report issues, and suggest solutions without fear of negative consequences to themselves or their career (CSA, 2013). Low job support was identified as a PRF in all systematic reviews of PRFs in CEIs (Chan et al., 2020; Derdowski & Mathisen, 2023; Frimpong et al., 2022; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020). Other PRFs included cognitive demand (Chan et al., 2020;

Derdowski & Mathisen, 2023; Frimpong et al., 2022; Sun et al., 2022) and workplace harassment or bullying (Chan et al., 2020; Derdowski & Mathisen, 2023; Miller et al., 2020; Tijani, Jin, & Osei-kyei, 2020).

Protection of Physical Safety. Protection of physical safety means safeguarding a worker's psychological and physical health and might lead an organization to demonstrate care for the work environment and taking concerns about health seriously (CSA, 2013). Poor working conditions and safety concerns are two prominent PRFs in this work factor (Chan et al., 2020; Derdowski & Mathisen, 2023; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020). A high number of workers in the Canadian oil sands reported working when sick and not taking time off when injured due to a culture that looked down upon threats to production timelines (Dorow et al., 2021).

Other Chronic Stressors as Identified by Workers. The CSA (2013) recommends that consideration of risk is extended to address other work factors and their stressors that have been identified by workers. In the CEIs, workers often travel long distances into remote and rural communities where they work, live, and play under the rules of their employer (Dorow et al., 2021; Miller et al., 2020). The nature of the work and requirement to live away from home creates a unique culture and an atypical set of stressful conditions that arise from camp living and travel and commuting (Ajayi et al., 2019; Dorow et al., 2021; Martin, 2020; Ryser et al., 2020; Sun et al., 2022), as well as limited availability of adequate healthcare services (Dorow et al., 2021; Labra et al., 2022; Seaton et al., 2019; Tijani, Jin, & Osei-kyei, 2020).

Transportation. Workers who are subject to FIFO style work arrangements have identified transportation as a significant concern (Dorow et al., 2021; Gardener et al., 2018; Ryser et al., 2016; Tijani, Jin, & Osei-kyei, 2020). Workers experienced stress related to unpredictable travel conditions that resulted from weather, delays, compressed transition times, and long duration travel requirements (Dorow et al., 2021). According to Dorow et al., most workers (70%) found travel and commuting to be a stressful part of their work experience while a smaller portion (17%) reported the stress to be intense.

Medical Services. Poor medical services were also identified as a stressor by workers (Dorow et al., 2021; Labra et al., 2022; Seaton et al., 2019; Tijani, Jin, & Osei-kyei, 2020); and those concerns are exacerbated within the Canadian context where many public health services are limited and variable within rural and remote locations (Northern Health, 2012; Rural Health Services Review Committee, 2015; Wilson et al., 2020). Workers often seek out public health services rather than employer-provided services because of concerns with confidentiality, impact to job security, quality and timeliness of service, and convenience (Dorow et al., 2020); or avoid seeking care regardless of need (Labra et al., 2022).

Camp Living. Other concerns raised within the context of the CEIs are issues with camp living which often generates feelings of isolation and entrapment, and limits workers' ability to make healthy lifestyle choices (Dorow et al., 2021; Dorow & Jean, 2022; Labra et al., 2022). Camp life is stressful for 77% of Canadian oil sands workers (Dorow et al., 2021); and CEI workers describe their experiences as highly emotional and say they often have feelings of isolation, loneliness, guilt, grief, and loss (Gardener et al.,

2018; Martin, 2020). Compromised sleep is a common issue for CEI workers (Brossoit et al., 2019; Powell & Copping, 2010). Insufficient sleep and excessive fatigue can lead to decreased productivity, increased risk of accidents and injuries, and negative effects on physical and mental health (Lock et al., 2018; Powell & Copping, 2010). Sleep disturbance is predictor of depression and suicidal ideation or suicidal attempts (Fang et al., 2019; Goodwin & Marusic, 2008), as well as bipolar disorder and generalized anxiety disorder (Fang et al., 2019). One study examining the effect of sleep on workplace safety found that inadequate sleep increased workers' risk of accident, either at home or at work, by 9% (Powell & Copping, 2010). While poor quality sleep and fatigue are both PHs, they also contribute to long-term and adverse outcomes such as a 55% increased risk of obesity, a 32% increased risk of hypertension, and a higher risk of cardiovascular disease in men but not in women (Knutson, 2010).

Although consistency in terminology is still developing within the literature, this section of the review has provided evidence of the numerous PRFs affecting workers' mental wellness within the CEIs and the direct and indirect impacts it has on the workers. It has also demonstrated that PRFs may arise through a multitude of work factors which makes categorical discussion and evaluation of PRFs appropriate within this study. The review also demonstrates common findings among studies of qualitative, quantitative, and mixed methods approaches; and studies investigating different types of work and workers within the CEIs. Having reviewed the identified PRFs within CEIs, a logical next point for discussion is the assessment of risk.

Assessment of Risk

Assessing psychosocial risk in the workplace is no simple task and it requires thoughtful consideration of not only worker health impact, but financial impact and organizational policies and procedures that promote psychological health (CSA, 2013), as well as consideration of impact to different worker groups and the wider context of the organization (ISO, 2021). Assessment of psychosocial risks differs between academia, which is primarily focused on the risk of outcomes to workers and the prevalence of common PRFs within the CEIs; and practice which calls for consideration of the impact upon different worker groups, interaction of risks from different hazards, and the prioritization of PRFs based on the level of risk (CSA, 2013; ISO, 2021). This section aims to provide greater context to elements of risk assessment through discussion of approaches taken within academia, the effect of PRFs upon different worker groups, and the interaction of different hazards and their risks.

Academic Approaches to Assessing Psychosocial Risk

Within the literature, attempts to measure psychosocial risk have often been approached from the perspective of outcome. For example, suicide and suicidal ideation are a frequent topic of focus within the literature on the CEIs and constitute nearly 20% of studies (Hutton et al., 2022; Tijani, Jin, & Osei-kyei, 2020). Researchers have attempted to measure the risk quantitatively by determining the prevalence and severity of symptoms within the CEI population using national surveys on health (see, for example, Dong et al., 2022); the Negative Acts Questionnaire – Revised (see, for example, Miller et al., 2020; Ross et al., 2022); the Beck Depression Inventory and Beck

Hopelessness Scale (see, for example, Dong et al., 2022); and AUDIT-C, the Kessler Psychological Distress Scale (K6), and WHO-5 Wellbeing Index (see, for example, Ross et al., 2022). Similarly, studies have focused on work-life imbalance as an undesirable outcome of work in the CEIs using assessment tools such as the Work-Life Balance Checklist 7 (WLBC7) and Depression Anxiety and Stress Scale (DASS21), among others (see, for example, Kotera et al., 2020). Research pertaining to the effect of PRFs in the CEIs has also utilized the General Well-Being Questionnaire (GWBQ) (see, for example, Bergh et al., 2018); and numerous tailor-made questionnaires that were either based on validated measurement scales (see, for example, Low et al., 2019), or self-designed (see, for example, Bergh et al., 2018; Ross et al., 2022). Still other studies have taken a qualitative approach to understanding the more nuanced experience of workers in these industries to put meaning behind the numbers and affect a sense of prioritization among the PRFs (see, for example, Hulls et al., 2022; Kotera et al., 2020). These studies share a common characteristic in that they are concerned with measuring and understanding the state of workers' mental health in relation to PRFs; and they differ in their broad range of measurement tools and underlying philosophical theories. While information garnered from studies on PRFs is helpful for understanding the nature of the issue, it is not sufficient for assessment of risk and more information is needed to inform leadership decision making (Hudson, 2016).

The inability to determine employer action from scholarly assessments of risk is an issue identified by several researchers. For example, Hudson (2016) investigated the use of the Health & Safety Executive's Stress Management Standards Indicator (SMSI)

which was developed specifically to help employers with prioritization of PRF threats and found a persistent issue with operationalizing PRM practices based on data from the tool. Researchers developed the COPSOQ, in part, to help address the operational shortcoming of existing measurement tools (Burr et al., 2019) and to assess the implications of PRFs in a broader workplace setting include changes in working conditions and factors contributing to WMH and insufficiency of commonly used models such as the JDR model and ERI model which may not adequately consider psychosocial threats (Burr et al., 2019; Ramkissoon et al., 2019). A third measurement model developed to help improve operationalization of findings in a practical and academic sense is the occupational health and well-being questionnaire (OHWQ) which builds on several questionnaires, including the ERI questionnaire and the COPSOQ, to identify both stressors and resources used to protect mental health (Truchon et al., 2022).

Effect of PRFs On Different Worker Groups

Within the CEIs, subgroups of workers experience mental health stressors differently from others. Age plays a role in the stress and anxiety levels and young workers (Dong et al., 2022; Nwaogu et al., 2019) and women experience stress at higher rates than their male counterparts (Dorow et al., 2021; Eyllon et al., 2020). Although much is known about the effect of PRFs on some worker groups, other groups, like women, are under-represented in the CEI workforce and have little representation in the current body of academic studies (Dorow et al., 2021). Moreover, categorization of workers in the CEIs can also be done based on unique industry characteristics such as their type of accommodation and place within the organizational hierarchy. Little is

known about these groups of workers but where information is available, it is restricted to one or two specific PRFs and fails to address the broader context of work in the CEIs.

Age. Age was found to be associated with fatigue and stress among oil and gas workers (Mohd Rani et al., 2022) and construction workers (Dong et al., 2022; Nwaogu et al., 2019). Young workers are at higher risk of depression and anxiety (Dong et al., 2022; Nwaogu et al., 2019). Within the construction industry, Dong et al. (2022) found that over 40% of workers 18-25 years of age experienced psychological distress at a moderate or serious level and that workers in this age group were five times higher to experience distress as compared to workers over 50 years of age and four times higher than workers 26-34 years of age. Younger workers have also reported stress from low quality relationships with family and friends, especially when the workers were parents (Frimpong et al., 2022).

Gender. Both men and women face gender related issues within the CEIs. For instance, men often take on a hyper-masculine role when at work and then face adjustment back to their home life and women must shed their femininity in favour of acceptance and blending in at work only to reembrace it in social contexts and when back at home (Saxinger, 2022). Women are scarce within the CEIs. Canada's major projects report that women make up 9% (LNG Canada Development, 2023), 10% (BC Hydro, 2023), and 13% (Coastal GasLink, 2022) of the workforce while in the mining industry women account for 17% of workers (Mining Industry Human Resources Council [MIHRC], 2016). The construction industry reports that women constitute 12% of the total workforce but only 4% of onsite workers (BuildForce Canada, 2018). Most of the

studies pertaining workers' mental health in the CEIs are based on predominantly male populations (see, for example, Dorow et al., 2021; Miller et al., 2020). Although some studies have helped to illustrate the gendered experience in CEIs, there is an overall lack of information regarding this worker group (Dorow et al., 2021). Gender is an important consideration because some studies have shown that PRFs affect men and women differently. For example, Padkapayeva et al. (2018) found that high job strain affected women, but not men; and higher levels of supervisor support lowered stress for women, but not for men. Additionally, women working in the CEIs are exposed to sexual harassment, gender inequality, and limited job opportunities (Tijani, Jin, & Osei-kyei, 2020). The MIHRC (2016) found that 32% of female mining workers experienced harassment, bullying or violence in the workplace over the past five years; compared to 16% for male workers.

Residence Type. Many workers in the CEIs are housed in camp accommodations that are either open camps which are operated by a third party, or closed camps which are operated by the project (Dorow & Jean, 2022). The routinized and restricted nature of camp life creates a sense of disorientation, monotony, and entrapment for workers because although workers are not formally working, they are subject to the rules and schedule of the employers (Dorow & Jean, 2022). Other factors related to residence type are workers' ability to make healthy decisions regarding food and lifestyle and quality of sleep (Dorow et al., 2021; Labra et al., 2022) and limited privacy and confinement (Mohd Rani et al., 2022). Studies comparing the experience of FIFO workers, who typically reside in camp, and residential workers who reside at home, are sparse. Miller et al.

(2020) found that residential workers experience higher levels of depression and hopelessness than their FIFO counterparts, but similar risk levels for suicide.

Employment Arrangement. Work in the CEIs is typically arranged through multilayer chain subcontracting in which a project owner hires one or more contractors who then hire subcontractors, who hire sub-subcontractors and so forth (Bartholomew, 2022; Tam et al., 2011). Employment agreements vary from employer to employer and can create disparity between workers because of different benefits, services and amenities. Evidence of such disparity was provided by Dorow et al. (2021) who found that 76% of the participants in their study had access to healthcare services while the rest did not. Where a worker fits within the project hierarchy can affect communication, job support, and other factors associated with PRM.

Impact of Workers Mental Ill Health on Families and Community

In addition to the impacts of mental ill health on workers and employers, there is a social cycle harm that moves from workers to their family and community, and back again. There is an expectation that partners and families will need to make adjustments to accommodate the schedule and patterns of work in the CEIs (Asare et al., 2023; Gardener et al., 2018); however, the impaired mental health of workers can become a threat to the mental and physical wellness of family (Asare et al., 2023; Dittman et al., 2016) and health and wellness of society (Shandro et al., 2011). Workers have indicated they experience additional stress via community ostracism which further distances workers from the fabric of society (Wright & Griep, 2019). The cyclical impact of mental ill-health in this way threatens organization's social license to operate and has led

researchers to investigate society's deep concerns about the net social value of CEI projects (Evensen & Stedman, 2018). Ultimately, consideration of the impacts of worker mental health upon other stakeholder groups is an essential part of overall PRM practices (CSA, 2013; ISO, 2021).

Impact of Workers' Mental Ill Health on Spouses and Family. The mental health issues affecting an individual have the potential to cascade upon spouses and families and lead to mental health issues, such as depression (Asare et al., 2023; Dittman et al., 2016; Orpana et al., 2016) and physical harm such as increased rates of sexually transmitted infections and domestic violence (Shandro et al., 2011). The challenges workers face in leading dual lives are extended to their partners who often assume two different roles depending on whether their partner is working or at home (Asare et al., 2023; Gardener et al., 2018; Shandro et al., 2011). Some studies have found that FIFO partners have higher levels of depression, anxiety, and stress than their community counterparts (Asare et al., 2023; Dittman et al., 2016); however, other studies found no significant differences (Cooke et al., 2019) and even greater stress for workers and families who reside locally (Miller et al., 2020). A common theme in literature is concern for women's health and the increased rates of pregnancy, sexually transmitted infections, domestic violence (Gibson et al., 2017; Shandro et al., 2011). Research findings on the impact to children of workers with mental health issues are mixed: Dittman et al. found that children were affected by the strained relationship between parents, a parents' emotional adjustment, and partner concerns for the wellbeing of their mate; and, although Asare et al. found children to be more prone to anger, sadness, and hate, as well as

behavioral problems, they argued that some children enjoy their parent working away because it offers solace from undesirable behaviours displayed by the parent.

Impact of Workers' Mental Ill Health on Community and Society. As a result of workers' poor mental health, there is harm caused to society through the financial burden placed upon taxpayers to fund health services (CAMH, 2020). The state of workers' mental health also has an impact upon community through increased stress, anxiety, depression, and alcoholism which are attributed to the job insecurity faced by workers (Shandro et al., 2011). The increased rates of socioeconomic outcomes of substance abuse, sex work, and violence have been described as *boomtown effects* (Measham et al., 2016; Rhubart & Brasier, 2019). Several studies have found evidence of harm to individual members of society including increased rates of sexual violence and rape (Gibson et al., 2017; Grisafi, 2020); fighting, bullying, sexual aggression to women (Stretesky & Grimmer, 2020) and increased rates of crime (Ruddell, 2011; Stretesky & Grimmer, 2020). This behaviour has been attributed to the hyper-masculine culture that is pervasive in industrial work (Gibson et al., 2017; Stretesky & Grimmer, 2020) and the lack of community connection held by transient workers (Gibson et al., 2017; Grisafi, 2020; Measham et al., 2016). Industry workers are often prone to excessive drug and alcohol use which can threaten the values of local communities and lead to the erosion of social cohesion (Ensign et al., 2014; Gibson et al., 2017; Klasic et al., 2022). Communities close to industrial work settings have concerns because although projects bring work, they also bring large populations and impacts to public health (Ensign et al.,

2014; Gibson et al., 2017; Northern Health, 2012; Malin, 2020; Ruddell, 2011; Shandro et al., 2011; Shaw et al., 2015).

Interaction of PRFs and Their Risks

PRFs are challenging to examine, in part, because they often behave as both a threat and an outcome. For example, Ross et al. (2022) found that suicide is a potential outcome of poor mental health, and it is also acts as a threat because workers who have been exposed to others who have attempted or completed suicide are at greater risk of suicidal ideation themselves (Ross et al., 2022). Similarly, poor quality sleep can be an outcome of poor mental health while also acting as a hazard by increasing risk of depression and chronic health issues (Fang et al., 2019). A further example can be found in Derdowski and Mathisen (2023) who demonstrated that perceived job insecurity affects job satisfaction which then influences safety behaviour and safety compliance. Job insecurity also acts as a barrier to the improvement of culture because workers fear retribution and fail to speak up (Hulls et al., 2022).

Evaluation of Risks

Within PRM standards, risk evaluation is described as a process that supports organizational decision making through the comparison of risk analysis results and organizational objectives to choose the best approach for treating the risk (CSA, 2013; ISO, 2018). A different approach is taken within scholarly research where the focus is on more discrete PRFs and their impact upon specific populations. As a result, there is a wide gap between how PRFs have been evaluated within practice and academia. This

section of the literature review discusses the approaches taken by scholars and practitioners in evaluating risks associated with PRFs.

Evaluation of Risks by Academia

The evaluation of psychosocial risk in the CEIs is largely focused on outcomes impacting workers' mental health and has studied the prevalence of health outcomes, including suicide, depression, anxiety, among others as discussed earlier in this dissertation. Other research has investigated the efficacy of controls, such as EAPs, to better understand their role in mitigating threats to workers and employers.

Evaluation of Mental Health Risks. Quantification of risk has included measurement of the prevalence of the outcome and less frequently, the severity of the outcome. Researchers have used the Depression Anxiety and Stress Scale (DASS21) and Depression Anxiety and Stress Scale (DASS42) to measure depression and anxiety (see, for example, Chan et al., 2020; Kotera et al., 2020); or alternative measures such as the Center for Epidemiological Studies – Depression (CES-D) tool, State-Trait Anxiety Index (STAI-T), Crown-Crisp Experiential Index (CCEI), and General Health Questionnaire (GHQ) (Chan et al., 2020). General mental health measures have been determined using the DASS, Hopkins Symptom Checklist (HSCL), GHQ, or CCEI (Chan et al., 2021). Suicide risk has been determined using the Mini International Psychiatric Interview (MINI) or non-professional measures (Chan et al., 2021). Additional measures have been used for other topics to understand their impact on mental health, such as work-life balance, which has been measured using the work-life balance checklist 7

(WLBC7), and worker attitudes towards mental health which have been measured by Kotera et al. (2020) using the attitudes toward mental health problems (ATMHP) tool.

Much of the research is of a qualitative nature and has been helpful in thematically analyzing the viewpoints of workers and collecting poignant statements about their experience in CEIs. One example is Martin's (2020) study on the effect of extended shift rosters on workers' mental health in which a worker's statement about time pressure from the contractor is brought to life by the words, "They were losing a lot of money and so the screws were well and truly tightened up" (p. 387). The acronym for FIFO (which typically stands for fly-in/fly-out) was given more colour by the commonly used industry colloquialism of "fit in or fuck off" which was shared by Wright and Griep (2019, p. 80).

Evaluation of Risk Mitigation Efficacy. Some studies, such as Milot's (2019) investigation on the effects of counselling services, employed a pretest-posttest design with a six-month interval. Other studies on the efficacy of app-based resiliency and de-stigmatization programs have also used pretest-posttest design with smaller intervals. Dobson et al. (2019) used the Opening Minds Scale for Workplace Attitudes (OMS-WA) to measure stigma over a three-month interval. Changes to work-related stress levels were measured using the Job Content Questionnaire (JCQ) by Molek-Winiarska and Zolnierczyk-Zreda (2018) who studied the impact of training on workers.

Literature has approached the evaluation of PRFs in a multitude of ways which has led to a plethora of tools and measures that help to provide understanding of the risks while also making it difficult to compare results. A new measure, the COPSOQ, was

developed to create greater cohesiveness in evaluating PRFs (Nuebling et al., 2022). It encompasses a broad range of PRFs which are well-aligned with the practical guidance put forward by the CSA (2013) and the ISO (2021). Versions of the tool have been developed at the national level to allow for better comparison of results internationally and across industries, and with consideration of the context of local cultures. For example, Metzler et al. (2019) used the COPSOQ Germany version and Ramkisoon et al. (2019) used the Canadian COPSOQ version.

Evaluation of Risks by Organizations

Risk management theory tells practitioners to identify, assess, and then evaluate the risks so that organizational decisions can be made to do nothing, investigate further, maintain existing controls, or reassess their objectives (ISO, 2018; Mehr & Hedges, 1963). Although this step of evaluation is a bonafide part of PRM, there is no literature discussing how organizations in the CEIs evaluate and make decisions about what mitigations to implement. Rather, the literature makes a leap from identification and assessment to control and monitoring of efficacy. The gap has been identified by Greiner et al. (2022) who noted that in a study of Irish and British health and safety professionals, those employed in the construction industry were less likely than those in other industries to implement PRM. Several explanations have been put forth by scholars to explain the lack of organizational participation in this step of PRM; for example, Potter et al. (2022) explained that given the relative newness of PRM, there is a lack of internal experience for its management, and concern about how implementation of PRM should be done in organizations of different sizes. In addition to the technical issues highlighted by Potter,

Quinane et al. (2021) found leaders had more philosophical issues about whether PRM applies to their organization and what their individual role is.

Clearly, the academic approach to risk evaluation is an important part of the information to be used in organizational risk assessment; however, it is not sufficient. Although frequency and severity are certainly two points of measurement for evaluating risk according to ISO (2018), these measures are incomplete from an organizational standpoint because they offer insight to just one of a multitude of factors that must be considered for effective PRF. To evaluate risk, organizations are advised to take a comprehensive look at data from a multitude of sources, explore the context of their specific work environment, and consider the voices of those most affected by the risks (CSA, 2013; ISO, 2018). The next section of my dissertation discusses control measures that have been implemented and opportunities which may provide further improvement.

Control Measures and Opportunities for Improvement

Tackling poor mental health in the CEIs is a shared responsibility between workers and employers that requires both individual and organizational-focused approaches (Asare-Doku et al., 2020). However, there is a persistent lack of awareness of how to mitigate mental health risk in industrial workplaces (Chan et al., 2020; Memish et al., 2017). While workers have a vested interest in their own wellbeing, many feel trapped by industry norms that limit their control over living and working conditions, working hours, and physical movement on and off site (Dorow et al., 2021; Saxinger, 2022). Despite awareness of the prevalence of mental health issues and the impact of PRFs in that regard, leaders are generally uncertain on how to approach mental health

risk management (Kirsh et al., 2018; Martin et al., 2018; Quinane et al., 2021). Legislations play a role too and there is an opportunity for government to make improvements to PRM legislation which is currently lacking in Canada (Samra, 2017). This section reviews the prominent individual and organizational control measures that have been recommended in the literature to improve PRM within the CEIs and discusses opportunities for improvement across workers, employers, and legislators.

Individual Control Measures and Opportunities for Improvement

Workers face heavy pressure to fit into the culture and order of work in the CEIs or risk being pushed out of employment (Wright & Griep, 2019); often because the worker is perceived as not being cut out for the work, or not being tough enough (Gardener et al., 2018). The effort to endure such an environment requires the adoption of coping strategies to either remove the source of stress or better regulate the response to it (Nwaogu et al., 2019; Wright & Griep, 2019). Coping strategies are frequently used to either avoid or minimize the impact of stressors and are, by nature, a reactive attempt to lower risk (Liu et al., 2021). Building resilience, a preferred approach, offers a more proactive strategy; but has been overly relied upon thus far according to London et al. (2022). The two primary approaches for managing mental health issues in the workplace have been identified as the use of coping strategies and increasing personal resilience, both of which are discussed further.

Coping Strategies. Coping strategies are implemented by workers after stress has begun to have an impact (Liu et al., 2021). Many coping strategies, such as escape, avoidance, and distancing can lead to increased anxiety and depression (Liu et al., 2021;

Nwaogu et al., 2019); and efforts to reframe issues, another technique for coping, can also lead to other forms of stigma between work groups and trades (Wright & Griep, 2019). The problem, according to Liu et al., is that because coping strategies often fall short of addressing the root of the problem, they can exacerbate the situation in the long term as workers increasingly feel hopeless in their ability to manage stress. For example, strategies to cope often involve the prominent use of alcohol and drugs within the CEIs (Frimpong et al., 2022); and has been shown to increased stress and anxiety (Chan et al., 2020); while also posing a threat to job safety (Liu et al., 2021). More appropriate approaches, such as physical exercise, are also common among workers in CEIs; however, the effect of coping strategies in these industries remains poorly understood (Liu et al., 2021). Liu et al. recommended that proactive practices of coping be developed in which stressful events are anticipated and prepared for.

Building Resilience. Individual resilience is an important measure of protection against workplace stressors and workers with higher resiliency are less likely to use coping measures to address stress (Nwaogu et al., 2019). The effects of employer-led resilience training are contradictory and been shown to have a positive effect on workers' mental health through reduced levels of anxiety and depressive symptoms (Molek-Winiarska & Zolnierczyk-Zreda, 2018); and no significant effect based on Greiner et al.'s (2022) meta-analysis of four intervention studies. An alternative approach to resilience training exists within technology. App-based programs to support mental health are becoming increasingly popular as a mechanism to reduce harm to workers and build their

individual resilience; however, studies have shown variable, but promising, results along with high rates of attrition (Deady et al., 2018; Lecomte et al., 2020).

Organizational Control Measures and Opportunities for Improvement

Organizational stressors are a leading source of threats to workers mental wellness (Tijani, Jin, & Osei-kyei, 2020); however, research has provided few recommendations for organizational control measures (Ajayi et al., 2019; Asare-Doku et al., 2020). When the literature does discuss organizational approaches, it is often debatable whether the approach is individual or organizational. For example, the provision of EAPs is typically discussed as an organizational measure; however, it is shared between individual and organization; as is Mental Health First Aid training and resiliency training which are increasingly used by employers to help workers recognize and respond to psychological issues (Seaton et al., 2018). True organizational controls are made through changes to policy, organizational commitment and culture, job resources, organization of workloads and schedules, and other systematic interventions as discussed by the CSA (2013). The remainder of this section discusses contracting practices and EAPs which are the primary sources of control currently implemented by CEI organizations, followed by discussion of stigma reduction and organization of work.

Contracting Practices. Contracts and subcontracts are fundamental for defining relationships and responsibilities among different parties involved in a project and involve all aspects of the work and how the work gets done (Bartholomew, 2022). The main contract, often known as the *prime contract*, serves as the primary agreement between the project owner and the main contractor and outlines project terms, including

scope of work, schedule, specifications, and payment details (Bartholomew, 2022). Prime contractors then hire subcontractors to complete specific portions of the work, and, in larger projects, subcontracting can occur at multiple tiers, creating a hierarchical structure of contracts (Bartholomew, 2022). Risk shifting, in this context, can be viewed as a risk management strategy employed by each tier in response to specific operational constraints, resource limitations, or project intricacies (Assaad et al., 2020).

There are many benefits to using subcontracts, not the least of which is transferring risk contractually to another entity (Bartholomew, 2022). However, there are a number of risks that arise due to the hierarchy of contracts including hiring new subcontractors without informing the first, delays in decision-making, delays in payment, low-quality resources, and non-compliance with the original agreement (Bartholomew, 2022; Kowshik & Deepak, 2017). In the CEIs lump sum contracts are most prevalent and the fixed-price nature of the agreement, along with the lack of rigour in flow-down contractual language from the main contract often results in a difference between what an organization thought they bought and what they ultimately get (Bartholomew, 2022).

Employee Assistance Programs. EAPs are employer-sponsored programs that aim to support workers in addressing acute behavioral health issues for the betterment of workers' health and employers' bottom line (Attridge, 2019; Jacobs et al., 2017; Milot, 2019). Programs vary widely from employer to employer, but typically include access to counselling, educational resources, and health risk screening tools (Attridge, 2019; Milot, 2019). In Canada, EAPs have been shown to have a positive effect on workers' mental health, increase productivity, and reduce disability claims costs (Dimoff & Kelloway,

2019; Milot, 2019); but within the Canadian construction industry, research has shown no significant effect on general mental health of workers (Greiner et al., 2022). A further challenge to the efficacy of EAPs is their track record of poor uptake by employees. One study by Attridge (2019) estimated participation rates to range from 2%-15% depending on the levels of promotion and integration. Within the CEIs, rates of participation are further challenged because of the transient nature of the work, inability to sustain health promotion initiatives, and hesitancy of workers to seek support within a male-dominated workplace (Greiner et al., 2022); as well as concerns about privacy, job uncertainty, and how their work may be affected (Martin, 2020; Seaton et al., 2018).

Combating Stigma. Stigma had been highlighted in research as a barrier to worker mental wellness (Dobson et al., 2019; Eyllon et al., 2020; Kirsh et al., 2018; Kunyk et al., 2016; Seaton et al., 2018), and it is particularly problematic within male-dominated workforces (Eyllon et al., 2020; Kunyk et al., 2016; Kotera et al., 2019: Seaton et al., 2018). Researchers often make recommendations to reduce stigma which is inherently related to improvements to workplace culture (Kirsh et al., 2018; Seaton et al., 2019) which has also been a target for improvement recommendations (see, for example, Asare-Doku et al., 2020). Within the CEIs, stigma reduction is especially challenging given its well documented and persistent culture of bravado and toxic masculinity. The Mental Health Commission of Canada (MHCC, 2023) developed The Working Mind program to help reduce stigma and improve mental health. A study on the efficacy of the program in a Canadian setting showed moderate, positive effects in participants (Dobson et al., 2019), although the study was not specific to the CEIs. Within the construction

industry in Australia, a study testing the efficacy of the Contact + Connect stigma reduction program found it was ineffective at reducing stigma (Milner et al., 2018).

Organization of Work. Research has demonstrated that organizational factors are a primary contributor to workers poor mental health; role conflict, role ambiguity, job insecurity, and interpersonal conflict had the strongest correlation with mental health issues (Sun et al., 2022). Despite the prominence of recognition as PRFs, very little discussion of change via organizational initiatives has been recommended in the research. Further, London et al. (2022) critiqued academia for its generic approach to addressing mental health in the construction industry, stating that not enough consideration has been given to the work environment and industry culture.

The provision of adequate job resources in the form of supervisor support, management safety commitment, coworker support, job control, and a culture of safety were discussed by Derdowski and Mathisen (2023) as key to reducing workers' psychological stress, emotional exhaustion, and burnout. Scholars have suggested that organizations set realistic time frames and budgets for their scopes of work and make improvements to how teams communicate and collaborate (Ajayi et al., 2019). The preference for controls to occur at the worker-level, and a lack of intervention at the organizational-level, has been noted by Greiner et al. (2022) who found that task reallocation was only used by one of the studies in their meta-analysis while the remaining three focused on worker-level resilience improvement.

Legislative Controls and Opportunities for Improvement

In Canada the provinces and territories are responsible for their own regulations on mental health. Recommendations have been made by the Centre for Addiction and Mental Health (CAMH, 2020) for government to strengthen and update legislation to account for WMH; and although Canada's national standard for psychological health in the workplace represents a milestone for improving mental health, it is voluntary (Samra, 2017). Further, research indicates that only 17% of Canadian employers are aware of the Standard and a mere 1.7% have fully implemented it (Sheikh et al., 2018); indicating that while the standard is a step in the right direction, it is insufficient. While ethical responsibilities may prompt employers to act on PRFs, concern over social responsibility combined with legislated requirements is more likely to have a positive impact on PRM practices (Leka & Jain, 2016, as cited in Potter et al., 2022).

Many of the controls for managing PRFs are individual-focused mitigations which are aimed to increase individual resiliency to stress rather than eliminate or reduce the source of harm. From a risk management perspective, the current approach is contrary to risk management theory which considers a prioritized application of mitigations based on the hierarchy of controls. Contributing to the problem are a multitude of stakeholders, gaps in legislation, and a lack of clarity on what is and is not considered within the realm of employer responsibility. As Memish et al. (2017) stated, it is usually assumed that what happens outside of work is not the responsibility of the employer. This assumption is challenged within the context of CEIs where the definitions of work and workplace are non-traditional. Complicating matters further, much of the provincial and territorial

legislation is largely silent on mental health; and the voluntary standard for addressing WMH has low uptake by organizations, especially within the construction and energy sectors (Kunyk et al., 2016).

Summary and Conclusions

In conclusion, the current research, found in scholarly literature and sources, indicates that psychosocial risks in the workplace represent a significant challenge for not only workers and employers, but families and society. This literature review has highlighted the types of psychosocial risks that exist, their impact on workers, and the interventions that can be implemented to address them. It has provided evidence that the risk management model provided by Mehr and Hedges (1963) is well-established and integrated in the CEIs. It also demonstrates that there are a wide variety of PRFs which interact with each other in ways that are not yet understood within academia and warrant categorical exploration. The review also provides a rationale for the use of age, gender, residence type, employment arrangement, and rotation status as CFs due to their known effect on mental health outcomes; or the lack of knowledge pertaining to their impact within the CEIs. Through the review, the lack of organizational mitigations has been made clear, as well as leaders' self-disclosure that they do not know how to incorporate PRM into existing business practices. The review helps to explain academic knowledge in a practical manner, highlighting areas for improvement.

The existing research is extensive. However, as this literature review has illustrated, gaps in the research remain including incomplete investigation into the PRFs affecting workers in the CEIs, a lack of research into Canadian CEIs, and an absence of

information pertaining to the assessment and evaluation of PRFs. By addressing the gaps in knowledge, process, and research, scholars and practitioners can work more collaboratively to create safer, healthier, and more productive work environments, benefiting workers, employers, and society. My research takes the next step in closing the gaps in knowledge and improving the understanding of PRFs within the CEIs. The methodology used to accomplish that objective is discussed in Chapter 3.

Chapter 3: Research Method

The purpose of this quantitative study was to examine the relationship between 15 measures of Canadian CEI workers' perspective of PRFs (RVs) and five demographic factors (CFs) of age, gender, residence type, employment arrangement, and rotation status. My research addressed the social and management problem that WMH is a global issue that affects over 15% of the working population at a cost of over 1 trillion dollars (USD) annually (WHO, 2022). The research problem was that the lack of knowledge of the importance of PRFs from the perspective of Canadian CEI workers is compromising risk management practices and has an adverse effect on workers' mental health.

This chapter provides a comprehensive overview of the nonexperimental, correlational design proposed for my study. It begins with a description of the research design and rationale, including an overview of the study variables and explanation of the relationship between the research design and the research question. Then, I provide details of the methodology for the study and data analysis plan and discuss the internal, external, and construct threats to validity. I conclude the chapter with a review of ethical considerations that are pertinent to my study.

Research Design and Rationale

I adopted a constructivist paradigm to view the world which is founded in understanding, multiple participant meanings, social and historical construction, and theory generation (see Creswell, 2014). Further, the research question relates to the influence of demographic factors upon views of PRFs which inherently assumes that perspectives will vary between groups; a concept that aligns well with the constructivist

world view, according to Creswell. This quantitative study was nonexperimental as the aim was to examine the relationship among the CFs and the RVs and not to ascertain causality (see Asenahabi, 2019). Further, the manipulation of some of the CFs of interest would have been unethical (e.g., gender) and membership to the groups of interest was predetermined (e.g., work arrangement, accommodation type); two factors which precluded the use of experimental designs and are amenable to a correlational study (see Schenker & Rumrill, 2004). Additionally, the variables included in my study were categorical CFs and continuous numerical RVs which are suited to a correlational study (see Schenker & Rumrill, 2004). In this way, the approach allowed for examination of the relationship between variables without controlling them.

My study was cross-sectional in nature. I obtained point-in-time data using a survey design to collect information from participants through an online questionnaire hosted by SurveyMonkey. Online questionnaires typically represent a lower cost alternative to other data collection methods and offer speed, efficiency, privacy, and a wide geographic reach (Sue & Ritter, 2012). I conducted ANOVA to investigate the effects of the CFs (age, gender, residence type, employment arrangement, and rotation status) on views of PRFs in the Canadian CEIs as measured through 15 RVs (quantitative demands, work pace, emotional demands, influence at work, possibilities for development, meaning of work and work commitment, predictability and rewards, role clarity, role conflict, leadership and social support, colleague social support, social community, job insecurity, work life conflict, and vertical trust and organizational justice).

Methodology

In this section, I provide details of my study such that other researchers could replicate it. I first define the target population and size, then identify, and justify the sampling strategy chosen for the research. I explain the procedures that were used for sampling, as well as the underlying analysis conducted for calculating the sample size. The procedures used for recruitment and participation are then discussed, as are details of the instrumentation and operationalization of constructs.

Population

The population for my study consisted of workers within the Canadian CEIs who had been employed in this capacity within the past one year and had site-based work as a component of their job requirements. Workers in this population were 18 years of age or older and employed in one of many trades or occupations (e.g., carpenter, iron worker, equipment operator, health and safety, logistics). I chose the CEIs because there was a lack of research pertaining to these industries at a time when workers' mental health issues are increasing and because my career has been based within these industries and I have business connections that provide access the target population. All data were self-reported by the participants who volunteered to take part in my study.

Quantification of the target population was difficult because while numbers of workers in the CEIs are tabulated in census, the number of site-based workers in these industries is not; and it is an issue that is mentioned in several studies (see, for example, Deacon et al., 2017; Dorow et al., 2021). Efforts to quantify local CEI workers have previously been undertaken in northern Alberta, home to Canada's oil sands and the most

active area of oil and gas work in the nation. Approaches to estimating the population included survey of major employers (Nichols Applied Management, 2018), measurement of transient workers by municipality (Friesen, 2015); and estimation of population based on camp water usage by municipality (Deacon et al., 2017). Those estimates placed the worker population of the area between 15,000 (Nichols Applied Management, 2018) and 60,000 (Friesen, 2015).

The northern regions of British Columbia are also an active area for CEI and draw tens of thousands of workers, according to project-provided estimates: BC Hydro's Site C project reported 4,856 workers (BC Hydro, 2023); the LNG Canada project reportedly employed approximately 6,000 workers (LNG Canada Development, 2023); the Trans Mountain Expansion Project employed 2,000 workers (Trans Mountain, 2022); the Coastal GasLink project reported 6,500 workers (Coastal GasLink, 2022). Other regions in Canada use smaller workforce populations for CEI work, such as Quebec (Bouchard-Bastien & Gervais, 2017) and Newfoundland (Butters, 2020).

Sampling and Sampling Procedures

The target population was accessed using social media platforms (LinkedIn, Facebook, Reddit, and Instagram); and direct email to personal contacts and publicly available contacts meeting the participant criteria. I used a combination of convenience, snowball, and stratified non-probability sampling within my target population. The target population included current or recently (within 1 year) employed workers within the Canadian CEIs, aged 18 years or older who had site-based work as part of their job and

access to the internet. Excluded from the study were workers in the Canadian CEIs who were under the age of 18, and workers without access to the internet.

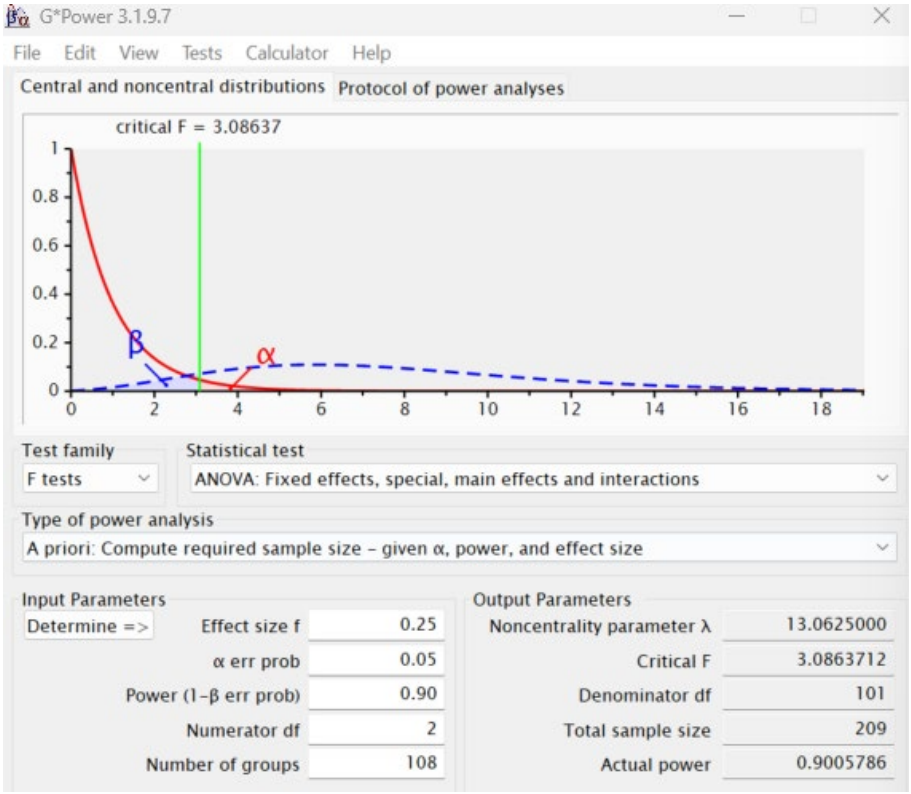
I conducted an a priori power analysis using G*Power software (version 3.1.9.7; Faul et al., 2009; see Figure 3) to determine the minimum sample size required to test the study hypothesis. I selected the F tests and ANOVA: Fixed effects, omnibus, one-way to indicate the required sample size and used parameters that minimize the risk of a Type I or II error while limiting the number of samples required. First, I limited the risk of a Type I error by setting the alpha (α) to .05 which is a standard level for social research (see Faul et al., 2009). Then, I limited the risk of Type II errors by setting the power (1 – β) to 0.90 which is higher than the commonly used value of 0.80; and lowers the potential for missing an actual effect (see Serdar et al., 2021). I then chose a medium effect size (*f* = .25*)* because it allows for identification of effects with a reasonably feasible sample size (see Cohen, 1988, 1992). I indicated the number of groups as 108 based on multiplication of levels across the five factors (age, 3 levels; gender, 2 levels; residence type, 3 levels; employment arrangement, 3 levels; rotation status, 2 levels). Finally, I selected 2 for numerator degrees of freedom because it represents the largest number of levels within the CFs less 1.

To ensure equal numbers in each group, the G*Power sample size (209) was divided by the number of groups (108) which is 1.94; and then rounded up to the next whole number (2). Then, I multiplied 2 by the number of groups (108) to produce an adjusted sample size of 216. It was not expected that all questionnaires would be valid or complete or that responses would be collected equally per group. As such, I monitored

data collection and as it appeared that more participants were needed to meet the overall minimum sample size or samples per group, I emailed or messaged groups and candidates seeking their participation. I used all the completed samples, even if there were more than two responses per group, because equal sample size is not an assumption made in ANOVA.

Figure 3

Required Sample Size



Procedures for Recruitment, Participation, and Data Collection

Canadians primarily use their time on the internet for email and social media; and are increasingly using mobile devices over home computers to access the internet (The Strategic Counsel, 2021). Canada is one of the most connected online countries with

more than 89% of the population using social media each year (Dixon, 2022). As such, the internet and social media were used to access the target population along with direct communication to my personal contacts and individuals with publicly available contact information.

Procedures for Recruitment and Participation

The survey was promoted on LinkedIn, Facebook, Instagram, and Reddit and used snowball sampling to further extend the invitation to obtain a suitable sample size. I selected this approach because it uses techniques that are appropriate when the population cannot be individually identified or when the population is too large for a census (see Stratton, 2021); and when a low-cost approach or large sample size is needed (see Kosinski et al., 2015).

Recruitment of Participants. Recruitment of participants was done using four social media platforms: LinkedIn, Facebook, Instagram, and Reddit. A sample of the promotional post used on the social media platforms is provided in Appendix A. I made direct invitations via email to my relevant personal contacts and publicly available contacts using the email invitation sample provided in Appendix B. I also sought permission from administrators of relevant social media groups to place promotion posts on their social media accounts and messaged individuals directly through the social media platforms to further solicit participants for population groups that were not yet represented in the collected data.

An unexpected outcome during the recruitment process was that several survey participants reached out to me directly and volunteered to share more information about

their experiences. Although this study was quantitative in nature, there was a valuable opportunity to supplement my findings with qualitative information from personal communications. An illustration of the overall process used for recruitment and participation is provided in Appendix C.

Conducting a study using social media can be a highly effective and cost-friendly approach to research; however, it requires effort to promote the study to the appropriate audience (Kosinski et al., 2016). To make data collection more effective, I used a tactic recommended by Kosinski et al. (2016) and Schneider and Harknett (2019) of promoting the survey to individuals within the target population using common characteristics, such as location, industry of employment, and age. Specifically, I used LinkedIn and Facebook to target groups based on industry, trade, and age; and Reddit to target populations based on location and industry of employment.

Participant Experience. Prospective participants were made aware of the study via a social media post (see Appendix A). The posts included a graphic (see Figure A1) and the survey invitation text (see Appendix B) which was included in the body of the post where possible, based on social media platform limitations. Hyperlinks were used in the body text and, where possible, on the image to connect the user to the survey platform. By clicking on the link, prospective participants were taken to the consent page (see Figure D1) and the survey. Alternatively, prospective participants were made aware of the survey through an email invitation using the survey invitation text (Appendix B). The survey invitation text provided potential participants with more detailed information

about the study and its purpose, eligibility requirements for participation, protection of individual privacy, and voluntary nature of participation in the survey.

Once prospective participants clicked on the hyperlink to the survey, they were greeted with the consent page where they were reminded of the conditions and asked: Do you consent to participate in this study? A negative response forwarded the individual to a disqualification page (Figure D2) which expressed gratitude to the individual for their interest and exited them from the survey. Upon providing consent, prospective participants were forwarded to the questionnaire (Appendix E).

At the completion of the questionnaire, participants were taken to a completion page (Figure D3) which included a statement of appreciation, a reminder that survey data would be used in aggregated form, information about acquiring a copy of the study results, and a request that the survey link be shared with colleagues and friends within the Canadian CEIs. Participants were able to exit the survey at any time they wished and had the option not to answer any of the questions contained within the questionnaire portion of the survey.

Incentive for Participation. Incentivization has traditionally been a part of the recruitment strategy because it offers reciprocity for the participants' time; however, the importance of incentives in an electronic world is unclear. Holtom et al. (2022) found that incentives are not as helpful at bolstering response rates when the data are collected electronically versus more traditional methods of data collection. Additionally, provision of an incentive would require participants to disclose personal information and compromise the promise of anonymity offered to participants. For those reasons, no

incentive was offered. A summary of the results of the study will be published on the social media pages used for recruiting participants.

Survey Availability. The online questionnaire was made available to the public through the SurveyMonkey platform. While it was open, I performed checks of the completed questionnaires to ensure their validity and monitored the survey to ensure there were no technical issues impairing the collection of data. Also, I tracked the number of completed, valid questionnaires to ensure at least two participants in each of the 108 groups.

Procedures for Data Collection

Data collection was anonymous and at no time were participants' names or contact information collected. The anonymous setting for responses was selected within SurveyMonkey and the option to collect IP addresses was disabled. The online nature of the questionnaire allowed for participation to be discreet enough that participation in the study may only be disclosed by the participants themselves. The survey data were initially stored by SurveyMonkey in my personal account to which only I have the password. After the survey was closed, the data were downloaded from the survey platform service to an Excel file stored within my personal, password-protected, cloud service (OneDrive). I was the only person with access to the OneDrive file and the only person with access to my password-protected personal computer. For extra protection of data, I used a screen-lock to ensure that access to my computer was restricted after being idle for 5 minutes and ensured that my computer software remained appropriately updated and protected by anti-virus software. The data will be stored for 5 years and

disposed of by deletion of the file(s) and permanent deletion of the deleted items. There were no printouts of the dataset.

Instrumentation and Operationalization of Constructs

To conduct this study, I used one questionnaire with two parts (see Appendix E). The first was a set of demographic questions, and the second contained the questions from a published instrument, known as the COPSOQ. The COPSOQ is a tool where workers indicate workplace exposure to PRFs and general health outcomes with the purpose of identifying priority risk categories for intervention (Burr et al., 2019). The tool is free to use and publicly available through StressAssess (2023). Permission to use the survey is not required; however, it was sought out through via email communication with Oudyk, who is a representative for COPSOQ in Canada (see Appendix F).

Previous Use of the Instrument

The COPSOQ was originally developed by the Danish National Research Centre of the Working Environment using principles of JD-R and ERI and was updated by Kristensen and Borg in 2000 who included the concept of social capital and stress-as-offence-to-self (SOS) theory which have meaning in the modern workplace (Burr et al., 2019; COPSOQ International Network, 2023). The questionnaire is available in three lengths, short, middle, and long, and is intended to support both practical occupational risk assessment and academic research (Burr et al., 2019). Version III of the COPSOQ has been validated internationally by Burr et al. (2019) who sampled $N = 23{,}362$ employees in Canada, Spain, France, Germany, Sweden, and Turkey. Burr et al. used Cronbach α to assess reliability with an $\alpha \geq 0.7$ deemed acceptable; and calculated correct

item-total correlations with values ≥ 0.4 deemed acceptable. Of the 23 scales tested, only three had an α less than 0.7: commitment to the workplace (α = 0.64; 95% CI: 0.61 – 0.67), demands for hiding emotions (α = 0.66; 95% CI: 0.58 – 0.73), and control over working time (α = 0.69; 95% CI: 0.57 – 0.78). The remaining 20 scales were deemed acceptable. The Spearman scale intercorrelations were calculated to evaluate divergent and convergent validity, where possible. Spearman correlation coefficients range from -1 to +1 with 0 representing no relationship and strong relationships associated with higher absolute values (Laerd Statistics, 2018). A total of 373 intercorrelations were tested and only seven were greater than 0.60; and none were greater than 0.69. Burr et al. concluded in their validation study that a strength of the questionnaire was its international use but recommended that each new language version be tested.

StressAssess serves as the Canadian version of the COPSOQ III and it has been adapted to address concerns in the Canadian workplace (StressAssess, 2023). The survey is a hybrid of selected scales and questions which includes all the items from the COPSOQ III core version along with selected items from the COPSOQ middle and long versions, but also including two items from the COPSOQ II short version that were dropped in COPSOQ III, along with additional questions from other sources, such as the Nordic Safety Climate Questionnaire (NOSACQ-50). The survey was tested by Ramkissoon et al. (2019) who conducted a study using a sample of working Canadians (*N* = 3,919) to validate the factor structure of the COPSOQ III among Canadian workers. Ramkissoon et al. used confirmatory factor analysis (CFA) and calculated the goodness-of fit index (GFI = 0.95), Bentler comparative fit index (CFI = 0.95), and root mean

square error of approximation (RMSEA = 0.044, 90% confidence interval [CI]: 0.043, 0.046). GFI is the proportion of variance accounted for by the estimated population covariance and should be >0.90; CFI compares the fit of a target model to the fit of an independent model and should be >0.90; RMSEA is a relative fit index and values closer to 0 represent a good fit and should be <0.10 (Cole, 1987). The COPSOQ III tool has been proven to be a reliable and valid tool for measuring exposure to PRFs in the workplace (Burr et al., 2019); and the Canadian version has been demonstrated as appropriate for application within the Canadian context (Ramkissoon et al., 2019).

Basis for the Development of the Instrument

The COPSOQ survey was developed to measure and assess various psychosocial factors in the workplace, such as job demands, job control, social support, and stress by being based in theory without anchoring to any one specific theory (COPSOQ Network, 2023). The history of the COPSOQ has been discussed by several researchers (see, for example, Burr et al., 2019; Kristensen et al., 2005; Lincke et al., 2021). The COPSOQ incorporates a broad range of concepts and theories such as the job characteristics model, the Michigan organizational stress model, the demand-control-support model, the sociotechnical approach, the action-theoretical approach, and the ERI model (Kristensen et al., 2005). The survey was designed to be a comprehensive, reliable, and easy to administer tool that helps to identify areas of improvement within work environments (Burr et al., 2019). The overall intent of the COPSOQ is to better understand the complex relationships between work, well-being, and performance, and to provide employers and

organizations with a tool to help promote a positive and supportive work environment (Burr et al., 2019).

Sufficiency of the Instrument to answer the Research Question

The COPSOQ was an appropriate instrument to use for answering my research question, which examined the relationship between a set of CFs and workers' views of PRFs, for two main reasons. First, the tool has been designed to support risk management within the Canadian workplace and aims to measure workers' views of the work environment and not assess individual health status. This was an important consideration for my study because the aim of the research was to understand how workers experience PRFs and not evaluate how they have been affected by them. Second, it provides one score for each of the PRFs included in my study by averaging the measurements of individual survey questions related to the PRF. The number of measures associated with each PRF ranges from two to four. Table 3 illustrates the specific measures included in each PRF measurement and the corresponding identification label of the questions (Ramkissoon et al., 2019).

Table 3

COPSOQ III Canadian Version Measurements

Psychosocial risk factor	Number of measures	COPSOQ Question ID
F1: Quantitative demands	3	QD2, QD3, QD4
F2: Work pace	3	WP1, WP2, WP3
F3: Emotional demands	3	ED1, EDX2, ED3
F4: Influence at work	2	INX1, IN3
F5: Possibilities for development	3	PD1, PD2, PD3
F6: Meaning of work and work commitment	4	MW1, MW2, CW2, CW3X
F7: Predictability and rewards	4	PR1, PR2, RE1, RE3
F8: Role clarity	2	CL1, CL3
F9: Role conflict	3	CO2, CO3, IT1
F10: Quality of leadership	4	QL2, QL3, QL4
F11: Social support from supervisor	2	SSX1, SSX2
F12: Social community	2	SCX1, SW1
F13: Job insecurity and satisfaction	4	JI1, JI3, IW1, JS4
F14: Work life conflict	3	WFX1, WF2, WF3
F15: Vertical trust and organizational justice	4	TM1, TMX2, JU1, JU4

Data Analysis Plan

This section provides the details of the analysis plan and outlines the procedures for initial data analysis, the statistical tests used for testing the hypotheses, procedures for multiple statistical tests, rationale for inclusion and exclusion of potential covariates and confounding variables, and how the results were interpreted.

Initial Data Analysis

The phase of initial data analysis (IDA) occurs once data are collected and before they are statistically analyzed in SPSS. During this phase, both data cleaning and data screening are done. The former requires seeking out and trying to fix issues in the data itself while the latter calls for finding and fixing inconsistencies that arise when the data

are viewed collectively, and both tasks are important for further statistical analysis (Huebner et al., 2020).

Error Prevention Strategies for Data Cleanliness

Van den Broeck et al. (2005) suggested researchers consider the discrete steps of the study process, such as design, collection and entering of data, data transformation and exact transfer, as well as exploration and analysis as opportunities for error. To minimize the potential for data errors, I followed the recommendations of Van den Broeck et al. and planned to identify errors by considering the likely sources of problems in advance and adjusting my research design accordingly.

The questionnaire was hosted by the SurveyMonkey platform, and several options were selected to promote data cleanliness. The questions were clearly written, and the design of the questionnaire was kept simple to promote respondents' engagement through to completion. All but a few questions required the selection of a single response which reduced the likelihood of contradictory responses resulting from multiple selections to a single question. I conducted a test of data input and output prior to opening the survey to the public to ensure that data wis collected as intended with minimal errors.

During data collection, I utilized the SurveyMonkey response quality analysis tool to identify poor-quality responses in open-ended and multiple-choice survey questions. The tool assesses patterns in responses, time spent completing the survey, and the quality of written response options to identify potential data issues. There were no issues identified during data collection.

Throughout the data collection period, I monitored survey responses to ensure adequate samples were collected. I monitored the number of responses, number of responses per group, and number of completed surveys daily to ensure that after the data were treated, using the post-data collection procedures discussed next, there would remain an adequate number of valid questionnaires in each group. When I observed groups with less than two valid questionnaires each, I used the previously discussed strategy of directly emailing and messaging personal and public contacts to obtain additional samples.

Post-Data Collection Procedures

Preparedness and prevention can help to minimize the need for data cleaning, but they are not likely to eliminate data issues (Van den Broeck et al., 2005). Post-collection there may have been a need to correct data values or determine the range of admissible values and identify values outside those ranges. The design of this study and format of the questions limited the potential for inadmissible values or outliers. However, there were additional steps taken to prepare the collected data for further analysis.

Data Errors and Omissions. When data collection was completed, I downloaded the data from SurveyMonkey into an Excel file and reviewed it to ensure that no data errors or omissions were present. Upon review, no errors, omissions, or corrupt data were observed. Missing data, which was observed, is discussed later in this section.

Transformation of Variables. The source data were not suitable for statistical analysis in its downloaded form. I manipulated the data so that each of the RVs was transformed into a quantitative value (see Appendix G). Specifically, the ordinal

responses provided to the Likert-type questions were transformed into numerical response values using the scales provided by the COPSOQ International Network (2021) and Oudyk (personal communication, September 28, 2022).

Missing Data. Huebner et al. (2020) suggested that issues of missing data or incorrect values can be largely avoided through research design. Missing data can pose the risk of bias depending on why the data are missing and how the issue is addressed (American Psychological Association [APA], 2020; Pepinsky, 2018; Sterne et al., 2009). The most common approach is listwise deletion in which the entire case is removed when one or more value is missing; and the other is multiple imputation which involves predicting missing values (McNeish, 2017; Pepinsky, 2018). I considered each option and, after weighing the risks and benefits, chose listwise deletion as my approach.

The values missing in my dataset could not be predicted based on observed data in the dataset and are therefore considered to be missing completely at random (MCAR) (McNeish, 2017; Pepinsky, 2018). In such cases, both approaches are unbiased and multiple imputation is more efficient because a larger sample size is retained. This is particularly important in smaller sample sizes where listwise deletion can dramatically reduce sample size (McNeish, 2017). However, the use of multiple imputation requires observed values to reliably predict the missing values and the use of multiple imputation could bias the sample by repeatedly using single donor observations which would have artificially limited variance, according to McNeish (2017).

Values Out of Range. To be appropriate for use in statistical testing, the data must be accurate, complete, and satisfy the assumptions applicable to the selected

statistical tests. I reviewed the data using descriptive analysis which allows for assessment of the variables' means, standard deviations, and range of scores. Further review was done through visualization of data using scatterplots and histograms to determine compliance with data assumptions. Although values out of range were not expected due to the use of qualitative CFs and Likert scale RVs, technical errors could have still occurred. To detect values that were out of range, I reviewed the data in excel and calculated the minimum, maximum, and range. No values out of range were identified.

Computation of Means. I computed the mean response to a subset of questions (see Table 3), using Excel, to inform the RVs as outlined in Table 4. The data were then copied and pasted into SPSS for statistical analysis.

Table 4

Computation of Means Chart Example

ID	Age	Gen	Acc	Arr	Rot	F1	F2	F3	F4	F5	F6	…

Statistical Analysis

The statistical analysis section of the data analysis plan first presents a recap of the research hypotheses presented in Chapter 1 and then provides an overview of ANOVA and its application. A brief discussion of other statistical tests that were used in this study is undertaken along with a detailed discussion of the assumptions related to

statistical analysis and the measures of control that were implemented when assumptions were violated. The section concludes with an overview of the interpretation of results.

Research Hypotheses

My study sought to answer the research question: What is the relationship between five demographic CFs (listed in Table 1) and PRFs in the Canadian CEIs as measured by 15 RVs (listed in Table 2)?

Analyses of Variance (ANOVA)

ANOVA can test the relationship between the independent and RVs through the comparison of means across groups (Field, 2018; Mason & Perreault, 1991). The technique is amenable to analyses in which there are categorical CFs and a single, continuous RV (Field, 2018; Mason & Perreault, 1991). This part of the data analysis plan provides a description of the predictive ANOVA model and 2FIs which were used in the study.

Predictive ANOVA Model. The theoretical model for a two-way ANOVA with two predictors is:

$$Y_{ijk} = \mu_Y + \alpha_i + \beta_j + \alpha\beta_{ij} + \varepsilon_{ijk}.$$

where:

Y_{ijk} = the value of the RV for record k within the group that corresponds to level i of *factor A* and level j for *factor B*

μ_Y = the population grand mean of Y values

α_i = the effect of the i^{th} level of *factor A*

β_j = the effect of the j^{th} level of *factor B*

$\alpha\beta_{ij}$ = the interaction effect for the i, j cell (interaction between factors A and B)

ε_{ij} = the random error or unexplained portion of the k^{th} value of Y (i.e., not accounted for in the other terms of the ANOVA equation).

The final, predictive, regression model is the following:

$\hat{Y}_{ijk} = \mu_Y + \alpha_i + \beta_j + \alpha\beta_{ij}$

where $\hat{Y}_{ijk}$ is the predicted value of the RV for the k^{th} record.

Two-Factor Interactions. Two-factor interactions (2FIs) between the CFs are analyzed in ANOVA. A 2FI exists when the relationship between one CF and the RV changes depending on the value of another CF. 2FIs are calculated as the cross-product of each pair of CFs and tested in the analysis.

ANOVA Hypotheses

To aid the analysis I developed a series of ANOVA hypotheses related to the CFs (see Table 1). The following are the ANOVA hypotheses for each CF (which were applied to each of the 15 RVs):

The hypothesis of *no difference in the RV due to factor A*:

H_0: $\mu_1 = \mu_2 = \mu_3$ (means for all three levels of A are equal)

Where the number of levels of *factor A* = 3

against the alternative:

H_1: not all μ_i are equal.

The hypothesis of *no difference in the RV due to factor B*:

H_0: $\mu_1 = \mu_2$ (means for both levels of B are equal)

Where the number of levels of *factor B* = 2

against the alternative:

H_1: not all μ_i are equal.

The hypothesis of *no difference in the RV due to factor C*:

H_0: $\mu_1 = \mu_2 = \mu_3$ (means for all three levels of C are equal)

Where the number of levels of *factor C* = 3

against the alternative:

H_1: not all μ_i are equal.

The hypothesis of *no difference in the RV due to factor D*:

H_0: $\mu_1 = \mu_2 = \mu_3$ (means for all three levels of D are equal)

Where the number of levels of *factor D* = 3

against the alternative:

H_1: not all μ_i are equal.

The hypothesis of *no difference in the RV due to factor E*:

H_0: $\mu_1 = \mu_2$ (means for both levels of E are equal)

Where the number of levels of *factor E* = 2

against the alternative:

H_1: not all μ_i are equal.

The hypothesis of *no interaction of factors A and B:*

H_0: the interaction of *A* and *B* is equal to zero.

against the alternative:

H_1: the interaction of *A* and *B* is not equal to zero

The hypothesis of *no interaction of factors A and C:*

H_0: the interaction of *A* and *C* is equal to zero.

against the alternative:

H_1: the interaction of *A* and *C* is not equal to zero

The hypothesis of *no interaction of factors A and D:*

H_0: the interaction of *A* and *D* is equal to zero.

against the alternative:

H_1: the interaction of *A* and *D* is not equal to zero

The hypothesis of *no interaction of factors A and E:*

H_0: the interaction of *A* and *E* is equal to zero.

against the alternative:

H_1: the interaction of *A* and *E* is not equal to zero

The hypothesis of *no interaction of factors B and C:*

H_0: The interaction of *B* and *C* is equal to zero

H_1: The interaction of *B* and *C* is not equal to zero

The hypothesis of *no interaction of factors B and D:*

H_0: The interaction of *B* and *D* is equal to zero

H_1: The interaction of *B* and *D* is not equal to zero

The hypothesis of *no interaction of factors B and E:*

H_0: The interaction of *B* and *E* is equal to zero

H_1: The interaction of *B* and *E* is not equal to zero

The hypothesis of *no interaction of factors C and D:*

H_0: The interaction of *C* and *D* is equal to zero

H_1: The interaction of *C* and *D* is not equal to zero

The hypothesis of *no interaction of factors C and E:*

H_0: The interaction of *C* and *E* is equal to zero

H_1: The interaction of *C* and *E* is not equal to zero

The hypothesis of *no interaction of factors D and E:*

H_0: The interaction of *D* and *E* is equal to zero

H_1: The interaction of *D* and *E* is not equal to zero

Hypotheses are tested using the *F* test (and its *p* value). The *F* test assesses whether the means of the RV vary based on the CF and predicts the RV. Adjusted R^2, the coefficient of determination, indicates the extent to which the predictors as a group contribute to the variance in the RV.

Procedures for Multiple Statistical Tests

During the analysis, if the null hypothesis was rejected, post hoc tests were used to determine which specific groups differ significantly from each other. Common post hoc tests include Tukey's Honestly Significant Difference (HSD), Bonferroni correction, or Dunnett's test, among others. These tests help identify pairwise differences and provide more detailed information about the significant effects which may be required as part of the statistical analysis.

Assumptions

Interpretation of results can only be made after the appropriate assumptions have been met and there are several to consider when conducting ANOVA. First, the RVs are assumed to be continuous, numerical variables. The assumption was met using a Likert-

type scale with quantitative values to measure the RVs. Then, each CF is assumed to consist of two or more categorical and independent groups (levels or values). This assumption was met, and the independent groups are illustrated in Table 1. The observations are assumed to be independent and without a time-related relationship between observations. To meet this assumption, random data collection was used and checked with a scatterplot. The assumption of no influential cases was met by checking the values of response to ensure none were more than three standard deviations from its overall mean. Each RV was checked using a normal probability plot to ensure that experimental errors (residuals) were approximately normally distributed. Finally, homogeneity of variance for each group (combination of factor levels or values) was checked using scatterplots and Levene's test. Violations of assumptions are discussed further in Chapter 4 as part of the findings.

Interpretation of Results

The Tests of Between-Subjects Effects table (*F test*s and associated *p* values [Sig.]) is the most appropriate table for ANOVA hypothesis tests (McAllister, 2022). When the *p* value for an CF is less than the significance ($\alpha = .05$), the null hypothesis is rejected, and a conclusion is made that there is a difference in the means among the levels of the CF. When the *p* value for an CF is greater than the significance ($\alpha = .05$), the null hypothesis is retained, and a conclusion is made that there is insufficient evidence that there is a significant interaction (McAllister, 2022). Visually, this would be observed in a plot of cell means in which the plots are parallel.

Once the ANOVA hypotheses were tested, and conclusions were made about the significance of differences in the means among the levels of the CFs, there was further question about the effect sizes of significant relationships. These were analyzed using the Parameter Estimates table which provides values for each level of the CFs that can be used to calculate the predicted value of a specific effect (McAllister, 2022).

The goodness-of-fit test measured how much of the variation in the RV was attributed to the model of the CFs and their interactions. When there was significance, but a low goodness-of-fit, I followed the guidance of McAllister (2022) and determined it is likely that there are other significant predictors that should be considered. Similarly, partial eta squared (η^2) was calculated in SPSS for each CF. Partial η^2 values range from 0 to 1 and measure the proportion of variance in the RV explained by each CF while accounting for variance explained by other CFs in the model. It is a measure of the influence of each CF and was helpful in predictive model-building and variable selection.

A final interpretation of results can only be made by simultaneously considering all influential factors through a final mathematical model that has been developed using a rigorous and sequential model-building process. This process included identification of candidate predictors through a review of *F test*s and associated *p* values; inclusion of significant CFs based on model adjusted R^2, and variable *p* value and partial η^2; iterative evaluations of various combinations of CFs and 2FIs; identification of the best model of predictors and factor interactions; and validation of the predictive model through goodness-of-fit test and partial eta squared.

Threats to Validity

External Validity

External validity relates to how well the sample represents the larger population (Schenker & Rumrill, 2004). To address external validity in correlational studies, Schenker and Rumrill (2004) recommended using random sampling and a large sample. Pure random sampling was not practicable for this study because the population is large and difficult to define. In lieu of random sampling, I aimed to select participants using stratified sampling to ensure they are representative of the population's relevant demographic characteristics (Schenker & Rumrill, 2004; Shadish et al., 2002). I required that participants be members of the Canadian CEIs and have site-based work as a component of their job. I calculated a sample size of 216 participants for my study that adequately protects against type I and II statistical errors. In this way, I aimed to ensure that participants were representative of the population's relevant demographic characteristics and that there was an adequate sample size.

Internal Validity

McMillan (2000) described internal validity as being synonymous with internal *credibility*. McMillan argued that within nonexperimental studies, internal credibility is threatened by an extensive list of statistical, relationship, or causal conclusions; and while his list is, self-admittedly, too extensive to be practical, it does offer several points with which to demonstrate the internal validity of this study. Perhaps the most discussed issue related to validity is type I and type II errors. The first leads to a false-positive and the second to a false negative. However, to minimize the potential for type I errors, the alpha

was set to $\alpha = 0.05$; for type II errors, the statistical power was set to 90% and a sample size of 216 participants was determined by using G*Power calculations. McMillan noted that violations of the assumptions related to a statistical test are also problematic; however, this study minimized the threat by testing each of the assumptions of ANOVA. Further efforts to strengthen internal validity were taken through the transparency of data cleaning and screening actions during initial data analysis.

Construct Validity

The measurements used in my study were based on validated, peer-reviewed, and published measures which minimize threats to construct validity in several ways. First, the COPSOQ has a strong theoretical foundation that is based on a number of well-established models and theories as described earlier and detailed by Kristensen et al. (2005). The questionnaire includes items that comprehensively capture the various dimensions of psychosocial hazards which were relevant to this study. The content validity of the COPSOQ was established through the involvement of experts in the development process and Ramkisoon et al.'s (2018) validation of the questionnaire in Canada bolsters validity within the Canadian population. Additionally, the COPSOQ demonstrates good criterion-related validity by exhibiting significant correlations with other established measures of psychosocial factors and work-related outcomes, as described earlier in this chapter.

Ethical Procedures

Maintaining ethical standards during research is a primary concern for universities, governments, and researchers. Approval for this study was obtained from the

Walden University Institutional Review Board (approval number: 07-31-23-1125598). A review of requirements for ethical approvals in Canada indicated that no separate approval was required (Canadian Institutes of Health Research et al., 2018). There were several ethical procedures put in place to protect participants from unintended consequences of participation in the study. Primary ethical procedures related to confidentiality, data management, requirements for participation, and informed consent.

Requirements for Participation. Participants were required to be consenting adults, age 18 years or older, currently working in the Canadian CEIs, and having site-based work as a component of their employment.

Informed Consent and Voluntary Participation. Participation in research must be voluntary and requires informed and ongoing consent (Canadian Institutes of Health Research et al., 2018). Recruitment was done through social media platforms and snowball sampling. Participants were provided with a survey invitation (see Appendix A) which informed the participant of the nature of the study and provided them with a link to the questionnaire hosted on the survey platform service. The first page of the survey provided information about the study and then asked if they consent to participate in the research. If the participant chose not to consent, they were forwarded to an exit page; and if they provided consent, they were advanced to the survey questions. Additionally, all questions were voluntary, and the participant could exit the survey at any time. Participation in the survey was assessed and it was determined that participation would not increase the risk of safety or health beyond normal daily life.

Confidentiality. To ensure confidentiality throughout the study, I did not collect any personal information that would enable identification of the participant. I used aggregated data only to further protect the confidentiality of participants.

Data Management. Data were maintained in my personal Microsoft OneDrive cloud-based application which was password protected. The data will be stored in a file named PRF_Study_2023 or something similar. Data will be deleted after a period of five years has passed since data were collected.

Summary

In this chapter, I presented details of the research design and rationale, methodology, including population, sampling, recruitment, pilot study, and operationalization of constructs, as well as the data analysis plan, and threats to validity. I hypothesized that at least one of the CFs (age, gender, residence type, employment arrangement, and rotation status) would have a significant relationship with one or more of the 15 PRFs (quantitative demands, work pace, emotional demands, influence at work, possibilities for development, meaning of work and work commitment, predictability and rewards, role clarity, role conflict, leadership and social support, colleague social support, social community, job insecurity, work life conflict, and vertical trust and organizational justice). To test the hypothesis, I developed and implemented a plan for data analysis that minimized threats to validity and maintained the confidentiality of participants. The results of the study are discussed in Chapter 4.

Chapter 4: Results

The purpose of this quantitative study was to examine the relationship between measures of Canadian CEI workers' perspective of PRFs (RVs) and the CFs of age, gender, residence type, employment arrangement, and rotation status to understand how workers view PRFs within the workplace. PRFs have been shown to have a negative impact on workers' mental health in the CEIs (Chan et al., 2020; Sun et al., 2022; Tijani, Jin, & Osei-kyei, 2020); however, little has been done to tackle the issue from a risk management perspective. In this study, I sought to address the research problem that the lack of knowledge of the importance of PRFs from the perspective of Canadian CEI workers is impairing effective risk management and having a deleterious effect on workers' mental health.

To address the purpose of the study, the RQ was "What is the relationship between five demographic CFs (listed in Table 1) and PRFs in the Canadian CEIs as measured by 15 RVs (*F1* through *F15*, listed in Table 2)?"

For each of the RVs (*F1* through *F15*), the following are the ANOVA hypothesis pairs for each CF (*A*, *B*, . . .) and for each two-factor interaction (2FI: *A*B*):

The hypothesis of no difference in the RV due to factor A:

H_{A0}: $\mu_1 = \mu_2 = \cdots = \mu_i \cdots = \mu_m$ (the means for all levels of *A* are equal)

where the number of levels of factor $A = m$

H_{A1}: not all μ_i are equal.

The hypothesis of *no difference in the RV due to factor B* (which, as an example here, has two levels):

H_{B0}: $\mu_1 = \mu_2$ (means for both levels of *B* are equal)

where the number of levels of factor *B* = 2

H_{B1}: $\mu_1 \neq \mu_2$ (general form: not all μ_i are equal).

The hypothesis of no *interaction* between factors *A* and *B*:

H_{AB0}: the interaction of *A* and *B* is equal to zero.

H_{AB1}: the interaction of *A* and *B* is not equal to zero.

In Chapter 4, I begin with an in-depth discussion of the actual data collection process, including recruitment and response, assessment of how representative the sample is of the population of interest, and an overview of the variables and ANOVA methodology. Then, I present the study results, organized by hypotheses, and address the assumptions related to ANOVA. Additionally, I provide context to the CEI work environment, culture, and psychosocial challenges faced by workers by sharing qualitative information collected through the online survey and personal communication with participants. The chapter concludes with information about statistical tests of hypotheses that emerged from the analysis of main hypotheses.

Data Collection

Collection of Data

Data were collected using an online survey which was made available to the public from August 2, 2023, to September 25, 2023. Initially, the survey was planned to be available for 4 weeks. However, after the initial four weeks, it was apparent that more participants were needed to meet the overall minimum sample size and samples per group. I then extended the timeframe for a further 2 weeks and proceeded to email and

directly message candidates seeking their participation and asking them to forward the survey invitation to others. After 6 weeks, I had exhausted my personal connections and there was diminishing interest amongst social media users. After several days with zero additional survey completions, I closed the survey.

Response Rates

During the data collection period, I promoted the survey on four different social media platforms with varying degrees of success. For example, I made 43 posts on LinkedIn which yielded 8,893 impressions, whereas on Reddit, just three posts yielded 16,100 impressions. Both Facebook and Instagram limit access to analytics for personal users, so comparison data are not available for those social media sites. Despite a high number of impressions, survey completion rates were observed to be more likely after a one-to-one request to participate.

The survey had a completion rate of 72% (249 responses collected; 174 completed). Missing data were observed in 28% (n = 75) of the survey responses. The average time for completion was 16 minutes. By tracking the time spent promoting the survey across various sites, I was able to estimate that each sample collected required, on average, 30 to 45 minutes of social media promotion.

Discrepancies from the Data Collection Plan

The initial data collection plan used three social media platforms for recruitment of participants: LinkedIn, Facebook, and Instagram. After 4 weeks of data collection, at the suggestion of several participants, I included Reddit as a fourth social media platform for recruitment. In addition to the planned collection of data through an online survey,

four participants volunteered to provide qualitative feedback about their experiences. The additional qualitative data were collected through in-person interview, video interview, email, and text messaging.

Participant Demographics

A summary of the participant demographics (n = 174) is provided in Table 5. The sample ratios were representative of the population age ratios in the CEIs (see Statistics Canada, 2023). A greater proportion of women completed the survey than the industry proportion (see BC Hydro, 2023; Coastal GasLink, 2022; LNG Canada Development, 2023; Mining Industry Human Resources Council, 2016). Workers' living arrangements were representative in the sample and reflected a similar ratio as was reported by industry operators (see Coastal Gas Link, 2023; LNG Canada, 2023). Based on this analysis, the sample collected is considered representative of the greater population.

Table 5

Frequency of Participant Demographics

Demographic characteristics	Respondents	
	n	%
Age	174	100
18-30	11	6.3
31-45	85	48.9
Over 45	78	44.8
Gender	174	100
Male	111	63.8
Female	63	36.2
Residence type	174	100
Self-provided accommodation	51	29.3
Employer-provided accommodation: camp/lodge	90	51.7
Employer-provided accommodation: other	33	19.0
Employment arrangement	174	100
I work for the project/operation owner	87	50.0
I work for a prime contractor	35	20.1
I work for a subcontractor	52	29.9
Rotation status	174	100
On rotation	95	54.6
Off rotation	79	45.4

Univariate Analysis of the Response Variables

There were 15 RVs and therefore 15 multistage analyses. Questions pertaining to the RVs used a Likert-type response which produced answers which were numerical and ordinal using the scales provided in Table F1. RVs were calculated as the average response to a set of measures as outlined in Table 3. Each RV was a continuous, numerical variable expressed with two significant digits to the right of the decimal point (e.g., 24.26). A descriptive summary of the RVs is provided in Table 6 and includes the minimum value (Min), maximum value (Max), mean value (Mean), and standard deviation (Std Dev).

Table 6

Min, Mean, Max, and Standard Deviation for Non-Categorical Variables

Variable	Min	Max	Range	Mean	Std Dev
F1	0.00	100.00	100.00	48.51	21.91
F2	8.33	100.00	91.67	61.42	16.42
F3	0.00	100.00	100.00	55.73	21.11
F4	0.00	100.00	100.00	51.16	23.04
F5	16.67	100.00	83.33	74.04	18.42
F6	0.00	100.00	100.00	62.39	22.93
F7	0.00	100.00	100.00	49.17	23.29
F8	0.00	100.00	100.00	64.60	24.40
F9	8.33	100.00	91.67	55.06	21.79
F10	0.00	100.00	100.00	50.72	26.25
F11	0.00	100.00	100.00	58.24	28.14
F12	0.00	100.00	100.00	68.28	21.09
F13	6.25	100.00	93.75	43.75	19.39
F14	0.00	100.00	100.00	57.08	24.11
F15	6.25	100.00	93.75	54.66	19.74

Most variables (F1, F3, F4, F6, F7, F8, F10, F11, F12, F14) had a range of 100.00; however, two variables (F13 and F15) had a range of 93.75, two variables (F2 and F9) had a range of 91.67, and one variable (F5) had a range of 83.33. Variable means ranged from a minimum of 43.75 (F13) to a maximum of 74.04 (F5) and had an average of 56.99. Variable standard deviation ranged from a minimum of 16.42 (F2) to a maximum of 28.14 (F11) with a mean standard deviation of 22.14.

Study Results

The final data set had $n = 174$ records with no missing or corrupt data, with no outliers, and with viable CFs. Minimum sample size was calculated using G*Power v. 3.1.9.7 (Faul et al., 2009) using the following parameters:

- *F* tests; ANOVA: Fixed effects, special, main effects, and interactions
- Effect size (Cohen, 1988) = f = 0.25 (medium)
- Model level of significance = α = .05
- Model statistical power = 1 – β = .90
- Numerator df = largest number of CF levels – 1 = 3 – 1 = 2
- Groups: The number of groups defined by the CFs and their respective levels = 3 * 2 * 3 * 3 * 2 = 108

A post hoc power analysis, with the same parameters as the a priori sample size calculation and n = 174 yielded a statistical power = 1 – β = .83; or the ability to detect a medium size effect with 83% probability. Or, with statistical power = 1 – β = .90, the analysis could detect an effect size less than 0.28 (medium; Cohen, 1988) with a probability of 90%.

Methodology: Analysis of Variance (ANOVA)

Univariate ANOVA was selected as the statistical methodology because the CFs were categorical, and the RV was numerical. Analysis was performed using SPSS v.28 (IBM, 2023), general linear model technique. Two-way ANOVA evaluates two or more CFs and a single RV. There is no limit to the number of CFs or levels that can be analyzed using ANOVA. Predictive modeling, specifically *purposeful sequential model-building*, was used to select the set of CFs representing the model that best predicts the RV and assess the sensitivity of the RV to changes in the CFs. The following section describes the predictive ANOVA model, predictive modeling, and purposeful sequential model-building further which were used in this study.

Predictive ANOVA Model

The theoretical model for a two-way ANOVA was discussed in Chapter 1. The equation signifies that the value of *Y* for any RV is predicted to be the sum of the grand mean; the effects of factors *A*, *B*, etc.; and the interaction between each pair of CFs. The coefficients in the predictive equation represent the *estimated* effects in the ANOVA model. The difference between the actual value of Y_{ijk} and the estimated or predicted value ($\hat{Y}_{ijk}$,) is the *error term*, or the *residual*, for the k^{th} record. Two-factor interactions (2FIs) between the CFs are analyzed in ANOVA. A 2FI exists when the relationship between one CF and the RV changes depending on the value of another CF. 2FIs are calculated as the cross-product of each pair of CFs and tested in the analysis. They were evaluated as part of the ANOVA process the same as individual CFs and using graphical analysis.

Adjusted R^2, the coefficient of determination, is a measure of the goodness-of-fit of any predictive model; and indicates the extent to which the predictors as a group (model) contribute to the variance in the RV. When a model is a significant predictor of the RV (based on an *F* test), yet with a lower than desired adjusted R^2, there are likely other significant predictors of *Y* that should be considered. Partial eta squared (η^2) ranges from 0 to 1 and measures the proportion of variance in the RV explained by each CF while accounting for variance explained by other CFs in the model.

Predictive Model-Building

In ANOVA, as in other multivariate analytical techniques, it is not possible to make a truthful statement about the influence of any single CF without simultaneously

considering all influential factors which are expressed in a final mathematical model, developed through a rigorous, sequential model-building process (McAllister, 2023). Predictive model-building is a strategy and technique for finding the mathematical model that best predicts the RV based on the sample data. That model is the set of predictors (CFs and 2FIs) that minimizes bias and that fits the data the best. Model-building involves purposefully selecting the CFs and 2FIs, using objective criteria and a rigorous, iterative process, to develop the model that best predicts the RV.

Model-building is performed in four stages, as described by McAllister (2023). The first uses a combination of theory, previous research, empirical results, and subject matter expertise to identify candidate CFs. The second stage is a screening stage in which ANOVA is employed to identify and eliminate candidate CFs that are clearly unlikely to be significant predictors of the RV or do not contribute to the goodness-of-fit of the model. Then, in the third stage, the remaining candidate CFs and their 2FIs are analyzed using ANOVA. In the fourth and final stage, the results from the various analyses employed in previous stages are compared and considered as a collaborative body of evidence, to select the final predictive model.

Purposeful Sequential Model-Building

Purposeful sequential model-building is variously called *hierarchical*, *simultaneous, standard,* or *user-determined ANOVA* (Warner, 2013). This technique employs a series of manual, individual analyses using the SPSS *general linear model* tool—essentially a manual, thoughtful, and iterative stepwise approach. Because it is not an automatic run through a series of models, and because it uses an iterative approach to

eliminating and adding back terms, purposeful sequential model-building overcomes many of the pitfalls of automated stepwise model-building.

Purposeful sequential model-building begins with a candidate model in which all candidate CFs are entered as a block in the general linear model technique. Then, SPSS performs the calculations to generate a predictive model of selected CFs and 2FIs; and provides the statistical outcomes needed to evaluate the first model and each subsequent model assessed. The process considers the following after each run:

- the measure of goodness-of-fit of the model (adjusted R^2)
- the change of adjusted R^2 after a run for which a term was added or eliminated
- the significance of each predictor (Sig. or *p* value)
- the measure of the proportion of variance in the RV explained by each CF while accounting for variance explained by other CFs (partial η^2 or partial eta squared)

After each run, the analyst decides which terms (CFs and 2FIs) to add or eliminate. The model-building process is iterative, in the sense that the analyst may remove and then add back various predictors based on the effect on adjusted R^2 and based on knowledge obtained throughout the model-building process. In other words, a CF entered into the model at an early stage may subsequently be removed after other CFs are considered (Levine et al., 2011). Or the converse is possible—CFs removed early may be considered for re-entry at a later stage.

Avoiding Type II Errors—Variable Selection Criteria

There is a tendency among analysts to use the generally accepted level of significance of .05 and a power of .80 for all problems, without thinking through the implications and the objectives of the analysis (Heinze & Dunkler, 2017; Heinze et al., 2018). Selecting α and β reflects their relative importance. Choosing α = .05 and β = .20 means that a Type II error is four times more likely than a Type I error; or that guarding against a Type I error is four times as important.

For model-building, the reverse is true—there should be more concern with guarding against a Type II error. A Type II error is more damaging than a Type I error when deciding on whether to include or exclude a predictor (McAllister, 2023). This is because a false negative translates into *missing variable bias*, whereas a false positive generally contributes only to a noisier predictive model. The intent is to detect true effects with high probability (high statistical power), avoiding the failure to detect, or Type II error. A priori sample size calculation should choose parameters (α, β, and effect size) that reflect the objective of the analysis.

In addition, according to McAllister (2023), it is important to understand the difference between the level of significance of the full predictive model, and the criteria used to choose the predictors that make up this model. Using a variable selection criterion based on the overall model level of significance (often α = .05) is inappropriate. McAllister advised the model should be developed based on a more reasonable criterion for each of the predictors and focus more on the impact on model goodness-of-fit (adjusted R^2). The final model can be evaluated using the commonly used level of

significance (.05), but that should not be confused with the criteria for including predictors where the focus is on fitting the best model, not solely the significance of each term. This strategy favors avoiding missing variable bias at the cost of losing some precision—adding noise to the model (Heinze et al., 2018).

Using an overly stringent variable selection criterion, especially with documented issues with stepwise ANOVA can lead to eliminating good predictors. With an over-specified model, there is always the option to assess the model in later stages or subsequent analyses using a more stringent variable inclusion criterion. A comparison of models, collaboratively examining the significance of predictors (*p* value or Sig.), contribution to variation in the RV (partial η^2), model goodness-of-fit (adjusted R^2), and subject matter and analyst judgment, is the most effective strategy for developing the final predictive model.

In seeking adequate statistical power ($1 - \beta$) over level of significance (α), the strategy of avoiding Type II errors translates into using a relatively liberal variable selection criterion during the model-development process, perhaps the reverse of conventional practice—to select $\beta = .05$ (high statistical power) and α (variable selection criterion) = .20. This is a relatively tolerant criterion for including terms, used early in the analysis; with a focus on the contribution of each term to goodness-of-fit (Heinze & Dunkler, 2017). This reflects a willingness to accept a higher risk of the Type I error; but increases the likelihood of finding a true effect (an influential predictor). The sample size for the experiment is then dictated by the operationally based effect size, α, and β.

During the model-building process, at each step (after each SPSS run) the significance of individual predictors, their partial η^2, and the impact on adjusted R^2 when deciding whether to eliminate them or add them back is evaluated. This makes the process iterative, trying different combinations of predictors, and eliminating and adding back with two objectives: (a) increase goodness-of-fit (adjusted R^2) and (b) develop a model with each predictor's p value (Sig.) < .20. Toward the end of this process, the focus tends more toward the variable selection criterion, sacrificing some goodness-of-fit to ensure no junk variables are included in the model. Also, a more stringent variable selection criterion (.05) can be employed later in the analysis. In this step, predictors with p values (Sig.) > .05 can be eliminated to see the effect on adjusted R^2. However, the priority is for each predictor's p value < .20 while maximizing adjusted R^2.

Evaluation of Statistical Assumptions

Several assumptions were tested prior to conducting ANOVA on each of the 15 RVs. The following assumptions were tested and validated:

- The IVs (CFs) represented two or more categorical and independent groups (see Table 1).
- The RVs were continuous, numerical variables which were obtained using Likert-type questions with quantitative values.
- Independent observations: There were no time-related relationships between observations due to the nature of randomized data collection. This was checked with a scatterplot of the RVs over time.

- There were no influential cases: The RVs were checked to ensure none were more than three standard deviations from its overall mean.
- Normality: Each RV was checked using a normal probability plot to ensure that experimental errors (residuals) were approximately normally distributed.
- Homogeneity of variance: Each combination of groups/levels/values were checked using Levene's test at the beginning and again post-hoc to evaluate the null hypothesis that the variance in the residuals is equal for all groups.

Statistical Analysis Findings

I examined the effect of five IVs and 10 2FIs on workers' views of 15 RVs (F1 through F15). The original data set comprised n = 174 records and was sufficient for conducting ANOVA. For each RV, I employed the ANOVA purposeful sequential model-building process described earlier using the SPSS *General Linear Model* > *Univariate* method with one RV. Each analysis began with all five CFs as fixed factors with Type III sum of squares. The process employed a series of ANOVA runs on various combinations of CFs to find the best predictive model, considering the significance and influence of each predictor (*p* value and partial η^2) and the impact on goodness-of-fit (adjusted R^2) to decide which CFs to add or eliminate after each run. The process progressed incrementally, run to run, with iteration and various combinations of CFs until the best model of CFs was found (highest adjusted R^2, and all CFs' p values < variable selection criterion of .20). This following presents the results of statistical analysis for

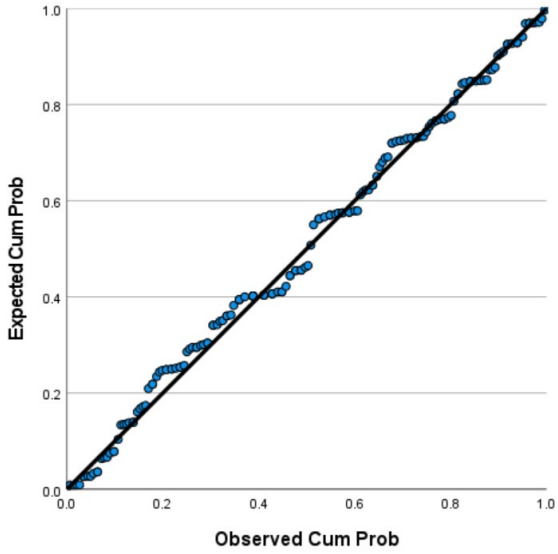
each RV, including the evaluation of assumptions for normal distribution of experimental errors and homogeneity of variance.

F1: Quantitative Demands

Assumption Testing. A preliminary test of assumptions was done using the full complement of CFs and 2FIs. In addition to the evaluation of statistical assumptions discussed earlier in this chapter, I also checked that the experimental errors (residuals) were approximately normally distributed as shown in the normal P-P plot depicted in Figure 4.

Figure 4

Normal Probability Plot of Residual for F1



Homogeneity of variance for each group (combination of factor levels or values) was checked in the beginning and again post hoc, using the Levene's test of equality of error variances, as shown in Table 7. In the test, the null hypothesis was not rejected (Sig. = .562), confirming the assumption of homogeneity of variance.

Table 7

F1: Levene's Test of Equality of Error Variances

Response variable: F1

F	df1	df2	Sig.
.961	61	112	.562

Tests the null hypothesis that the error variance of the response variable is equal across groups.
a. Design: Intercept + AGE + ARR + AGE * ARR + AGE * ROT + ARR * ROT + GDR * ARR

ANOVA Model-Building. I employed the ANOVA purposeful sequential model-building process described earlier in this chapter using the SPSS *General Linear Model* > *Univariate* method with one RV (*F1*). I found the best predictive model of the RV after 10 SPSS runs and model assessments with the main effects of *age* and *employment arrangement* and the 2FIs of *age*employment arrangement*, *age*rotation status*, *employment arrangement*rotation status, and gender*employment arrangement* each of which had a *p* value < .187. Table 8 shows the final predictive model for *F1: Quantitative demands*.

Table 8

F1: Test of Between Subject Effects

Response variable: F1

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	17168.536[a]	16	1073.033	2.539	.002	.206	40.621	.990
Intercept	99677.423	1	99677.423	235.840	<.001	.600	235.840	1.000
AGE	2691.746	2	1345.873	3.184	.044	.039	6.369	.603
ARR	3018.048	2	1509.024	3.570	.030	.044	7.141	.656
AGE * ARR	2927.539	4	731.885	1.732	.146	.042	6.927	.521
AGE * ROT	2683.149	2	1341.575	3.174	.045	.039	6.348	.601
ARR * ROT	1805.330	2	902.665	2.136	.122	.026	4.271	.433
GDR * ARR	2050.939	3	683.646	1.618	.187	.030	4.853	.419
Error	66355.871	157	422.649					
Total	491460.001	174						
Corrected Total	83524.406	173						

a. R Squared = .206 (Adjusted R Squared = .125)

b. Computed using alpha = .05

The effect for each significant CF and 2FI in the final model for this analysis can be derived from the parameter estimates table shown in Tables 9-10.

Table 9

F1: Parameter Estimates Table

Response variable: F1

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	Partial Eta Squared
Intercept	24.628	13.375	1.841	0.067	-1.791	51.047	0.021
[AGE=X45]	16.724	14.590	1.146	0.253	-12.094	45.543	0.008
[AGE=Y31]	27.786	14.677	1.893	0.060	-1.203	56.775	0.022
[AGE=Z18]	0[a]						
[ARR=QOWNER]	34.990	17.174	2.037	0.043	1.068	68.911	0.026
[ARR=RSUB]	-7.214	18.497	-0.390	0.697	-43.749	29.322	0.001
[ARR=SPRIME]	0[a]						
[AGE=X45] * [ARR=QOWNER]	-29.806	16.421	-1.815	0.071	-62.241	2.629	0.021
[AGE=X45] * [ARR=RSUB]	21.727	19.166	1.134	0.259	-16.130	59.584	0.008
[AGE=X45] * [ARR=SPRIME]	0[a]						
[AGE=Y31] * [ARR=QOWNER]	-24.300	16.477	-1.475	0.142	-56.845	8.245	0.014
[AGE=Y31] * [ARR=RSUB]	14.845	18.559	0.800	0.425	-21.813	51.502	0.004
[AGE=Y31] * [ARR=SPRIME]	0[a]						
[AGE=Z18] * [ARR=QOWNER]	0[a]						
[AGE=Z18] * [ARR=RSUB]	0[a]						
[AGE=Z18] * [ARR=SPRIME]	0[a]						
[AGE=X45] * [ROT=NON]	11.396	7.134	1.597	0.112	-2.696	25.488	0.016
[AGE=X45] * [ROT=POF]	0[a]						
[AGE=Y31] * [ROT=NON]	-5.790	6.864	-0.844	0.400	-19.348	7.767	0.005
[AGE=Y31] * [ROT=POF]	0a						
[AGE=Z18] * [ROT=NON]	3.577	16.237	0.220	0.826	-28.495	35.649	0.000

Table 10

F1: Parameter Estimates Table (continued)

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	Partial Eta Squared
Intercept	24.628	13.375	1.841	0.067	-1.791	51.047	0.021
[AGE=Z18] * [ROT=POF]	0[a]						
[ARR=QOWNER] * [ROT=NON]	-11.009	7.632	-1.443	0.151	-26.084	4.065	0.013
[ARR=QOWNER] * [ROT=POF]	0[a]						
[ARR=RSUB] * [ROT=NON]	-18.701	9.372	-1.995	0.048	-37.214	-0.189	0.025
[ARR=RSUB] * [ROT=POF]	0[a]						
[ARR=SPRIME] * [ROT=NON]	0[a]						
[ARR=SPRIME] * [ROT=POF]	0[a]						
[GDR=Fema] * [ARR=QOWNER]	-0.201	4.711	-0.043	0.966	-9.506	9.105	0.000
[GDR=Fema] * [ARR=RSUB]	13.626	8.204	1.661	0.099	-2.580	29.831	0.017
[GDR=Fema] * [ARR=SPRIME]	-8.861	6.276	-1.412	0.160	-21.257	3.535	0.013
[GDR=Male] * [ARR=QOWNER]	0[a]						
[GDR=Male] * [ARR=RSUB]	0[a]						
[GDR=Male] * [ARR=SPRIME]	0[a]						

a. This parameter is set to zero because it is redundant.
b. Computed using alpha = .05

ANOVA Hypotheses. I tested the null hypotheses for the final model (no difference in RV means for each level of that factor) using a level of significance equal to the variable inclusion criterion (.20). For each CF in the final model, I rejected the null hypothesis. I concluded that there is a difference in mean values of *F1: Quantitative demands* for different levels of *age* and *employment arrangement*. In addition, tests for the hypothesis that there is a difference in mean of *F1: Quantitative demands* as a

function of the 2FIs of *age*employment arrangement*, *age*rotation status*, *employment arrangement*rotation status, and gender*employment arrangement.*

Interpret, Test, and Use the Final Model. Various statistical outputs of SPSS are used to interpret the result. Based on the results in Table 8, the final predictive model is a statistically significant predictor of *F1: Quantitative demands* ($F = 2.539$, $p = .002 < \alpha = .05$). Based on adjusted $R^2 = .125$ from the same table, the predictive model accounts for approximately 13% of the variation in *F1: Quantitative demands* for the data set. The relatively low adjusted R^2 indicates that approximately 87% of the variation in *F1: Quantitative demands* is attributed to noise (statistical variation) or other CFs.

Note that in this model, and all subsequent models, for each of the CFs, their values were coded for the purpose of executing the least squares approach to the general linear model. Therefore, for each CF, there is a baseline value whose coefficient (B) is zero. All other coefficients reflect the difference in mean value of the RV compared to the baseline case.

The final model can be used to predict a value for *F1: Quantitative demands* based on the values of the predictors in the model (the CFs), using Tables 9 and 10. Predicted values of the RV can be compared to actual values from the data set as a method of validating the predictive, mathematical model. *F1: Quantitative demands* can be predicted for the case when any case by adding the intercept coefficient to the coefficient for each of the values of the CFs for that case.

Control Factors. For each of the CFs, the value of *F1: Quantitative demands* predicted can be shown in the bar charts in Figures 5-6. As a reminder, higher numerical

values on the quantitative demands scale correspond to increased perceptions of quantitative demands.

Figure 5

F1: Quantitative Demands as a Function of Age

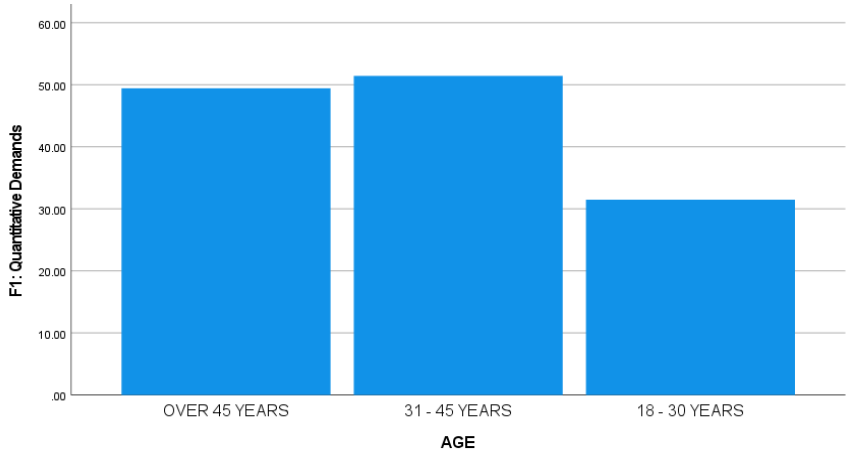
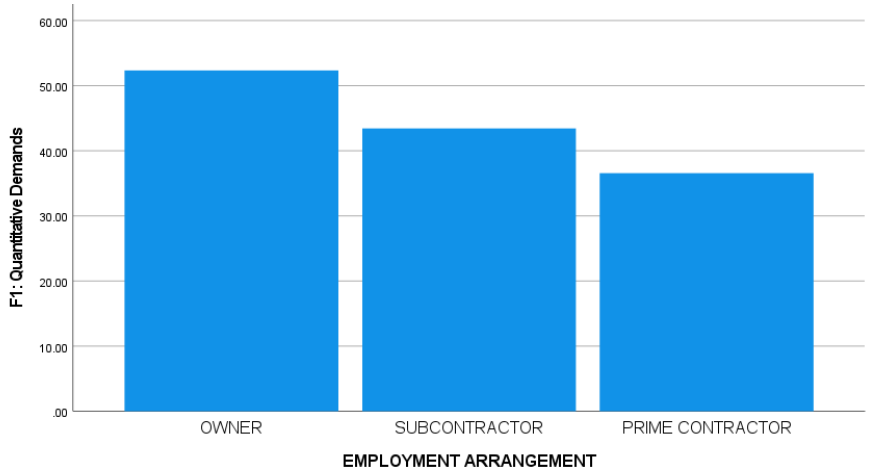


Figure 6

F1: Quantitative Demands as a Function of Employment Arrangement



Two-Factor Interactions (2FIs). Four 2FIs were found to be significant predictors of *F1: Quantitative demands*: *age*employment arrangement*, *age*rotation status, employment arrangement*rotation status*, *and gender*employment arrangement*. The 2FIs are confirmed and interpreted using graphical analysis as shown in Figures 7-14.

The first 2FI, *age*employment arrangement*, is composed of two CFs which are significant predictors by themselves. Figures 7 and 8 show that the highest quantitative demands are experienced by subcontract workers over 45 years of age whereas the lowest quantitative demands are experienced by subcontract workers aged 18 – 30 years.

Figure 7

*F1: 2FI: Age*Employment Arrangement; View 1*

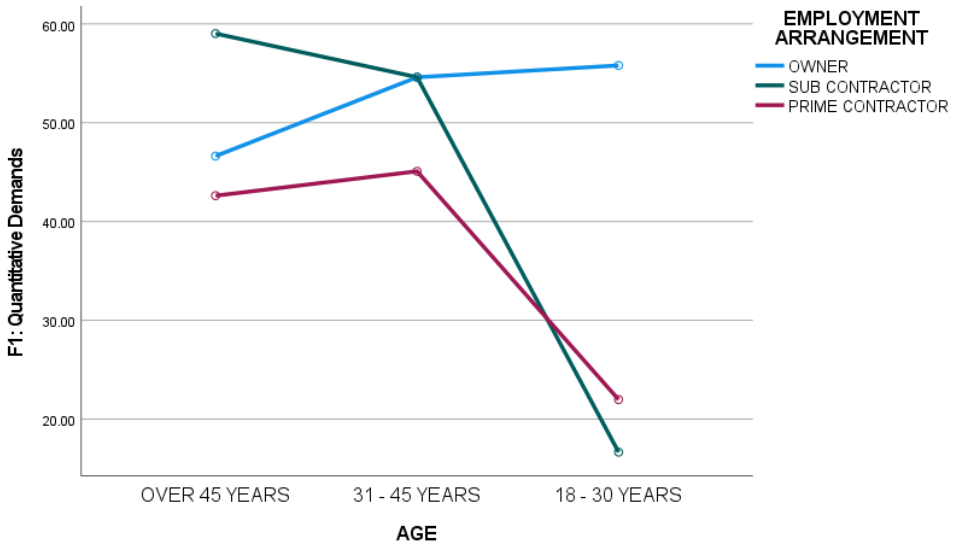
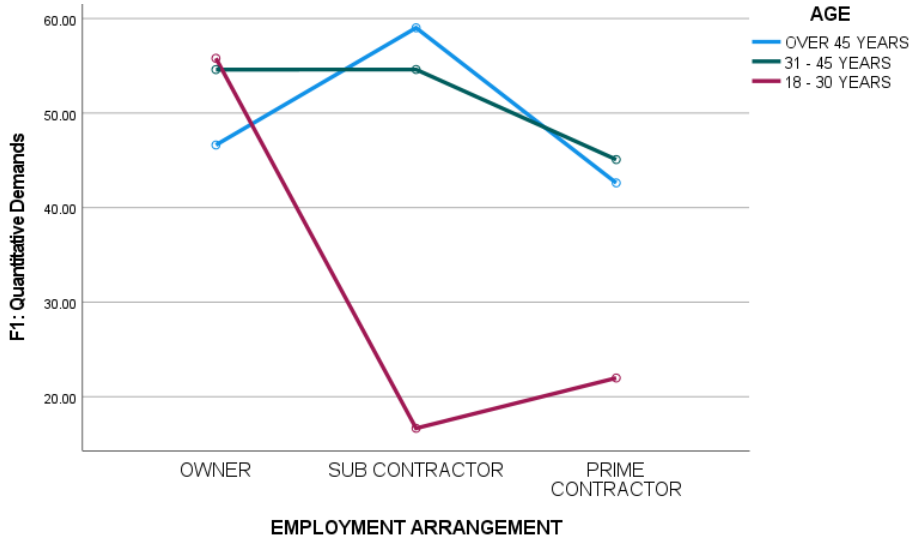


Figure 8

*F1: 2FI: Age*Employment Arrangement; View 2*



The other three 2FIs: *age*rotation status*, *employment arrangement*rotation status*, and *gender*employment arrangement* are each composed of one CF which had a significant influence on *F1: Quantitative demands* by itself. Figures 9 and 10 show that *age* moderates the influence of *rotation status*. Figures 11-14 illustrate that *employment arrangement* moderates the influence of *rotation status* and *gender* on workers views of *F1: Quantitative demands*. Highest levels of quantitative demands were experienced by workers who were 31-45 years of age and off rotation, employed by an owner and off rotation, and men and women employed by an owner. Comparatively, lowest levels of quantitative demands were experienced by workers who were 18-30 years of age and on rotation, those employed by a prime contractor and off rotation, and women employed by prime contractors.

Figure 9

*F1: 2FI: Age*Rotation Status; View 1*

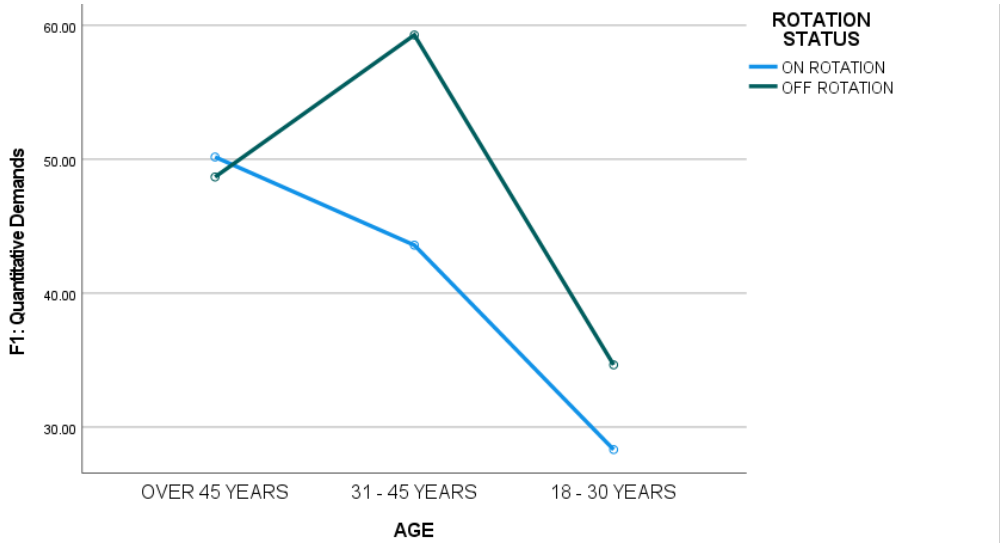


Figure 10

*F1: 2FI: Age*Rotation Status; View 2*

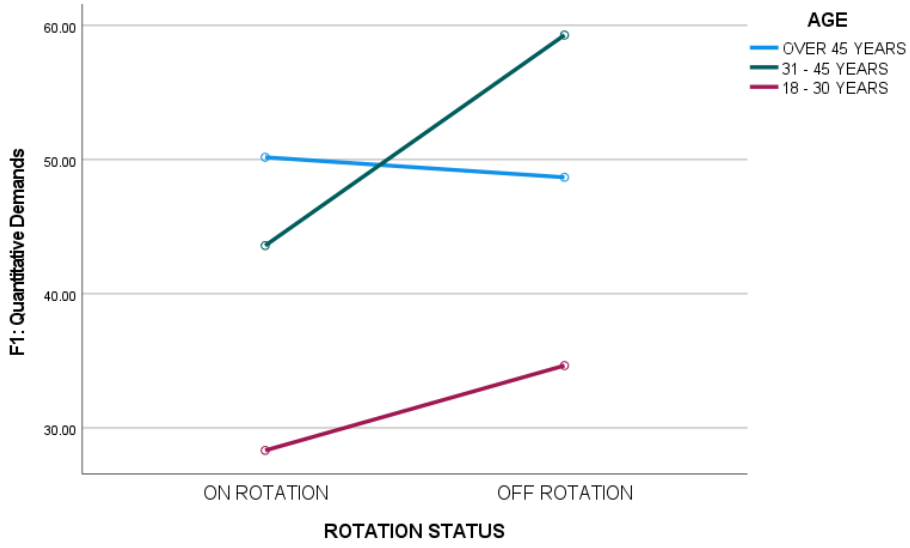


Figure 11

*F1: 2FI: Employment Arrangement*Rotation Status; View 1*

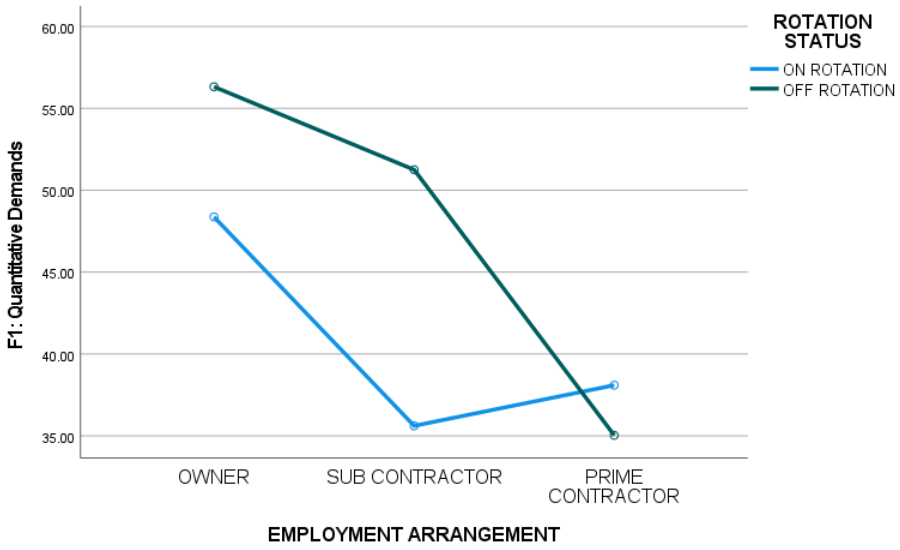


Figure 12

*F1: 2FI: Employment Arrangement*Rotation Status; View*

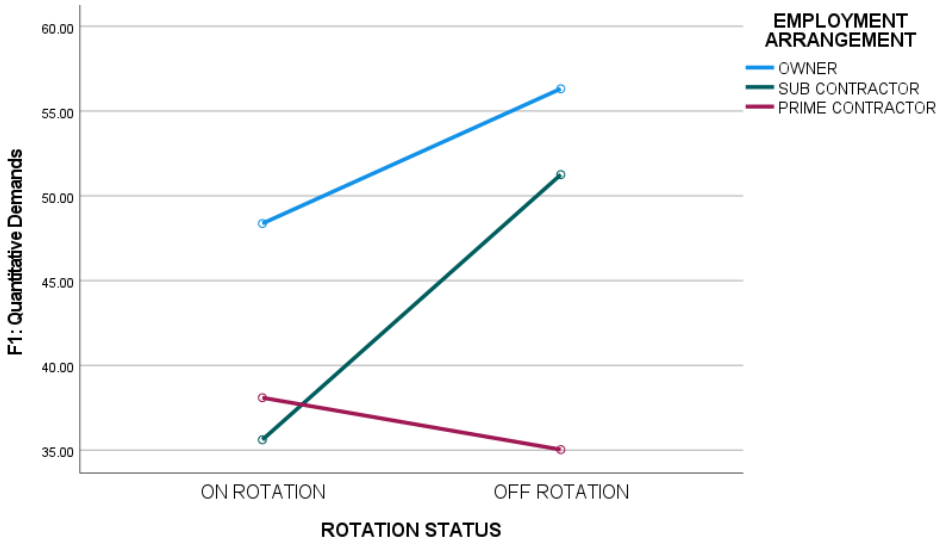


Figure 13

*F1: 2FI: Gender*Employment Arrangement; View 1*

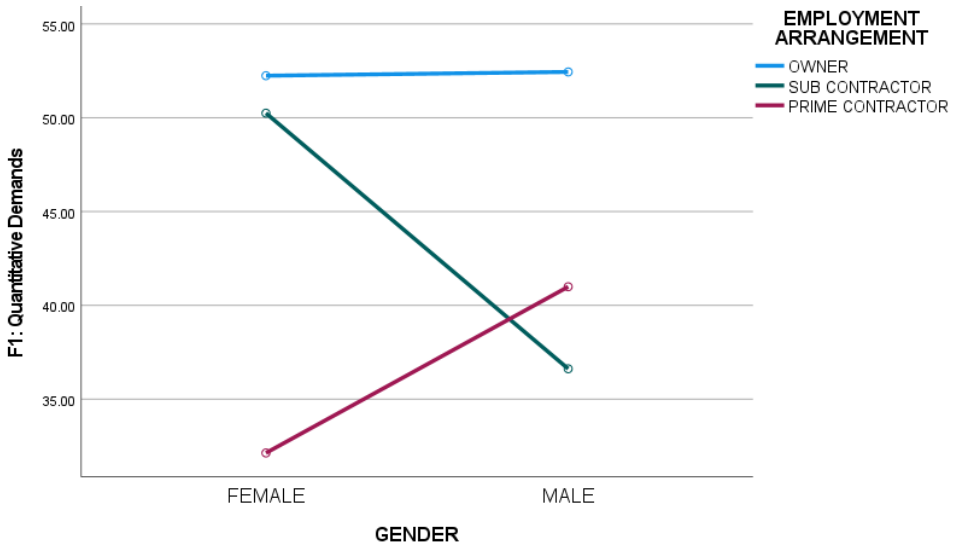
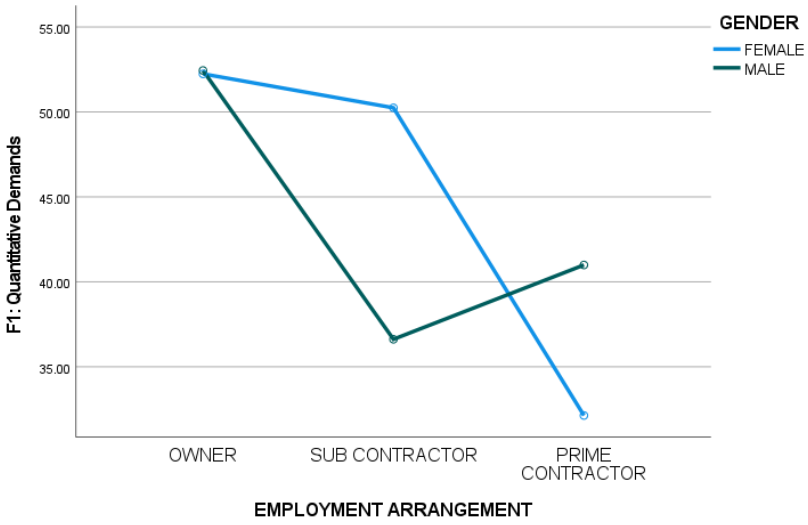


Figure 14

*F1: 2FI: Gender*Employment Arrangement; View 2*



F2: Work Pace

There were no significant predictors, either CFs or 2FIs, in the best model I could develop based on adjusted R^2. Further, no model, including the best goodness-of-fit model, was a significant predictor of the RV based on comparing p-value to a level of significance of $\alpha = .05$.

F3: Emotional Demands

There were no significant predictors, either CFs or 2FIs, in the best model I could develop based on adjusted R^2. Further, no model, including the best goodness-of-fit model, was a significant predictor of the RV based on comparing p-value to a level of significance of $\alpha = .05$.

F4: Influence at Work

Assumption Testing. In addition to the evaluation of statistical assumptions discussed earlier in this chapter which were applied to all analyses, I also checked that the experimental errors (residuals) were approximately normally distributed as shown in the normal P-P plot depicted in Figure 15.

The homogeneity of variance for each group (combination of factor levels or values) was checked in the beginning and again post hoc, using the Levene's test of equality of error variances, as shown in Table 11. In the test, the null hypothesis was not rejected (Sig. = .347), confirming the assumption of homogeneity of variance.

Figure 15

Normal Probability Plot of Residual for F2

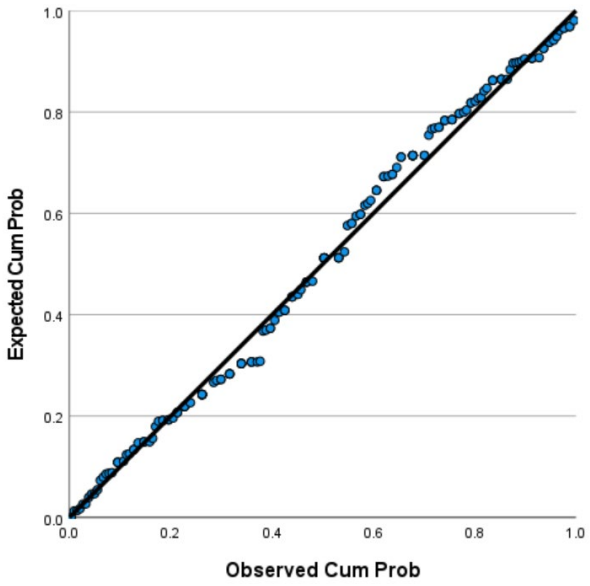


Table 11

F4: Levene's Test of Equality of Error Variances

Response variable: F4

F	df1	df2	Sig.
1.087	61	112	.347

Tests the null hypothesis that the error variance of the response variable is equal across groups.

a. Design: Intercept + AGE + GDR + ACC * ROT

ANOVA Model-Building. I employed ANOVA purposeful sequential model-building process described earlier using the SPSS *General Linear Model* > *Univariate* method with one RV (*F4*). I found the best predictive model of the RV after 17 SPSS runs and model assessments. The main effects of *age* and *gender* and the 2FI of

*accommodation type*rotation status* each had a *p* value < .046. Table 12 shows the final predictive model for *F4: Influence at work.*

Table 12

F4: Test of Between Subject Effects

Response variable: F4

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	16085.941[a]	8	2010.743	4.348	<.001	0.174	34.781	0.995
Intercept	132784.532	1	132784.532	287.108	<.001	0.635	287.108	1.000
AGE	7817.840	2	3908.920	8.452	<.001	0.093	16.904	0.963
GDR	2862.063	1	2862.063	6.188	0.014	0.036	6.188	0.696
ACC * ROT	5354.323	5	1070.865	2.315	0.046	0.066	11.577	0.735
Error	76310.790	165	462.490					
Total	548906.250	174						
Corrected Total	92396.731	173						

a. R Squared = .174 (Adjusted R Squared = .134)

b. Computed using alpha = .05

The effect for each significant CF and 2FI in the final model for this analysis can be derived from the parameter estimates table shown in Table 13.

Table 13

F4: Parameter Estimates Table

Response variable: F4

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	Partial Eta Squared
Intercept	35.626	7.717	4.617	0.000	20.389	50.863	0.114
[AGE=X45]	26.879	7.102	3.785	0.000	12.856	40.902	0.080
[AGE=Y31]	17.820	6.998	2.546	0.012	4.003	31.637	0.038
[AGE=Z18]	0[a]						
[GDR=Fema]	-8.744	3.515	-2.488	0.014	-15.684	-1.804	0.036
[GDR=Male]	0[a]						
[ACC=TLODGE] * [ROT=NON]	-6.720	4.631	-1.451	0.149	-15.863	2.424	0.013
[ACC=TLODGE] * [ROT=POF]	-2.996	5.714	-0.524	0.601	-14.278	8.285	0.002
[ACC=UOTHER] * [ROT=NON]	-9.409	7.347	-1.281	0.202	-23.916	5.098	0.010
[ACC=UOTHER] * [ROT=POF]	7.461	6.023	1.239	0.217	-4.432	19.354	0.009
[ACC=VSELF] * [ROT=NON]	6.726	6.395	1.052	0.294	-5.901	19.354	0.007
[ACC=VSELF] * [ROT=POF]	0[a]						

a. This parameter is set to zero because it is redundant.

b. Computed using alpha = .05

ANOVA Hypotheses. I tested the null hypotheses for the final model (no difference in RV means for each level of that factor) using a level of significance equal to the variable inclusion criterion (.20). For each CF in the final model, I rejected the null hypothesis. I concluded that there is a difference in mean values of *F4: Influence at work* for different levels of *age* and *gender*. In addition, tests for the hypothesis that there is a

difference in mean of *F4: Influence at work* as a function of 2FIs yielded one significant 2FI: *accommodation type*rotation status*.

Interpret, Test, and Use the Final Model. Various statistical outputs of SPSS are used to interpret the result. Based on the results in Table 12, the final predictive model is a statistically significant predictor of *F4: Influence at work* ($F = 4.348$, $p < .001 < \alpha = .05$). Based on adjusted $R^2 = .134$ from the same table, the predictive model accounts for approximately 13% of the variation in *F4: Influence at work* for the data set. The adjusted R^2 indicates that approximately 87% of the variation in *F4: Influence at work* is attributed to noise (statistical variation) or other CFs.

The final model can be used to predict a value for *F4: Influence at work* based on the values of the predictors in the model (the CFs), using Table 13. Predicted values of the RV can be compared to actual values from the data set as a method of validating the predictive, mathematical model. *F4: Influence at work* can be predicted for any case by adding the intercept coefficient to the coefficient for each of the values of the CFs for that case.

Control Factors. For each of the CFs, the value of *F4: Influence at work* predicted can be shown in the bar charts in Figures 16-19. As a reminder, higher numerical values on the influence at work scale correspond to increased perceptions among workers regarding higher levels of influence at work in their job or tasks.

Figure 16

F4: Influence at Work as a Function of Age

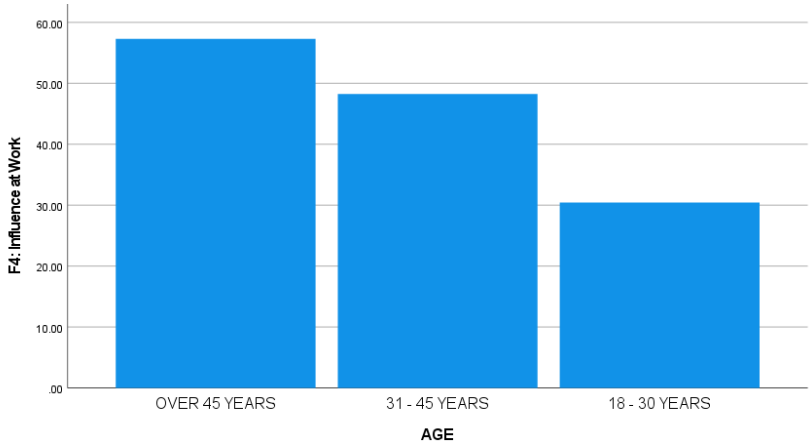
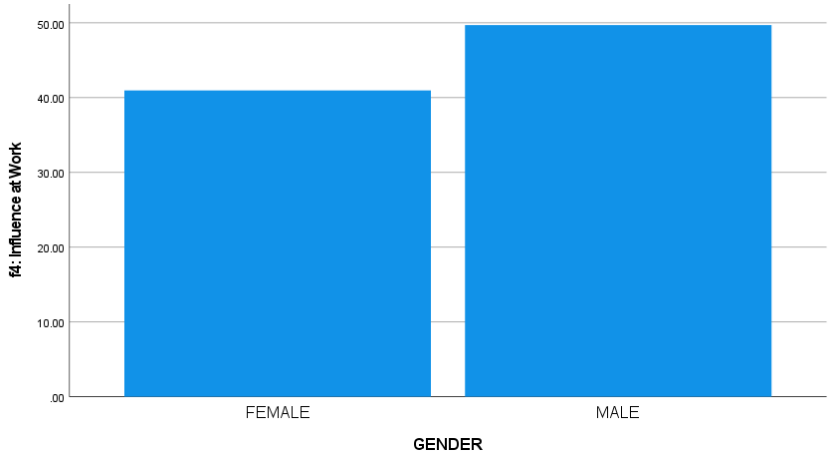


Figure 17

F4: Influence at Work as a Function of Gender



Two-Factor Interactions (2FIs). A single 2FI was found to be a significant predictor of *F4: Influence at work: accommodation type*rotation status.* The 2FI is confirmed and interpreted using graphical analysis as shown in Figures 18 and 19. The 2FI is composed of two CFs which were not significant predictors by themselves.

However, the combination of accommodation type and rotation status was an influence on *F4: Influence at work*.

Workers who were off rotation and living in employer-provided accommodation other than camp/lodge perceived their influence to be high when off rotation whereas the same group reported the lowest levels of influence when they were on rotation. Comparatively, workers who were on rotation and living in self-provided accommodation reported higher levels of influence at work than workers living in employer-provided accommodation of any type.

Figure 18

*F4: 2FI: Accommodation Type*Rotation Status; View 1*

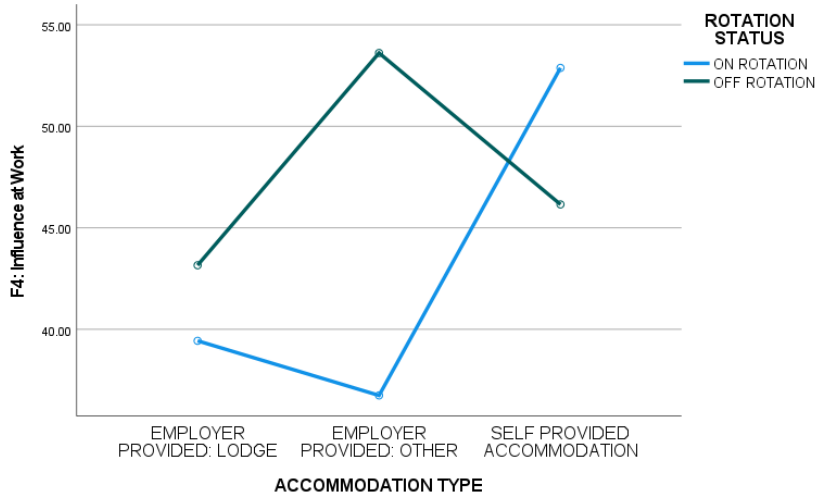
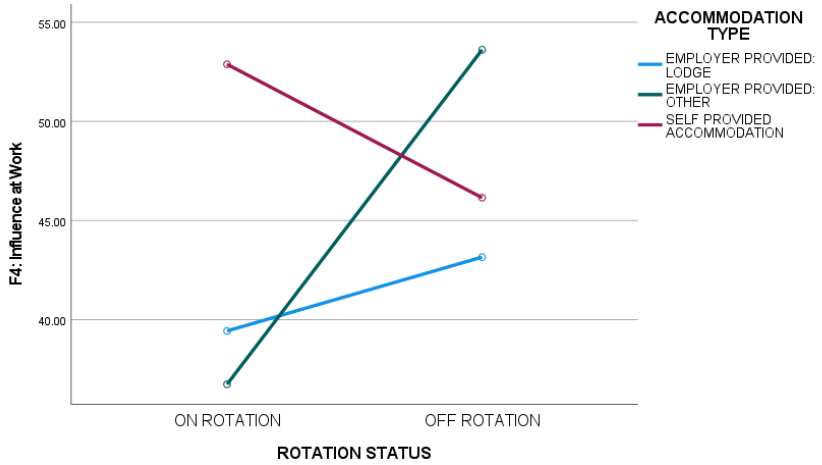


Figure 19

*F4: 2FI: Accommodation Type*Rotation Status; View 2*

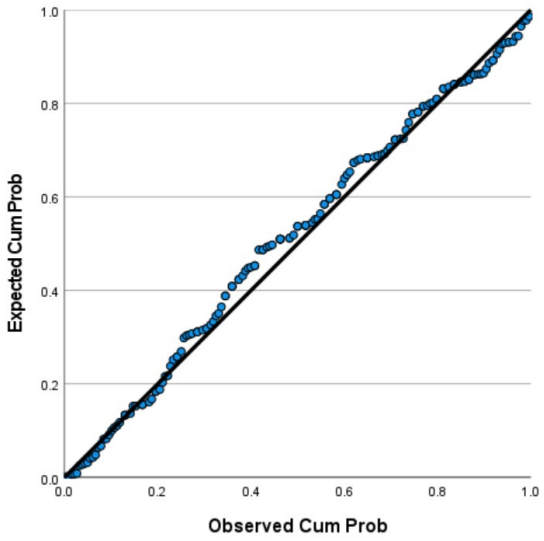


F5: Possibilities for Development

Assumption Testing. In addition to the evaluation of statistical assumptions discussed earlier, I checked that the experimental errors (residuals) were approximately normally distributed as shown in the normal P-P plot depicted in Figure 20.

Figure 20

Normal Probability Plot of Residual for F5



Homogeneity of variance for each group (combination of factor levels or values) was checked in the beginning and again post hoc, using the Levene's test of equality of error variances, as shown in Table 14. In the test, the null hypothesis was not rejected (Sig. = .676), confirming the assumption of homogeneity of variance.

Table 14

F5: Levene's Test of Equality of Error Variances

Response variable: F5

F	df1	df2	Sig.
.897	61	112	.676

Tests the null hypothesis that the error variance of the response variable is equal across groups.

a. Design: Intercept + AGE + ARR + GDR*ACC + AGE*ARR + AGE*GDR

ANOVA Model-Building. I employed ANOVA purposeful sequential model-building process described earlier using the SPSS *General Linear Model > Univariate* method with one RV (*F5*). I found the best predictive model of the RV after 17 SPSS runs and model assessments with the main effects of *age* and *employment arrangement* and the 2FIs of *gender*accommodation type*, *age*employment arrangement*, and *age*gender* each of which had a *p* value < .190. Table 15 shows the final predictive model for *F5: Possibilities for development*.

Table 15

F5: Test of Between Subject Effects

Response variable: F5

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	10320.372[a]	15	688.025	2.231	0.007	0.175	33.469	0.971
Intercept	294329.075	1	294329.075	954.507	0.000	0.858	954.507	1.000
AGE	1499.064	2	749.532	2.431	0.091	0.030	4.861	0.484
ARR	1867.119	2	933.559	3.028	0.051	0.037	6.055	0.580
GDR * ACC	3113.094	4	778.273	2.524	0.043	0.060	10.096	0.706
AGE * ARR	1915.285	4	478.821	1.553	0.190	0.038	6.211	0.472
AGE * GDR	1104.254	2	552.127	1.791	0.170	0.022	3.581	0.370
Error	48720.451	158	308.357					
Total	1015417.168	174						
Corrected Total	59040.823	173						

a. R Squared = .175 (Adjusted R Squared = .096)

b. Computed using alpha = .05

The effect for each significant CF and 2FI in the final model for this analysis can be derived from the parameter estimates table shown in Tables 16-17.

Table 16

F5: Parameter Estimates Table

Response variable: F5

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	74.827	9.103	8.220	0.000	56.848	92.805	0.300
[ARR=QOWNER]	21.856	12.289	1.779	0.077	-2.415	46.127	0.020
[ARR=RSUB]	19.057	15.458	1.233	0.219	-11.474	49.589	0.010
[ARR=SPRIME]	0[a]						
[GDR=Fema] * [ACC=TLODGE]	-29.428	12.683	-2.320	0.022	-54.478	-4.379	0.033
[GDR=Fema] * [ACC=UOTHER]	-26.972	13.432	-2.008	0.046	-53.501	-0.443	0.025
[GDR=Fema] * [ACC=VSELF]	-27.549	12.088	-2.279	0.024	-51.424	-3.675	0.032
[GDR=Male] * [ACC=TLODGE]	-11.646	4.145	-2.810	0.006	-19.833	-3.459	0.048
[GDR=Male] * [ACC=UOTHER]	-13.767	5.257	-2.619	0.010	-24.150	-3.383	0.042
[GDR=Male] * [ACC=VSELF]	0[a]						
[AGE=X45]	12.133	9.131	1.329	0.186	-5.901	30.167	0.011
[AGE=Y31]	-0.602	9.272	-0.065	0.948	-18.915	17.711	0.000
[AGE=Z18]	0[a]						
[AGE=X45] * [ARR=QOWNER]	-21.612	13.148	-1.644	0.102	-47.579	4.356	0.017
[AGE=X45] * [ARR=RSUB]	-28.197	16.764	-1.682	0.095	-61.307	4.913	0.018
[AGE=X45] * [ARR=SPRIME]	0[a]						
[AGE=Y31] * [ARR=QOWNER]	-9.844	13.098	-0.752	0.453	-35.714	16.026	0.004
[AGE=Y31] * [ARR=RSUB]	-15.034	16.412	-0.916	0.361	-47.449	17.382	0.005
[AGE=Y31] * [ARR=SPRIME]	0[a]						

Table 17

F5: Parameter Estimates Table (continued)

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	Partial Eta Squared
[AGE=Z18] * [ARR=QOWNER]	0[a]						
[AGE=Z18] * [ARR=RSUB]	0[a]						
[AGE=Z18] * [ARR=SPRIME]	0[a]						
[AGE=X45] * [GDR=Fema]	23.901	12.853	1.860	0.065	-1.485	49.286	0.021
[AGE=X45] * [GDR=Male]	0[a]						
[AGE=Y31] * [GDR=Fema]	18.304	12.408	1.475	0.142	-6.203	42.812	0.014
[AGE=Y31] * [GDR=Male]	0[a]						
[AGE=Z18] * [GDR=Fema]	0[a]						
[AGE=Z18] * [GDR=Male]	0[a]						

a. This parameter is set to zero because it is redundant.
b. Computed using alpha = .05

ANOVA Hypotheses. I tested the null hypotheses for the final model (no difference in RV means for each level of that factor) using a level of significance equal to the variable inclusion criterion (.20). For each CF in the final model, I rejected the null hypothesis. I concluded that there is a difference in mean values of *F5: Possibilities for development* for different levels of *Employment Arrangement*. In addition, tests for the hypothesis that there is a difference in mean of *F5: Possibilities for development* as a function of 2FIs yielded one significant 2FI: *gender*accommodation type*.

Interpret, Test, and Use the Final Model. Various statistical outputs of SPSS are used to interpret the result. Based on the results in Table 15, the final predictive

model is a statistically significant predictor of *F5: Possibilities for development* (F = 2.231, p = .007 < α = .05). Based on adjusted R^2 = .096 from the same table, the predictive model accounts for approximately 10% of the variation in *F5: Possibilities for development* for the data set and indicates that approximately 90% of the variation in *F5: Possibilities for development* is attributed to noise or other CFs.

The final model can be used to predict a value for *F5: Possibilities for development* based on the values of the predictors in the model (the CFs), using Tables 16-17. Predicted values of the RV can be compared to actual values from the data set as a method of validating the predictive, mathematical model. *F5: Possibilities for development* can be predicted for any case by adding the intercept coefficient to the coefficient for each of the values of the CFs for that case.

Control Factors. For each of the CFs, the value of F*5: Possibilities for development* predicted can be shown in the bar charts in Figures 21-22. As a reminder, higher numerical values on the quantitative demands scale correspond to increased perceptions among workers regarding possibilities for development.

Figure 21

F5: Possibilities for Development as a Function of Age

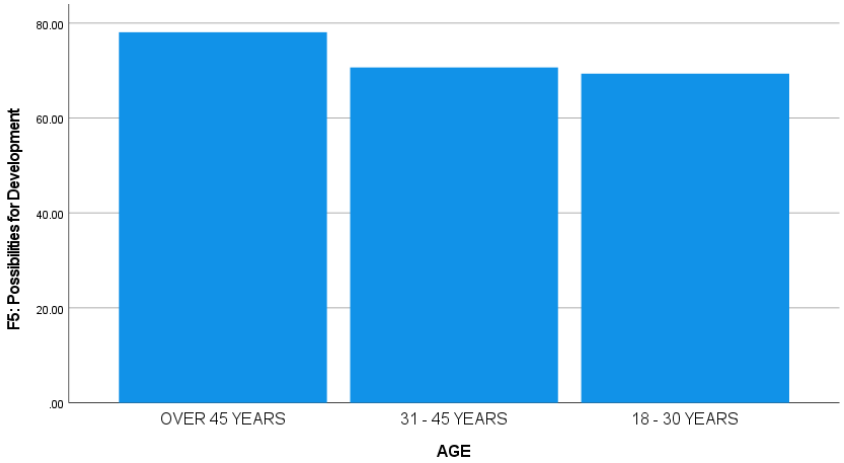
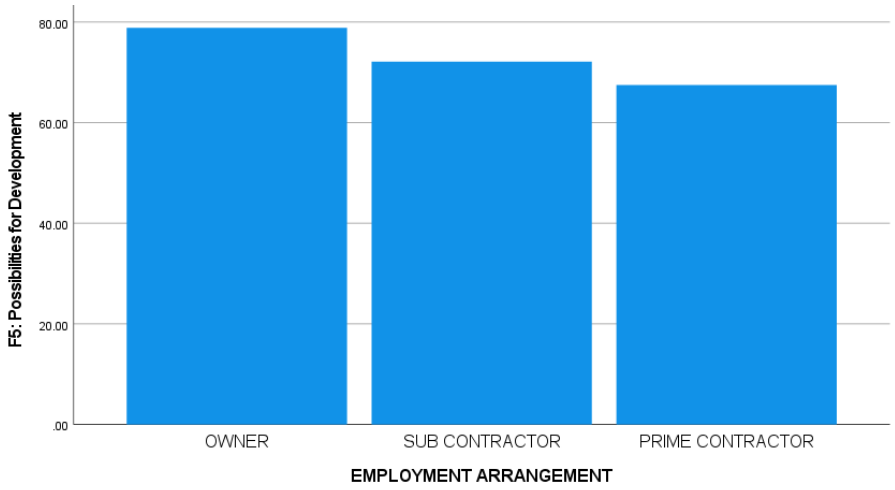


Figure 22

F5: Possibilities for Development as a Function of Employment Arrangement



Two-Factor Interactions (2FIs). Three 2FIs remained in the final model. The first 2FI, *gender*accommodation type*, is composed of two CFs which were not significant predictors by themselves but together produced a statistically significant influence on *F5: Possibilities for development*. Figures 23-24 show that the highest

perceived possibility for development is experienced by male workers who reside in self-provided accommodation whereas the lowest scores are reported by female workers living in employer provided lodge style accommodation.

Figure 23

*F5: 2FI: Gender*Accommodation Type; View 1*

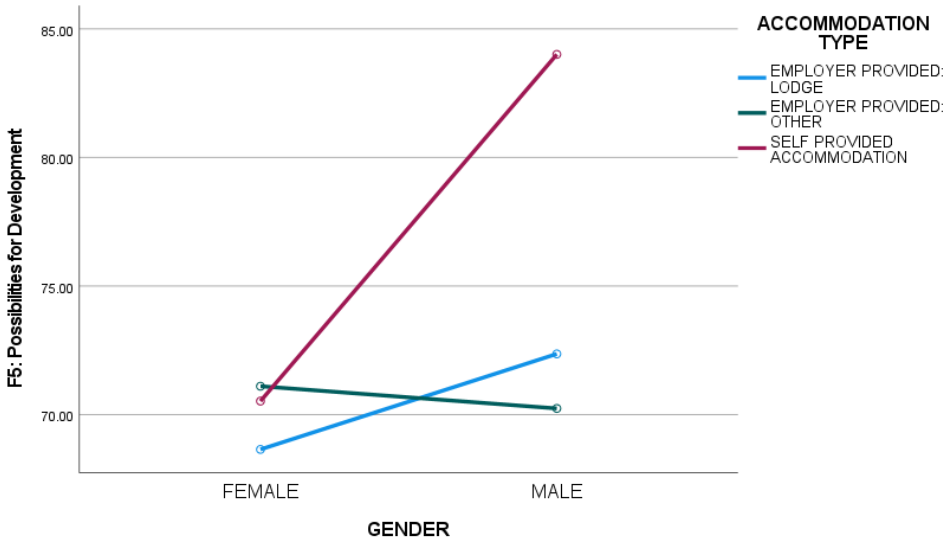
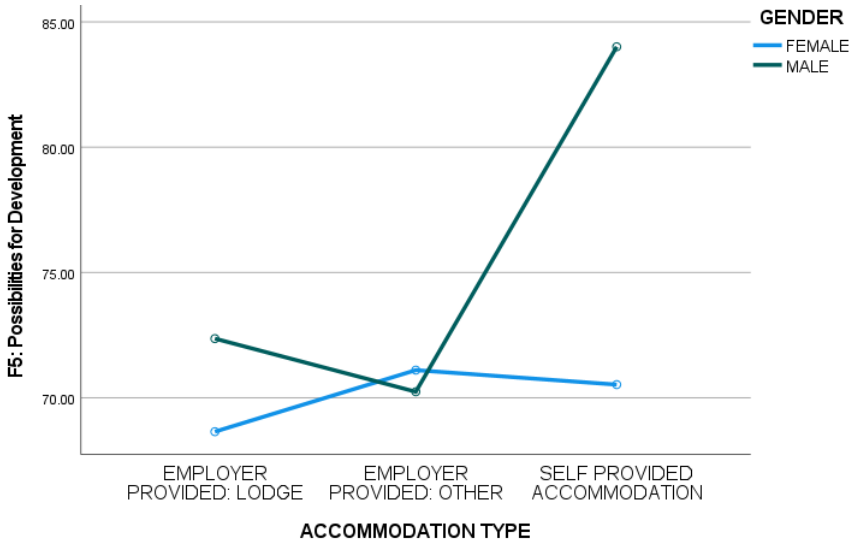


Figure 24

*F5: 2FI: Gender*Accommodation Type; View 2*



The other two 2FIs, *age*employment arrangement* and *age*gender*, were not statistically significant, but did demonstrate an important role in the goodness of fit for the model. Figures 25-26 illustrate the influence of the *age*employment arrangement* on workers' views of *F5: Possibilities for development* and show the highest scores are experienced by workers who are over 45 years of age and working for the owner or a prime contractor. Comparatively, workers aged 18-30 years who are employed by a prime contractor report the lowest scores.

Figure 25

*F5: 2FI: Age*Employment Arrangement; View 1*

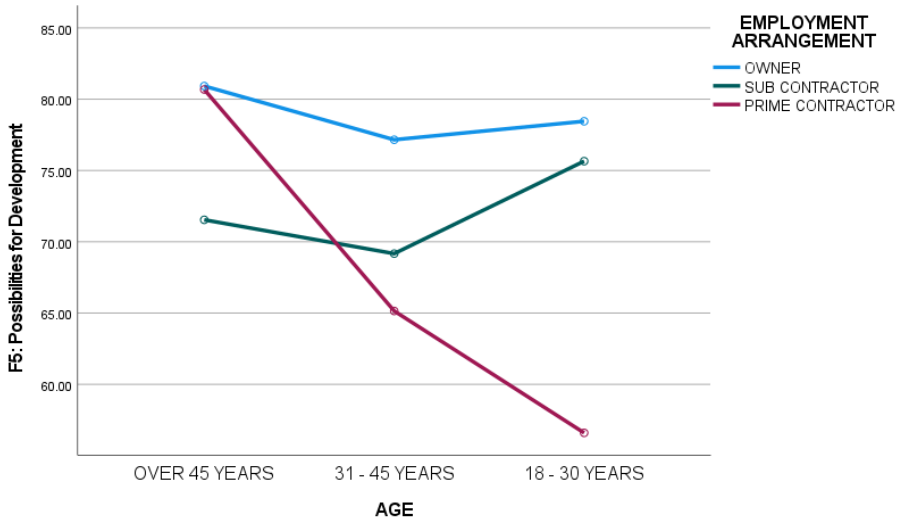
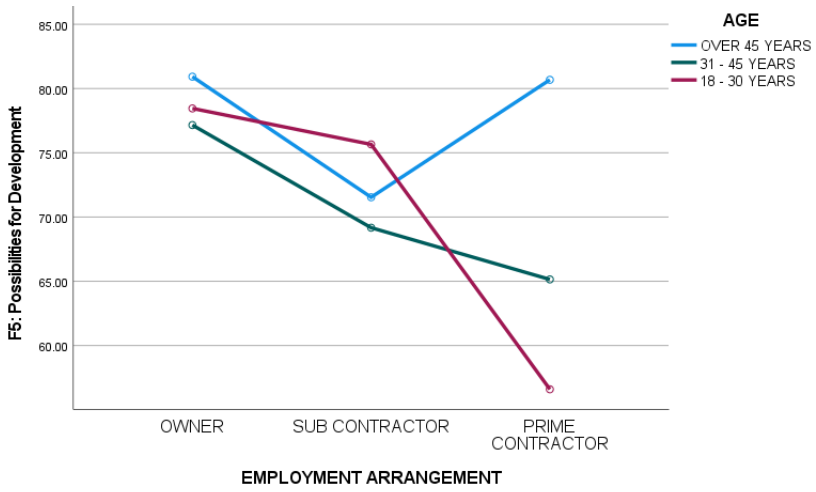


Figure 26

*F5: 2FI: Age*Employment Arrangement; View 2*



The 2FI of *age*gender* is illustrated in Figures 27-28 and shows that females over 45 years and males 18-30 years have the highest scores for possibility for development while females 18-30 years have the lowest perceived possibility for development.

Figure 27

*F5: 2FI: Age*Gender; View 1*

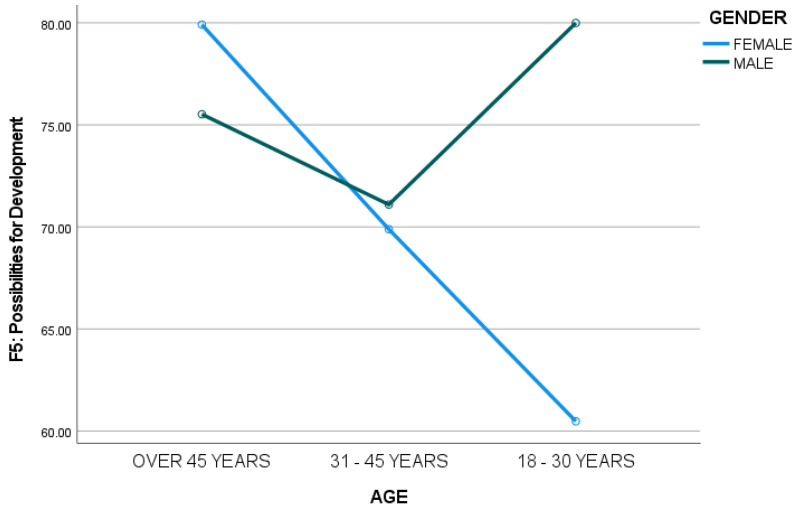
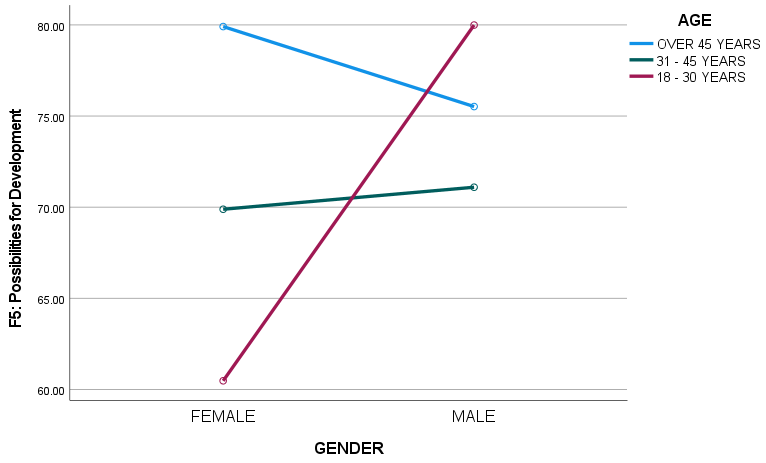


Figure 28

*F5: 2FI: Age*Gender; View 2*

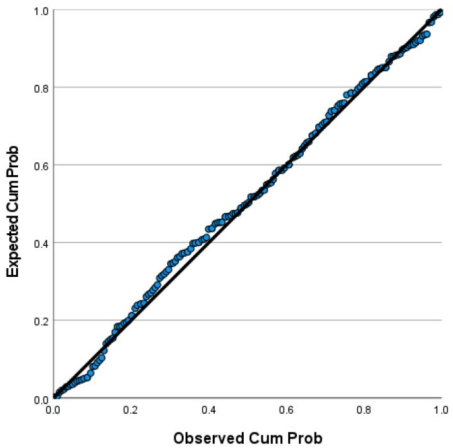


F6: Meaning of Work and Work Commitment

Assumption Testing. A preliminary test of assumptions was done using all the CFs and 2FIs. In addition to the evaluation of statistical assumptions discussed earlier in this chapter, I also checked that the experimental errors (residuals) were approximately normally distributed as shown in the normal P-P plot depicted in Figure 29.

Figure 29

Normal Probability Plot of Residual for F6



Homogeneity of variance for each group (combination of factor levels or values) was checked in the beginning and again post hoc, using the Levene's test of equality of error variances, as shown in Table 18. In the test, the null hypothesis was not rejected (Sig. = .916), confirming the assumption of homogeneity of variance.

Table 18

F6: Levene's Test of Equality of Error Variances

Response variable: F6

F	df1	df2	Sig.
.725	61	112	.916

Tests the null hypothesis that the error variance of the response variable is equal across groups.

a. Design: Intercept + AGE + ACC + ROT + ACC * ARR + AGE * ARR + AGE * GDR + AGE * ROT + GDR * ARR

ANOVA Model-Building. I employed ANOVA purposeful sequential model-building process described earlier using the SPSS *General Linear Model > Univariate* method with one RV (*F6*). I found the best predictive model of the RV after 12 SPSS runs and model assessments with the main effects of *age, accommodation type, and rotation status* and the 2FIs of *accommodation type*employment arrangement*, *age*employment arrangement*, *age*gender*, *age*rotation status, and gender*employment arrangement* each of which had a *p* value < .147. Table 19 shows the final predictive model for *F6: Meaning of work and work commitment*.

Table 19

F6: Test of Between Subject Effects

Response variable: F6

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	24505.602[a]	22	1113.891	2.511	<.001	0.268	55.247	0.998
Intercept	137150.507	1	137150.507	309.198	<.001	0.672	309.198	1.000
AGE	3227.084	2	1613.542	3.638	0.029	0.046	7.275	0.664
ACC	2035.533	2	1017.766	2.294	0.104	0.029	4.589	0.460
ROT	1192.431	1	1192.431	2.688	0.103	0.017	2.688	0.371
ACC * ARR	3954.581	4	988.645	2.229	0.069	0.056	8.915	0.643
AGE * ARR	4290.384	4	1072.596	2.418	0.051	0.060	9.672	0.684
AGE * GDR	2886.762	2	1443.381	3.254	0.041	0.041	6.508	0.612
AGE * ROT	1794.465	2	897.233	2.023	0.136	0.026	4.046	0.412
GDR * ARR	1725.414	2	862.707	1.945	0.147	0.025	3.890	0.398
Error	66978.773	151	443.568					
Total	771171.875	174						
Corrected Total	91484.375	173						

a. R Squared = .268 (Adjusted R Squared = .161)

b. Computed using alpha = .05

The effect for each significant CF and 2FI in the final model for this analysis can be derived from the parameter estimates table shown in Tables 20-22.

Table 20

F6: Parameter Estimates Table

Response variable: F6

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	58.008	15.307	3.790	<.001	27.766	88.251	0.087
[AGE=X45]	31.880	15.049	2.118	0.036	2.147	61.614	0.029
[AGE=Y31]	3.164	15.328	0.206	0.837	-27.122	33.450	0.000
[AGE=Z18]	0[a]						
[ACC=TLODGE]	-15.338	7.265	-2.111	0.036	-29.692	-0.983	0.029
[ACC=UOTHER]	-22.860	10.003	-2.285	0.024	-42.624	-3.096	0.033
[ACC=VSELF]	0a						
[ROT=NON]	35.910	18.521	1.939	0.054	-0.684	72.504	0.024
[ROT=POF]	0a						
[ACC=TLODGE] * [ARR=QOWNER]	2.214	16.254	0.136	0.892	-29.901	34.329	0.000
[ACC=TLODGE] * [ARR=RSUB]	-9.774	20.057	-0.487	0.627	-49.402	29.854	0.002
[ACC=TLODGE] * [ARR=SPRIME]	0a						
[ACC=UOTHER] * [ARR=QOWNER]	27.003	19.355	1.395	0.165	-11.238	65.244	0.013
[ACC=UOTHER] * [ARR=RSUB]	-9.425	24.000	-0.393	0.695	-56.843	37.994	0.001
[ACC=UOTHER] * [ARR=SPRIME]	0a						
[ACC=VSELF] * [ARR=QOWNER]	0.782	17.092	0.046	0.964	-32.989	34.552	0.000
[ACC=VSELF] * [ARR=RSUB]	-24.599	20.453	-1.203	0.231	-65.011	15.813	0.009
[ACC=VSELF] * [ARR=SPRIME]	0a						
[AGE=X45] * [ARR=QOWNER]	-17.356	16.861	-1.029	0.305	-50.670	15.958	0.007
[AGE=X45] * [ARR=RSUB]	-9.683	21.038	-0.460	0.646	-51.251	31.884	0.001
[AGE=X45] * [ARR=SPRIME]	0[a]						

Table 21

F6: Parameter Estimates Table (continued)

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
[AGE=Y31] * [ARR=QOWNER]	7.004	16.747	0.418	0.676	-26.085	40.093	0.001
[AGE=Y31] * [ARR=RSUB]	14.000	20.195	0.693	0.489	-25.900	53.901	0.003
[AGE=Y31] * [ARR=SPRIME]	0[a]						
[AGE=Z18] * [ARR=QOWNER]	0[a]						
[AGE=Z18] * [ARR=RSUB]	0[a]						
[AGE=Z18] * [ARR=SPRIME]	0[a]						
[AGE=X45] * [GDR=Fema]	-7.125	8.180	-0.871	0.385	-23.288	9.038	0.005
[AGE=X45] * [GDR=Male]	0[a]						
[AGE=Y31] * [GDR=Fema]	-0.513	7.204	-0.071	0.943	-14.747	13.722	0.000
[AGE=Y31] * [GDR=Male]	0[a]						
[AGE=Z18] * [GDR=Fema]	-42.670	16.960	-2.516	0.013	-76.180	-9.160	0.040
[AGE=Z18] * [GDR=Male]	0[a]						
[AGE=X45] * [ROT=NON]	-38.464	19.131	-2.011	0.046	-76.263	-0.664	0.026
[AGE=X45] * [ROT=POF]	0[a]						
[AGE=Y31] * [ROT=NON]	-35.994	18.986	-1.896	0.060	-73.506	1.518	0.023
[AGE=Y31] * [ROT=POF]	0[a]						
[AGE=Z18] * [ROT=NON]	0[a]						
[AGE=Z18] * [ROT=POF]	0[a]						
[GDR=Fema] * [ARR=QOWNER]	7.801	8.208	0.950	0.343	-8.416	24.018	0.006

Table 22

F6: Parameter Estimates Table (continued)

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	Partial Eta Squared
[GDR=Fema] * [ARR=RSUB]	21.705	11.007	1.972	0.050	-0.044	43.453	0.025
[GDR=Fema] * [ARR=SPRIME]	0[a]						
[GDR=Male] * [ARR=QOWNER]	0[a]						
[GDR=Male] * [ARR=RSUB]	0[a]						
[GDR=Male] * [ARR=SPRIME]	0[a]						

a. This parameter is set to zero because it is redundant.

b. Computed using alpha = .05

ANOVA Hypotheses. I tested the null hypotheses for the final model (no difference in RV means for each level of that factor) using a level of significance equal to the variable inclusion criterion (.20). For each CF in the final model, I rejected the null hypothesis. I concluded that there is a difference in mean values of *F6: Meaning of work and work commitment* for different levels of *age, accommodation type,* and *rotation status*. In addition, tests for the hypothesis that there is a difference in mean of *F6: Meaning of work and work commitment* as a function of 2FIs yielded five influential 2FIs, two of which were statistically significant: *age*employment arrangement* and *age*gender*.

Interpret, Test, and Use the Final Model. Various statistical outputs of SPSS are used to interpret the result. Based on the results in Table 19, the final predictive model is a statistically significant predictor of *F6: Meaning of work and work*

commitment ($F = 2.511$, $p < .001 < \alpha = .05$). Based on adjusted $R^2 = .161$ from the same table, the predictive model accounts for approximately 16% of the variation in *F6: Meaning of work and work commitment* for the data set. The relatively low adjusted R^2 indicates that approximately 84% of the variation in *F6: Meaning of work and work commitment* is attributed to noise (statistical variation) or other CFs.

Note that for each of the CFs, their values were coded for the purpose of executing the least squares approach to the general linear model. Therefore, for each CF, there is a baseline value whose coefficient (B) is zero. All other coefficients reflect the difference in mean value of *F6: Meaning of work and work commitment* compared to the baseline case.

The final model can be used to predict a value for *F6: Meaning of work and work commitment* based on the values of the predictors in the model (the CFs), using Tables 20-22. Predicted values of the RV can be compared to actual values from the data set as a method of validating the predictive, mathematical model. *F6: Meaning of work and work commitment* can be predicted for any case by adding the intercept coefficient to the coefficient for each of the values of the CFs for that case.

Control Factors. For each of the CFs, the value of F*6: Meaning of work and work commitment* predicted can be shown in the bar charts in Figures 30-32. As a reminder, higher numerical values on the quantitative demands scale correspond to increased perceptions among workers regarding higher meaning of work and work commitment.

Figure 30

F6: Meaning of Work and Work Commitment as a Function of Age

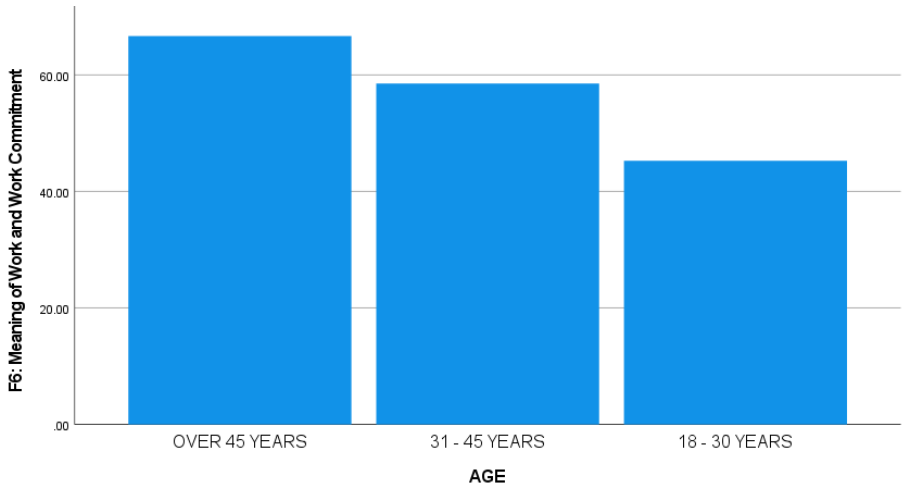


Figure 31

F6: Meaning of Work and Work Commitment as a Function of Accommodation Type

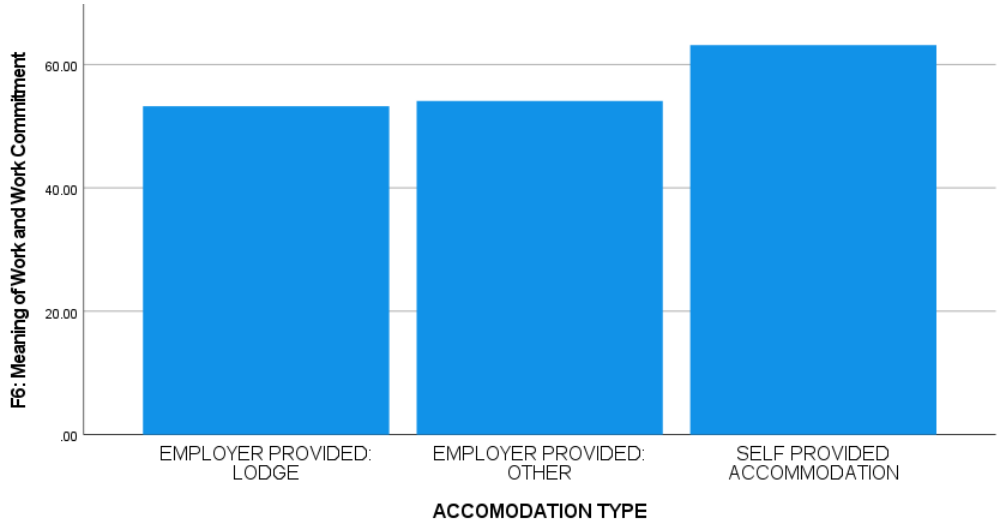
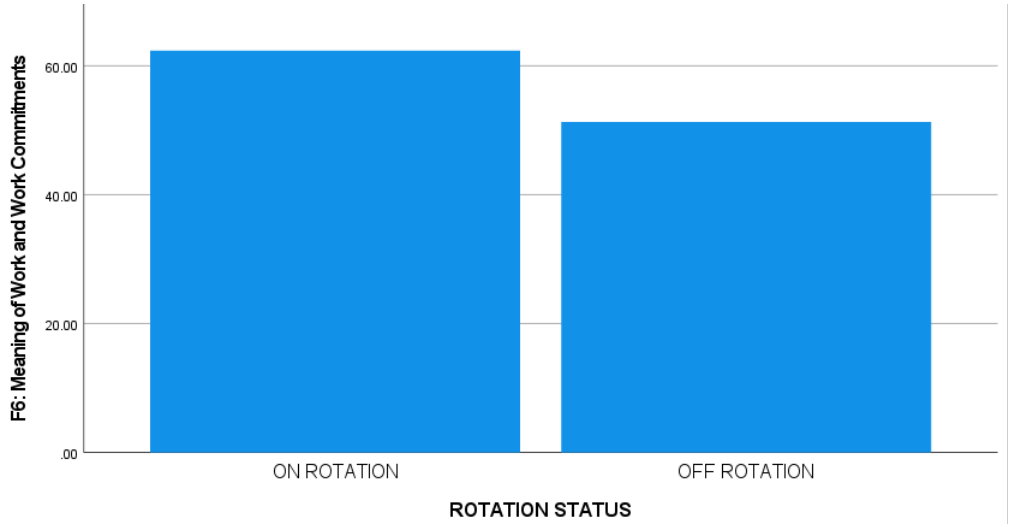


Figure 32

F6: Meaning of Work and Work Commitment as a Function of Rotation Status



Two-Factor Interactions (2FIs). Four 2FIs remained in the final model as predictors of *F6: Meaning of work and work commitment*: *age*employment arrangement*, *age*gender, accommodation type*employment arrangement, age*rotation status*, *and gender*employment arrangement*. The 2FIs are confirmed and interpreted using graphical analysis as shown in Figures 33-42.

The statistically significant 2FIs, *age*employment arrangement* and *age*gender* are composed of one CF (*age*) which is a significant predictor by itself and other CFs (*gender*, *employment arrangement*) which are not statistically significant by themselves. Figures 33-34 show that the highest values for meaning of work and work commitment are experienced by prime contractor workers who are over 45 years of age; and the lowest values are reported by subcontract workers aged 18 – 30 years. Figures 35-36 illustrate the combined effect of age and gender, showing that female workers over 45

years of age reported the highest levels of meaning of work and work commitment; and female workers aged 18-30 years of age experience the lowest levels.

Figure 33

*F6: 2FI: Age*Employment Arrangement; View 1*

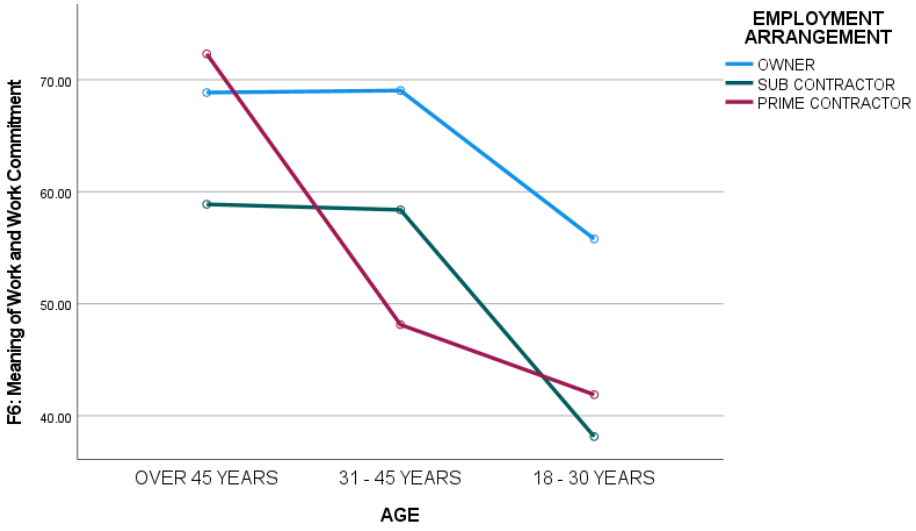


Figure 34

*F6: 2FI: Age*Employment Arrangement; View 2*

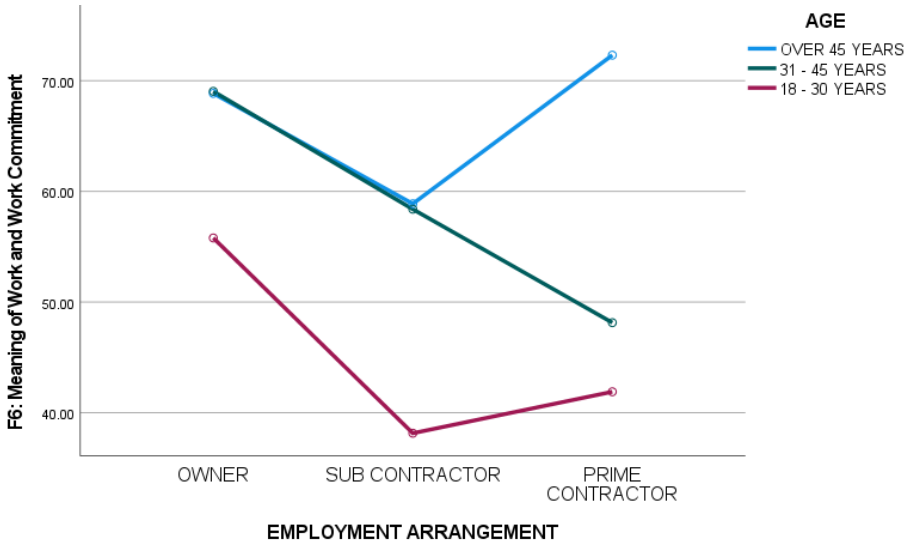


Figure 35

*F6: 2FI: Age*Gender; View 1*

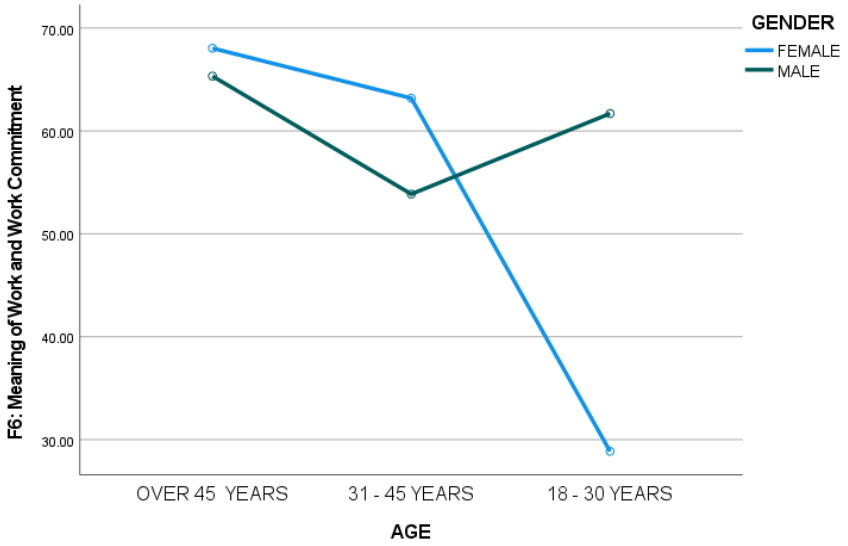
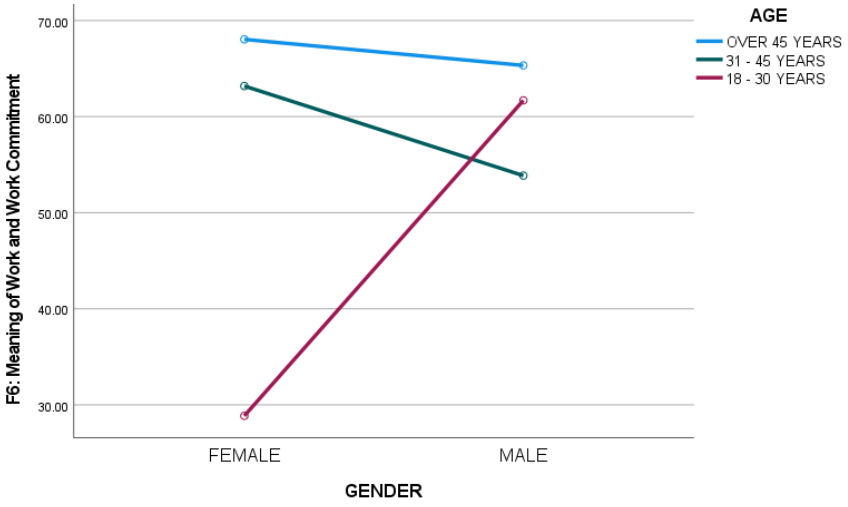


Figure 36

*F6: 2FI: Age*Gender; View 2*



As shown in Figures 37-38, workers employed by owners experienced the highest levels of meaning of work and work commitment when considering accommodation

type; and employees of prime contractors living in other types of employer-provided accommodation reported the lowest levels.

Figure 37

*F6: 2FI: Accommodation Type*Employment Arrangement; View 1*

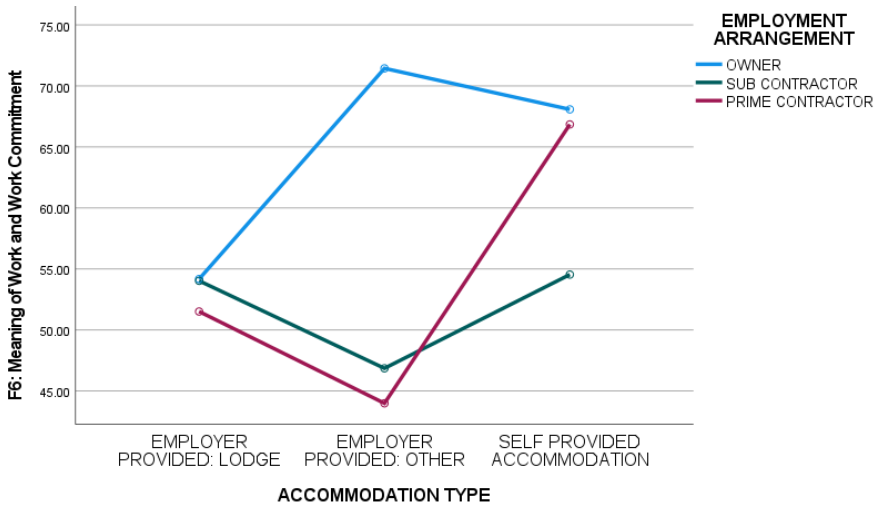
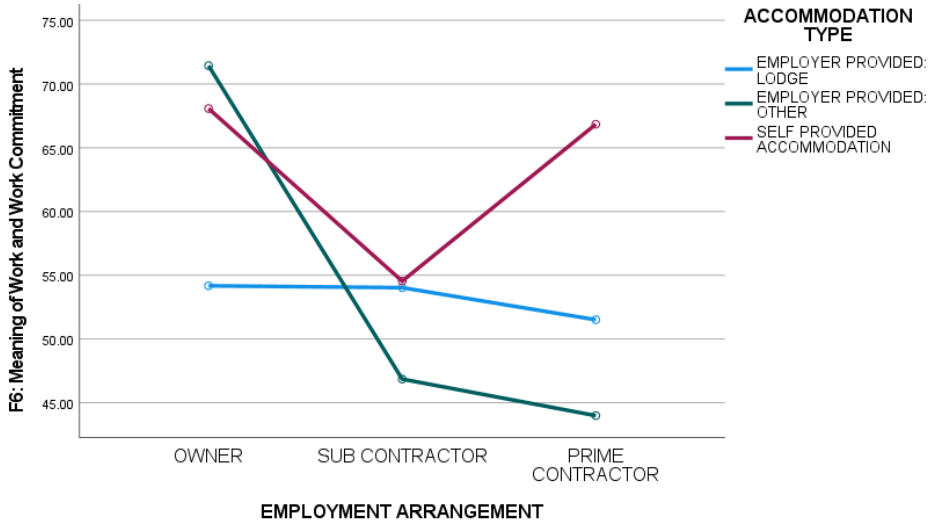


Figure 38

*F6: 2FI: Accommodation Type*Employment Arrangement; View 2*



As shown in Figures 39-40, workers aged 31 years and over reported similar levels of meaning of work both on and off rotation. Comparatively, workers aged 18-30 years rated their meaning of work lowest when they were off rotation.

Figure 39

*F6: 2FI: Age*Rotation Status; View 1*

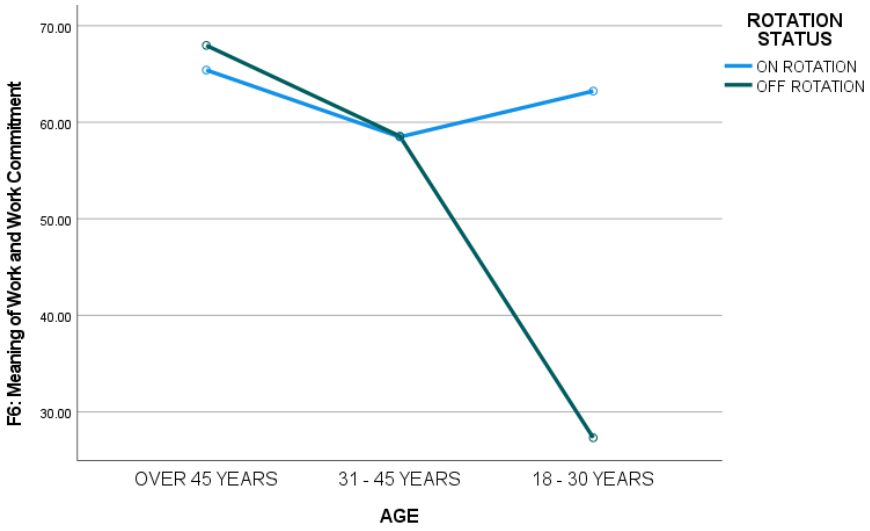
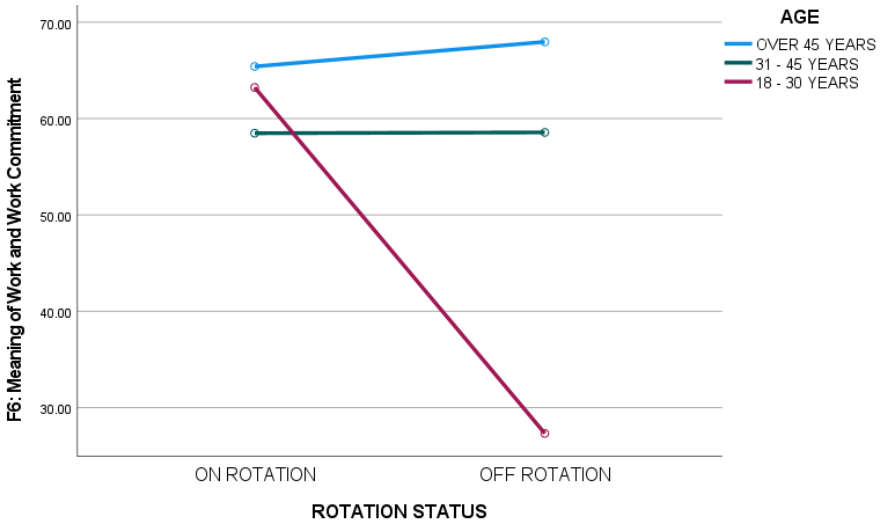


Figure 40

*F6: 2FI: Age*Rotation Status; View 2*



As shown in Figures 41-42, male workers employed by an owner reported the highest level of meaning of work and work commitment while their female counterparts employed by a prime contractor reported the lowest levels.

Figure 41

*F6: 2FI: Gender*Employment Arrangement; View 1*

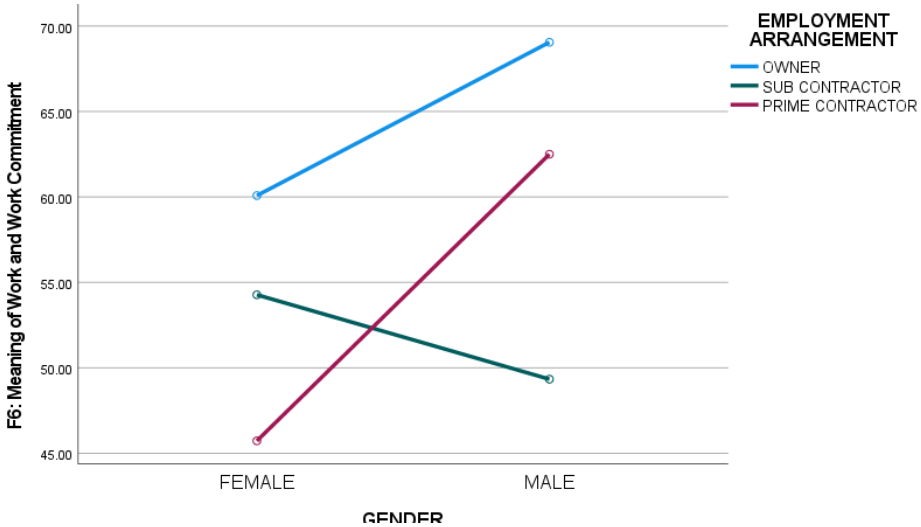
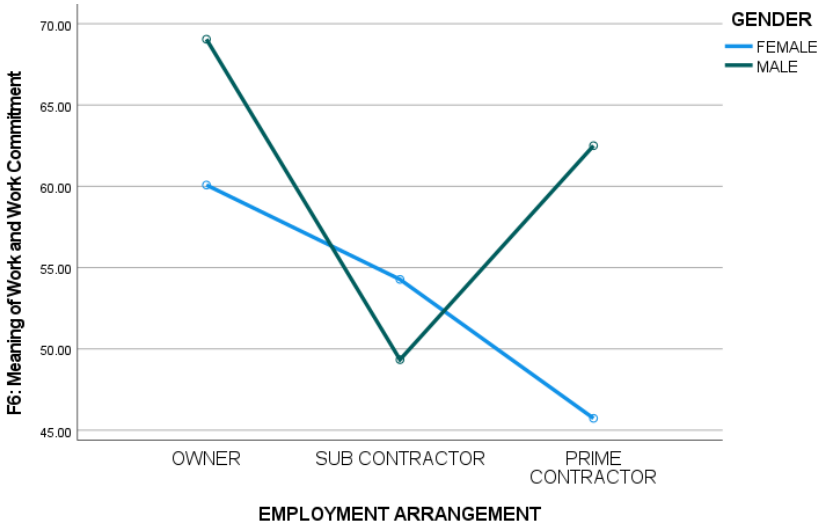


Figure 42

*F6: 2FI: Gender*Employment Arrangement; View 2*



F7: Predictability and Rewards

There were no significant predictors, either CFs or 2FIs, in the best model I could develop based on adjusted R^2. Further, no model, including the best goodness-of-fit model, was a significant predictor of the RV based on comparing p-value to a level of significance of $\alpha = .05$.

F8: Role Clarity

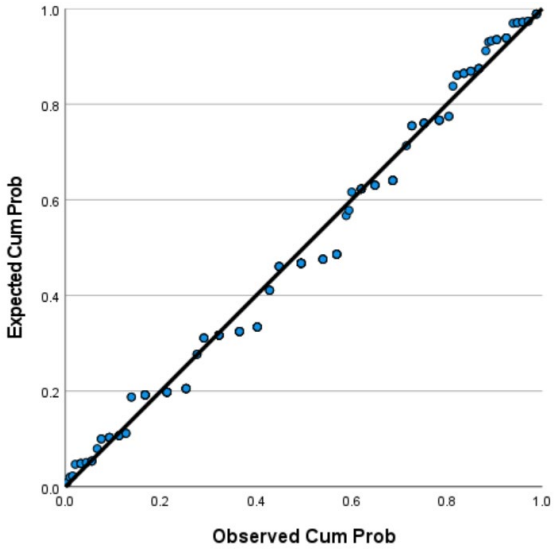
There were no significant predictors, either CFs or 2FIs, in the best model I could develop based on adjusted R^2. Further, no model, including the best goodness-of-fit model, was a significant predictor of the RV based on comparing p-value to a level of significance of $\alpha = .05$.

F9: Role Conflict

Assumption Testing. In addition to the evaluation of statistical assumptions discussed earlier, I checked that the experimental errors (residuals) were approximately normally distributed as shown in the normal P-P plot illustrated in Figure 43.

Figure 43

Normal Probability Plot of Residual for F9



Homogeneity of variance for each group (combination of factor levels or values) was checked in the beginning and again post hoc, using the Levene's test of equality of error variances, as shown in Table 23. In the test, the null hypothesis was not rejected (Sig. = .845), confirming the assumption of homogeneity of variance.

Table 23

F9: Levene's Test of Equality of Error Variances

Levene's Test of Equality of Error Variances[a]

Response variable: F9

F	df1	df2	Sig.
.789	61	112	.845

Tests the null hypothesis that the error variance of the response variable is equal across groups.

a. Design: Intercept + AGE * GDR

ANOVA Model-Building. I employed ANOVA purposeful sequential model-building process described earlier in this chapter using the SPSS *General Linear Model* > *Univariate* method with one RV (*F9*). After several rounds of CF and 2FI analysis, I found the best predictive model of the RV after 16 SPSS runs and model assessments with a single 2FI of *age* gender* which had a *p* value = .045. No single CF was found to have a significant contribution to the model. Table 24 shows the final predictive model for *F9: Role conflict*.

Table 24

F9: Test of Between Subject Effects

Tests of Between-Subjects Effects

Response variable: F9

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	5356.113[a]	5	1071.223	2.329	0.045	0.065	11.645	0.738
Intercept	238746.052	1	238746.052	519.062	0.000	0.755	519.062	1.000
AGE * GDR	5356.113	5	1071.223	2.329	0.045	0.065	11.645	0.738
Error	77272.714	168	459.957					
Total	608615.890	174						
Corrected Total	82628.828	173						

a. R Squared = .065 (Adjusted R Squared = .045)

b. Computed using alpha = .05

The effect for the significant 2FI (*age*gender)* in the final model for this analysis can be derived from the parameter estimates table shown in Table 25.

Table 25

F9: Parameter Estimates Table

Response variable: F9

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	Partial Eta Squared
Intercept	46.430	8.106	5.728	<.001	30.427	62.433	0.163
[AGE=X45] * [GDR=Fema]	13.986	9.418	1.485	0.139	-4.608	32.580	0.013
[AGE=X45] * [GDR=Male]	5.294	8.581	0.617	0.538	-11.647	22.235	0.002
[AGE=Y31] * [GDR=Fema]	4.852	8.804	0.551	0.582	-12.528	22.232	0.002
[AGE=Y31] * [GDR=Male]	12.628	8.701	1.451	0.149	-4.549	29.806	0.012
[AGE=Z18] * [GDR=Fema]	32.738	13.442	2.435	0.016	6.200	59.275	0.034
[AGE=Z18] * [GDR=Male]	0[a]						

a. This parameter is set to zero because it is redundant.

b. Computed using alpha = .05

ANOVA Hypotheses. I tested the null hypotheses for the final model (no difference in RV means for each level of that factor) using a level of significance equal to the variable inclusion criterion (.20). No CFs remained in the final model and therefore, no testing of the hypothesis was done. Tests for the hypothesis that there is a difference in mean of *F9: Role conflict* as a function of 2FIs yielded one significant 2FI: *age*gender*.

Interpret, Test, and Use the Final Model. Various statistical outputs of SPSS are used to interpret the result. Based on the results in Table 24, the final predictive model is a statistically significant predictor of *F9: Role conflict* ($F = 2.329$, $p = .045 < \alpha = .05$). Based on adjusted $R^2 = .037$ from the same table, the predictive model accounts for approximately 4% of the variation in *F9: Role conflict* for the data set. The low

adjusted R^2 indicates that approximately 96% of the variation in *F9: Role conflict* is attributed to noise (statistical variation) or other CFs.

The final model can be used to predict a value for *F9: Role conflict* based on the values of the predictors in the model, using Table 25. Predicted values of the RV can be compared to actual values from the data set as a method of validating the predictive, mathematical model. *F9: Role conflict* can be predicted for any case by adding the intercept coefficient to the coefficient for each of the values of the predictors for that case.

Two-Factor Interactions (2FIs). One 2FI was found to be a significant predictor of *F9: Role conflict*: *age*gender*. The 2FI is confirmed and interpreted using graphical analysis as shown in Figures 44-45. Female workers aged 18-30 years report the highest levels of role conflict with their same-aged male counterparts reporting the lowest levels of role conflict.

Figure 44

*F9: 2FI: Age*Gender; View 1*

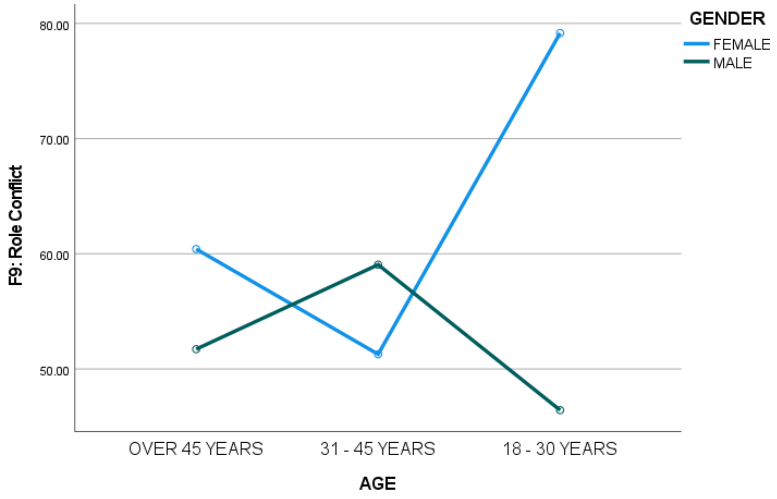
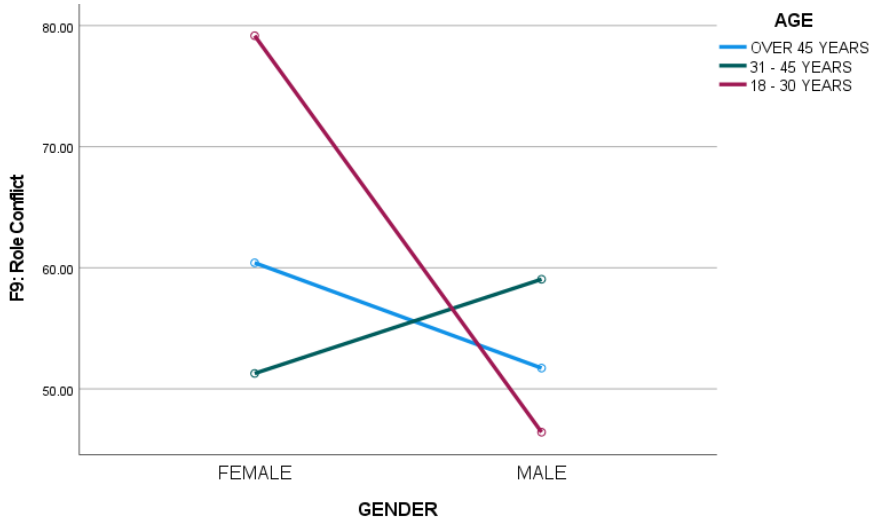


Figure 45

*F9: 2FI: Age*Gender; View 2*



F10: Quality of Leadership

There were no significant predictors, either CFs or 2FIs, in the best model I could develop based on adjusted R^2. Further, no model, including the best goodness-of-fit model, was a significant predictor of the RV based on comparing p-value to a level of significance of $\alpha = .05$.

F11: Social Support from Supervisor

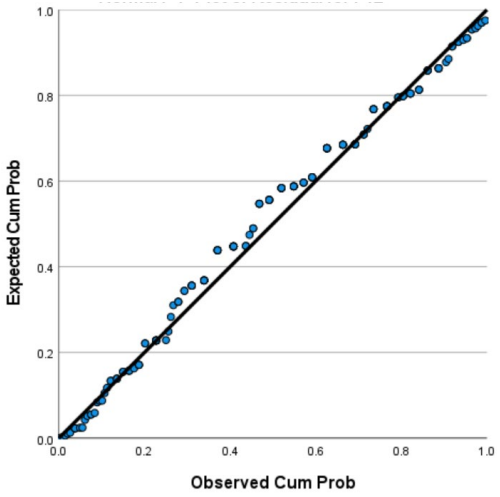
There were no significant predictors, either CFs or 2FIs, in the best model I could develop based on adjusted R^2. Further, no model, including the best goodness-of-fit model, was a significant predictor of the RV based on comparing p-value to a level of significance of $\alpha = .05$.

F12: Social Community

Assumption Testing. A preliminary test of assumptions was done using the full complement of CFs and 2FIs. In addition to the evaluation of statistical assumptions discussed earlier, I checked that the experimental errors (residuals) were approximately normally distributed as shown in the normal P-P plot depicted in Figure 46.

Figure 46

Normal Probability Plot of Residual for F12



Homogeneity of variance for each group (combination of factor levels or values) was checked in the beginning and again post hoc, using the Levene's test of equality of error variances, as shown in Table 26. In the test, the null hypothesis was not rejected (Sig. = .562), confirming the assumption of homogeneity of variance.

Table 26

F1: Levene's Test of Equality of Error Variances

Levene's Test of Equality of Error Variances[a]

Response variable: F1

F	df1	df2	Sig.
.961	61	112	.562

Tests the null hypothesis that the error variance of the response variable is equal across groups.

a. Design: Intercept + AGE + ARR + AGE * ARR + AGE * ROT + ARR * ROT + GDR * ARR

ANOVA Model-Building. I employed ANOVA purposeful sequential model-building process described earlier using the SPSS *General Linear Model > Univariate* method with one RV (*F12*). I found the best predictive model of the RV after 21 SPSS runs and model assessments with the main effects of *employment arrangement* and *rotation status* and the 2FIs of *gender*rotation status* each of which had a *p* value < .222. Table 27 shows the final predictive model for *F12: Social community*.

Table 27

F12: Test of Between Subject Effects

Tests of Between-Subjects Effects

Response variable: F12

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	5584.895a	5	1116.979	2.613	0.026	0.072	13.065	0.793
Intercept	605320.62	1	605320.62	1416.063	<.001	0.894	1416.063	1
ARR	1844.641	2	922.321	2.158	0.119	0.025	4.315	0.437
ROT	1763.909	1	1763.909	4.126	0.044	0.024	4.126	0.524
GDR * ROT	1298.27	2	649.135	1.519	0.222	0.018	3.037	0.32
Error	71814.531	168	427.467					
Total	891250	174						
Corrected Total	77399.425	173						

a. R Squared = .072 (Adjusted R Squared = .045)

b. Computed using alpha = .05

The effect for each significant CF and 2FI in the final model for this analysis can be derived from the parameter estimates table shown in Table 28.

Table 28

F12: Parameter Estimates Table

Response variable: F12

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	60.087	3.944	15.233	<.001	52.300	67.874	0.580
[ARR=QOWNER]	5.560	3.646	1.525	0.129	-1.638	12.757	0.014
[ARR=RSUB]	-2.105	4.537	-0.464	0.643	-11.063	6.852	0.001
[ARR=SPRIME]	0[a]						
[ROT=NON]	12.040	3.974	3.030	0.003	4.194	19.885	0.052
[ROT=POF]	0[a]						
[GDR=Fema] * [ROT=NON]	-6.999	4.500	-1.555	0.122	-15.884	1.885	0.014
[GDR=Fema] * [ROT=POF]	3.713	4.781	0.777	0.439	-5.727	13.152	0.004
[GDR=Male] * [ROT=NON]	0[a]						
[GDR=Male] * [ROT=POF]	0[a]						

a. This parameter is set to zero because it is redundant.

b. Computed using alpha = .05

ANOVA Hypotheses. I tested the null hypotheses for the final model (no difference in RV means for each level of that factor) using a level of significance equal to the variable inclusion criterion (.20). For each CF in the final model, I rejected the null hypothesis. I concluded that there is a difference in mean values of *F12: Social community* for different levels of *employment arrangement* and *rotation status*. In addition, tests for the hypothesis that there is a difference in mean of *F12: Social community* as a function of 2FIs yielded a single significant 2FI: *gender*rotation status*.

Note: The removal of the 2FI: *gender*rotation status* had a negative impact on Adjusted R square and did not have a meaningful change on the individual significance of the two CFs included in the model (*employment arrangement* and *rotation status*).

Interpret, Test, and Use the Final Model. Various statistical outputs of SPSS are used to interpret the result. Based on the results in Table 27, the final predictive model is a statistically significant predictor of *F12: Social community* ($F = 2.613$, $p = .026 < \alpha = .05$). Based on adjusted $R^2 = .045$ from the same table, the predictive model accounts for approximately 5% of the variation *F12: Social community* for the data set. The low adjusted R^2 indicates that approximately 95% of the variation in *F12: Social community* is attributed to noise (statistical variation) or other CFs.

Note that for each of the CFs, their values were coded for the purpose of executing the least squares approach to the general linear model. Therefore, for each CF, there is a baseline value whose coefficient (B) is zero. All other coefficients reflect the difference in mean value of *F12: Social community* compared to the baseline case.

The final model can be used to predict a value for *F12: Social community* based on the values of the predictors in the model (the CFs), using Table 28. Predicted values of the RV can be compared to actual values from the data set as a method of validating the predictive, mathematical model. *F12: Social community* can be predicted for any case by adding the intercept coefficient to the coefficient for each of the values of the CFs for that case.

Control Factors. For each of the CFs, the value of F*12: Social community* predicted can be shown in the bar charts in Figures 47-48. As a reminder, higher

numerical values on the social community scale correspond to increased perceptions among workers regarding sense of social community in their tasks or roles.

Figure 47

F12: Social Community as a Function of Employment Arrangement

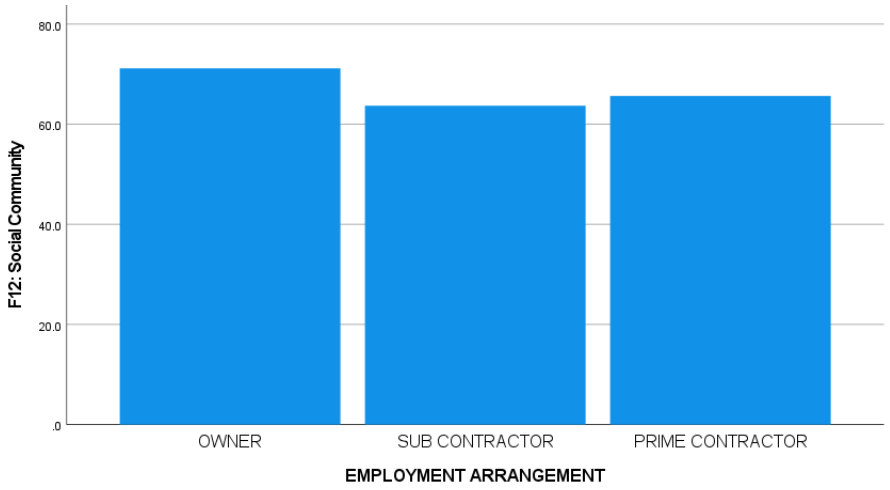
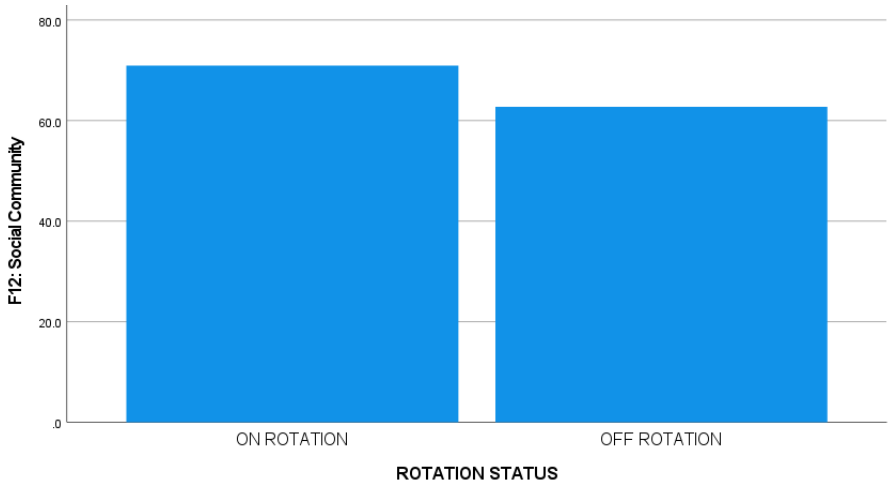


Figure 48

F12: Social Community as a Function of Rotation Status



Two-Factor Interactions (2FIs). One 2FI was found to be a significant predictor of *F12: Social community*: *gender*rotation status*. The 2FI, *gender*rotation status*, is composed of one CF which is a statistically significant predictor by itself (*rotation status)* and one CF which is not (*gender)*. The 2FI is confirmed and interpreted using graphical analysis as shown in Figures 49-50. The highest values for social community are experienced by male workers who are on rotation. Comparatively, male workers who are off rotation reported the lowest values for social community.

Figure 49

*F12: 2FI: Gender*Rotation Status; View 1*

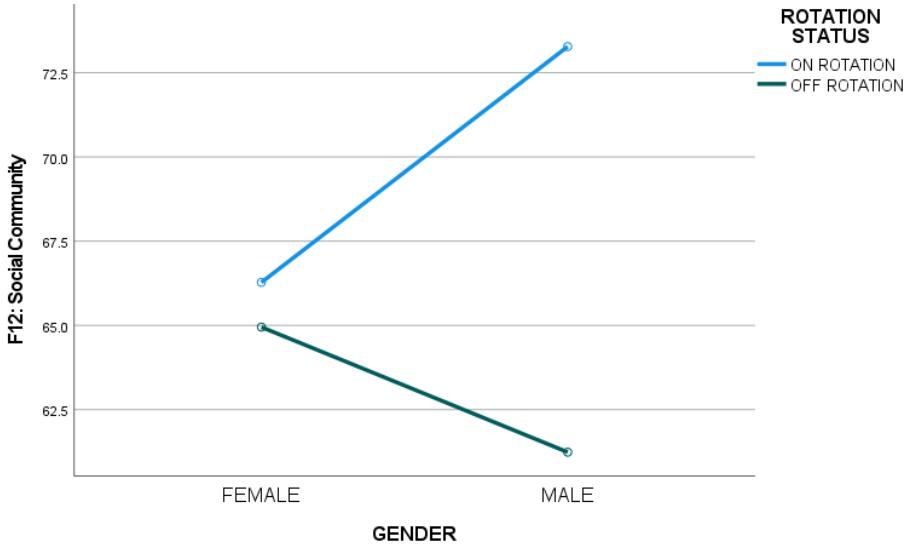
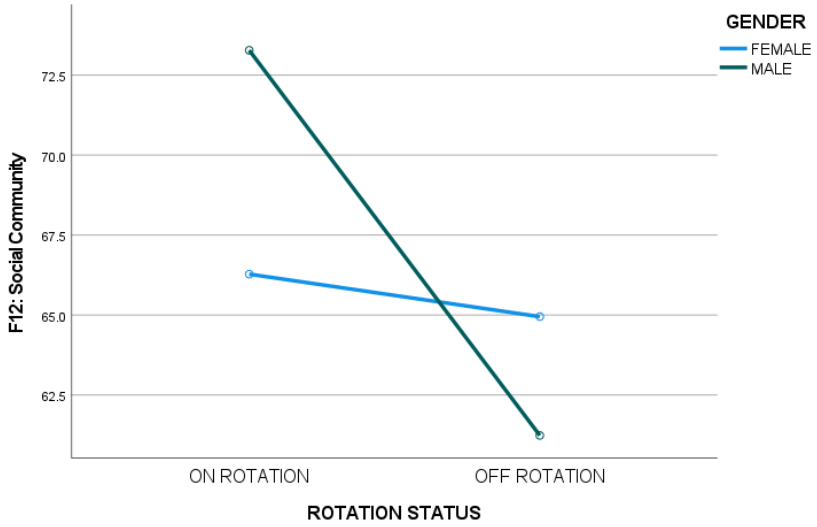


Figure 50

*F12: 2FI: Gender*Rotation Status; View 2*



F13: Job Insecurity and Satisfaction

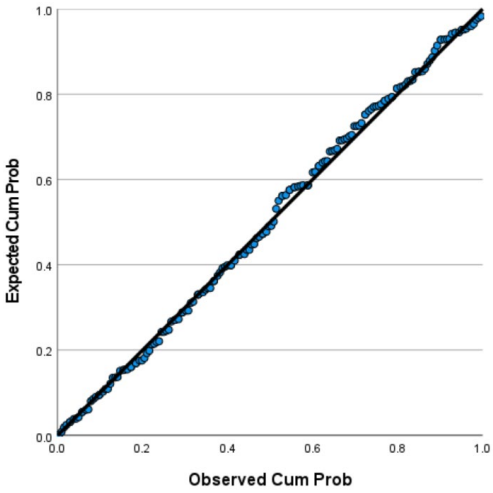
There were no significant predictors, either CFs or 2FIs, in the best model I could develop based on adjusted R^2. Further, no model, including the best goodness-of-fit model, was a significant predictor of the RV based on comparing p-value to a level of significance of $\alpha = .05$.

F14: Work Life Conflict

Assumption Testing. A preliminary test of assumptions was done using the full complement of CFs and 2FIs. In addition to the evaluation of statistical assumptions discussed earlier in this chapter, I also checked that the experimental errors (residuals) were approximately normally distributed as shown in the normal P-P plot depicted in Figure 51.

Figure 51

Normal Probability Plot of Residual for F14



Homogeneity of variance for each group (combination of factor levels or values) was checked in the beginning and again post hoc, using the Levene's test of equality of error variances, as shown in Table 29. In the test, the null hypothesis was not rejected (Sig. = .906), confirming the assumption of homogeneity of variance.

Table 29

F14: Levene's Test of Equality of Error Variances

Levene's Test of Equality of Error Variances[a]

Response variable: F14

F	df1	df2	Sig.
.736	61	112	.906

Tests the null hypothesis that the error variance of the response variable is equal across groups.

a. Design: Intercept + AGE + GDR + ACC + ROT + GDR * ACC + AGE * GDR + AGE * ROT + GDR * ARR

ANOVA Model-Building. Using the SPSS *General Linear Model > Univariate* method with one RV (*F14*), I found the best predictive model of the RV after 11 SPSS runs and model assessments with the main effects of *age*, *gender*, *accommodation type*, and *rotation status* and the 2FIs of *age*gender*, *age*rotation status*, *gender*accommodation type*, *and gender*employment arrangement* each of which had a *p* value < .143. Table 30 shows the final predictive model for *F14: Work life conflict*.

Table 30

F14: Test of Between Subject Effects

Tests of Between-Subjects Effects
Response variable: F14

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	19060.991[a]	16	1191.312	2.279	0.005	0.188	36.468	0.980
Intercept	188131.720	1	188131.720	359.943	0.000	0.696	359.943	1.000
AGE	4613.875	2	2306.938	4.414	0.014	0.053	8.828	0.754
GDR	3864.568	1	3864.568	7.394	0.007	0.045	7.394	0.771
ACC	2366.331	2	1183.166	2.264	0.107	0.028	4.527	0.455
ROT	3166.556	1	3166.556	6.058	0.015	0.037	6.058	0.687
AGE * GDR	4934.778	2	2467.389	4.721	0.010	0.057	9.441	0.783
AGE * ROT	2791.647	2	1395.824	2.671	0.072	0.033	5.341	0.524
GDR * ACC	2620.249	2	1310.125	2.507	0.085	0.031	5.013	0.497
GDR * ARR	3647.084	4	911.771	1.744	0.143	0.043	6.978	0.524
Error	82059.287	157	522.671					
Total	668196.390	174						
Corrected Total	101120.278	173						

a. R Squared = .188 (Adjusted R Squared = .106)
b. Computed using alpha = .05

The effect for each significant CF and 2FI in the final model for this analysis can be derived from the parameter estimates table shown in Tables 31-32.

Table 31

F14: Parameter Estimates Table

Response variable: F14

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	Partial Eta Squared
Intercept	64.238	13.836	4.643	0.000	36.910	91.566	0.121
[AGE=X45]	-20.756	14.201	-1.462	0.146	-48.806	7.293	0.013
[AGE=Y31]	-1.057	14.175	-0.075	0.941	-29.056	26.942	0.000
[AGE=Z18]	0[a]						
[GDR=Fema]	58.066	18.127	3.203	0.002	22.262	93.870	0.061
[GDR=Male]	0[a]						
[ACC=TLODGE]	11.670	5.583	2.090	0.038	0.643	22.698	0.027
[ACC=UOTHER]	5.046	6.845	0.737	0.462	-8.474	18.566	0.003
[ACC=VSELF]	0[a]						
[ROT=NON]	-35.245	17.757	-1.985	0.049	-70.319	-0.171	0.024
[ROT=POF]	0[a]						
[GDR=Fema] * [ACC=TLODGE]	-9.612	8.731	-1.101	0.273	-26.857	7.633	0.008
[GDR=Fema] * [ACC=UOTHER]	12.365	11.057	1.118	0.265	-9.474	34.204	0.008
[GDR=Fema] * [ACC=VSELF]	0[a]						
[GDR=Male] * [ACC=TLODGE]	0[a]						
[GDR=Male] * [ACC=UOTHER]	0[a]						
[GDR=Male] * [ACC=VSELF]	0[a]						
[AGE=X45] * [GDR=Fema]	-43.294	17.926	-2.415	0.017	-78.700	-7.887	0.036
[AGE=X45] * [GDR=Male]	0[a]						
[AGE=Y31] * [GDR=Fema]	-52.519	17.447	-3.010	0.003	-86.981	-18.058	0.055

Table 32

F14: Parameter Estimates Table (continued)

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	Partial Eta Squared
[AGE=Y31] * [GDR=Male]	0[a]						
[AGE=Z18] * [GDR=Fema]	0[a]						
[AGE=Z18] * [GDR=Male]	0[a]						
[AGE=X45] * [ROT=NON]	35.056	18.549	1.890	0.061	-1.582	71.694	0.022
[AGE=X45] * [ROT=POF]	0[a]						
[AGE=Y31] * [ROT=NON]	22.293	18.372	1.213	0.227	-13.995	58.581	0.009
[AGE=Y31] * [ROT=POF]	0[a]						
[AGE=Z18] * [ROT=NON]	0[a]						
[AGE=Z18] * [ROT=POF]	0[a]						
[GDR=Fema] * [ARR=QOWNER]	-17.229	6.644	-2.593	0.010	-30.352	-4.107	0.041
[GDR=Fema] * [ARR=RSUB]	-7.504	9.594	-0.782	0.435	-26.454	11.445	0.004
[GDR=Fema] * [ARR=SPRIME]	0[a]						
[GDR=Male] * [ARR=QOWNER]	2.009	5.286	0.380	0.704	-8.433	12.450	0.001
[GDR=Male] * [ARR=RSUB]	0.615	6.161	0.100	0.921	-11.554	12.784	0.000
[GDR=Male] * [ARR=SPRIME]	0[a]						

a. This parameter is set to zero because it is redundant.

b. Computed using alpha = .05

ANOVA Hypotheses. I tested the null hypotheses for the final model (no difference in RV means for each level of that factor) using a level of significance equal to the variable inclusion criterion (.20). For each CF in the final model, I rejected the null

hypothesis. I concluded that there is a difference in mean values of *F14: Work life conflict* for different levels of *age*, *gender*, *accommodation type*, and *rotation status.* In addition, tests for the hypothesis that there is a difference in mean of *F14: Work life conflict* as a function of 2FIs yielded four significant 2FIs: *gender*accommodation type*, *age*gender*, *age*rotation status*, *and gender*employment arrangement*.

Interpret, Test, and Use the Final Model. Various statistical outputs of SPSS are used to interpret the result. Based on the results in Table 30, the final predictive model is a statistically significant predictor of *F14: Work life conflict* ($F = 2.279$, $p = .006 < \alpha = .05$). Based on adjusted $R^2 = .106$ from the same table, the predictive model accounts for approximately 11% of the variation in *F14: Work life conflict* for the data set. The relatively low adjusted R^2 indicates that approximately 89% of the variation in *F14: Work life conflict* is attributed to noise (statistical variation) or other CFs.

Note that for each of the CFs, their values were coded for the purpose of executing the least squares approach to the general linear model. Therefore, for each CF, there is a baseline value whose coefficient (B) is zero. All other coefficients reflect the difference in mean value of *F14: Work life conflict* compared to the baseline case.

The final model can be used to predict a value for *F14: Work life conflict* based on the values of the predictors in the model (the CFs), using Tables 31-32. Predicted values of the RV can be compared to actual values from the data set as a method of validating the predictive, mathematical model. *F14: Work life conflict* can be predicted for any case by adding the intercept coefficient to the coefficient for each of the values of the CFs for that case.

Control Factors. For each of the CFs, the value of F*14: Work life conflict* predicted can be shown in the bar charts in Figures 52-55. As a reminder, higher numerical values on the quantitative demands scale correspond to increased perceptions among workers regarding work life conflict in their tasks or roles.

Figure 52

F14: Work Life Conflict as a Function of Age

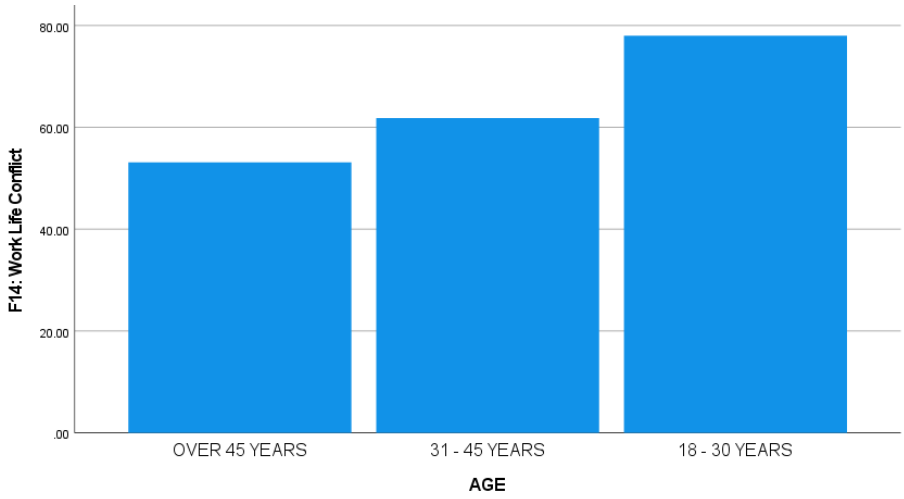


Figure 53

F14: Work Life Conflict as a Function of Gender

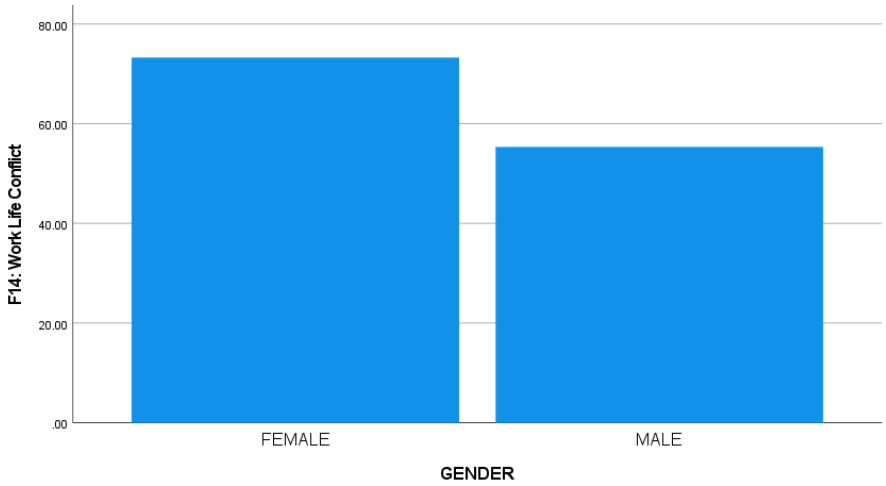


Figure 54

F14: Work Life Conflict as a Function of Accommodation Type

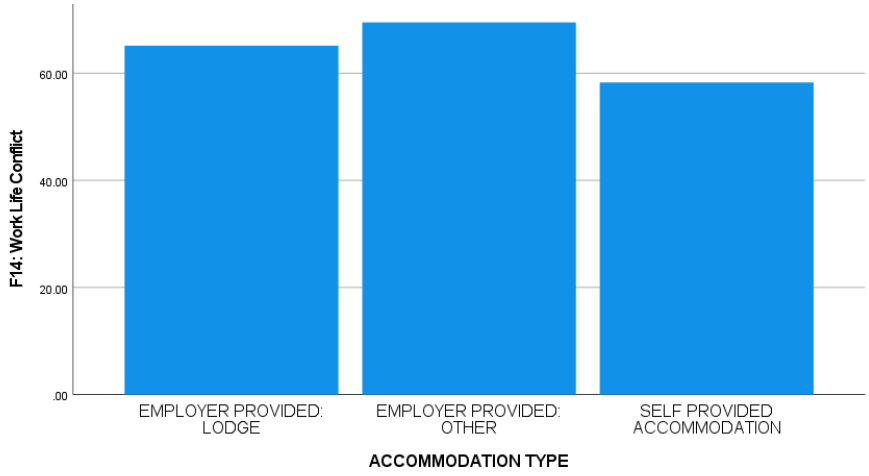
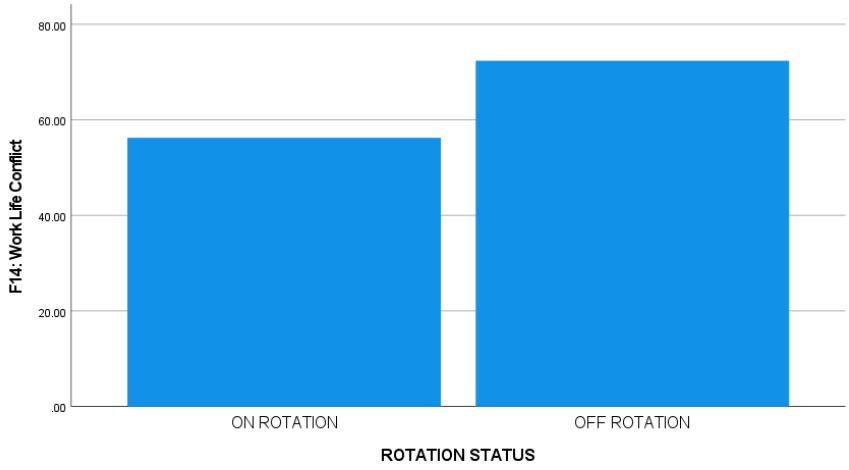


Figure 55

F14: Work Life Conflict as a Function of Rotation Status



Two-Factor Interactions (2FIs). Four 2FIs were found to be significant predictors of *F14: Work life conflict: age*gender*, *age*rotation status*, *gender*accommodation type*, *and gender*employment arrangement*. The 2FIs are confirmed and interpreted using graphical analysis as shown in Figures 56-63.

The first 2FI, *age*gender*, is composed of two CFs which are significant predictors by themselves. Figures 57-58 show that the highest levels of work life conflict are experienced by female workers aged 18-30 years whereas the lowest levels of conflict are experienced by male workers over 45 years.

Figure 56

*F14: 2FI: Age*Gender; View 1*

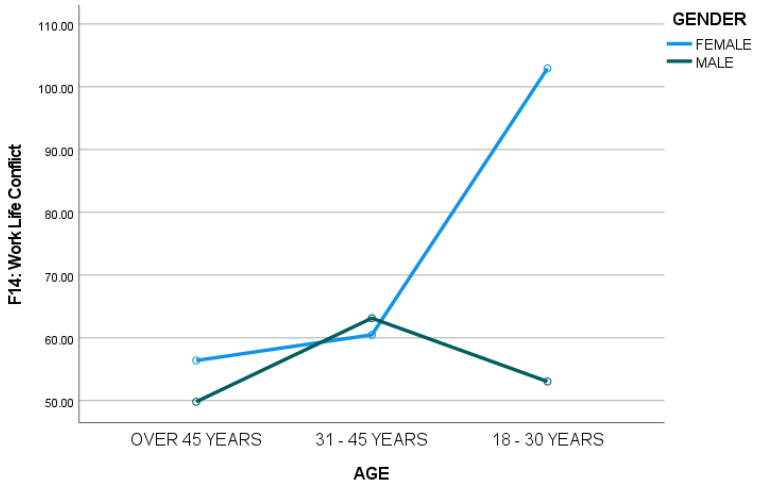
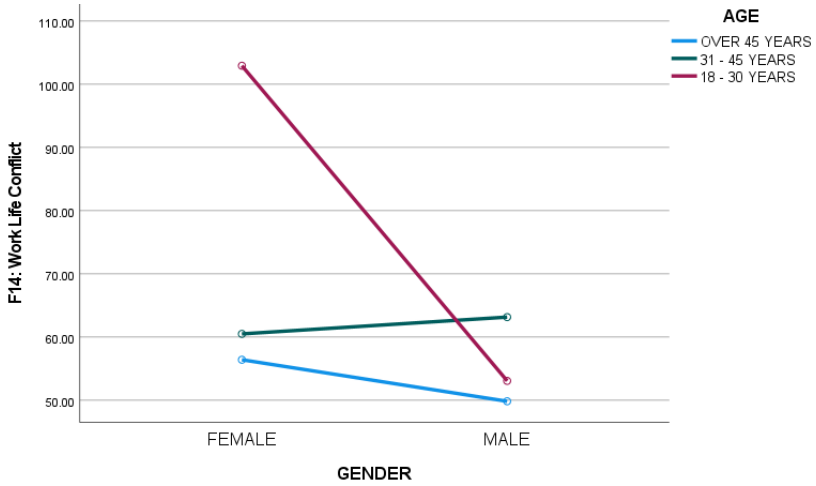


Figure 57

*F14: 2FI: Age*Gender; View 2*



The effect of *age*rotation status* is shown in Figures 58-59 and indicates that workers aged 18-30 years who are off rotation experience the highest levels of work life conflict compared to workers over 45 years, either on or off rotation, who report the lowest levels of work life conflict.

Figure 58

*F14: 2FI: Age*Rotation Status; View 1*

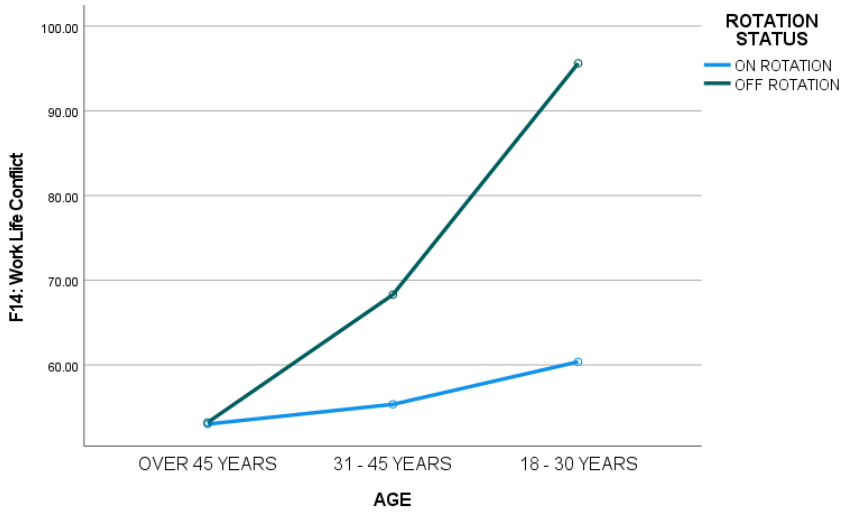
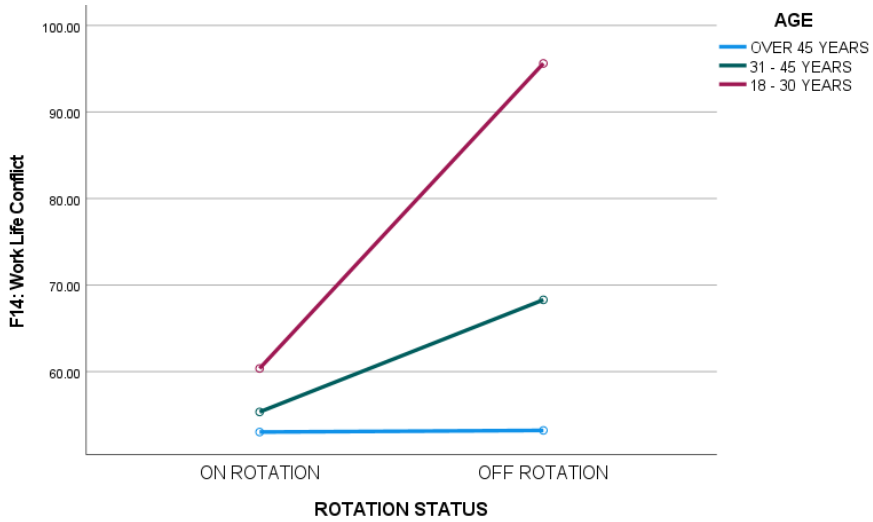


Figure 59

*F14: 2FI: Age*Rotation Status; View 2*



The effect of *gender*accommodation type* is shown in Figures 60-61 and indicates that the highest levels of work life conflict are reported by female workers living in other types of employer-provided accommodation while the lowest levels are reported by male workers living in self-provided accommodation.

Figure 60

*F14: 2FI: Gender*Accommodation Type; View 1*

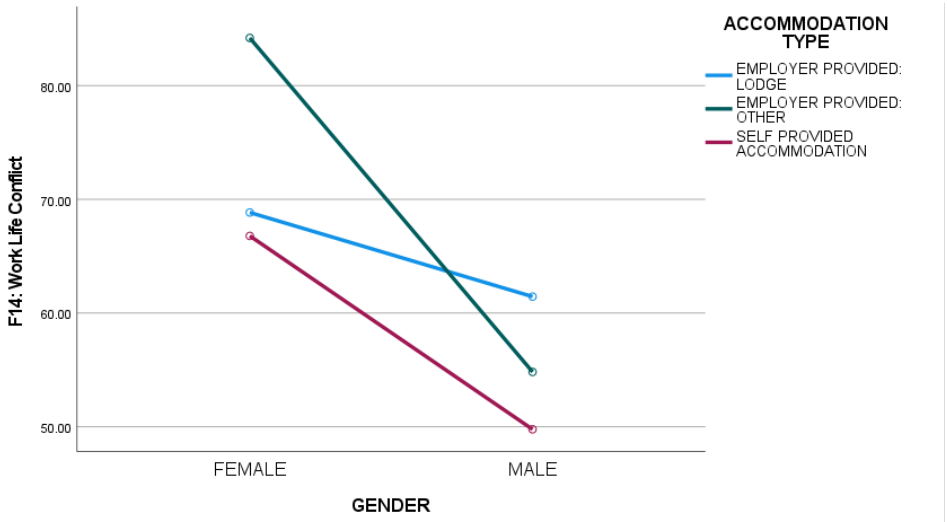
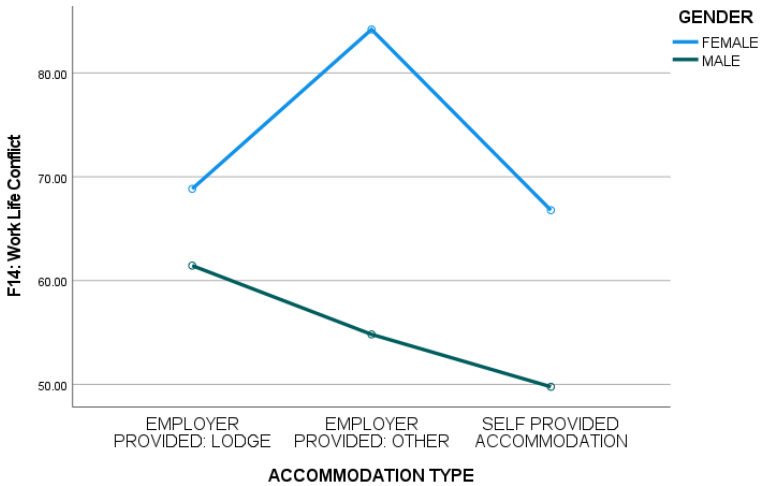


Figure 61

*F14: 2FI: Gender*Accommodation Type; View 2*



The effect of *gender*employment arrangement* is shown in Figures 62-63 and indicates that female worker experience higher levels of work life conflict than their male counterparts in all three levels of employment arrangement.

Figure 62

*F14: 2FI: Gender*Employment Arrangement; View 1*

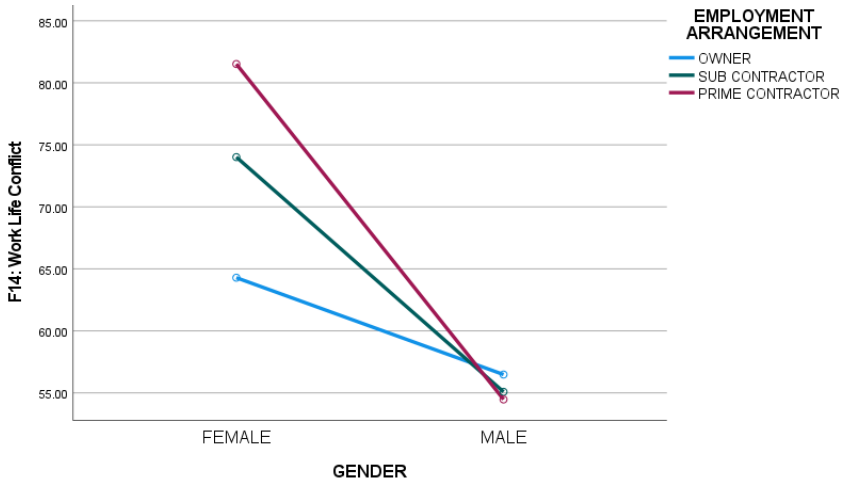
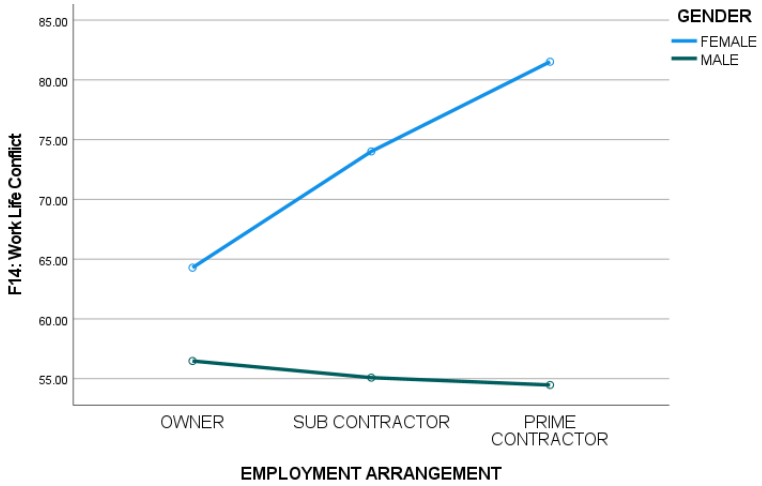


Figure 63

*F14: 2FI: Gender*Employment Arrangement; View 2*



F15: Vertical Trust and Organizational Justice

There were no significant predictors, either CFs or 2FIs, in the best model I could develop based on adjusted R^2. Further, no model, including the best goodness-of-fit model, was a significant predictor of the RV based on comparing p-value to a level of significance of $\alpha = .05$.

Summary of Analyses

For each RV, there is a subset of CFs and two-factor interactions (2FIs) found to form a model that is a significant predictor, based on model p-value compared to a level of significance of a = .05. The predictors and 2FIs that form that model are considered influences of the RV. In some cases, CFs were predictors by themselves. In other cases, CFs were moderators of the relationship between the RV and other CFs, as part of 2FIs; or found to be predictors of the RV as part of 2FIs. A summary of these relationships is provided in Table 33.

Where there were no significant predictors, either CFs or 2FIs, in the best model I could develop based on adjusted R^2 (F2, F3, F7, F8, F10, F11, F13, and F15), there may be some evidence of the possibility of significant influence among some of the CFs and 2FIs. However, there was insufficient evidence of that influence and insufficient evidence to conclude that any models comprising subsets of the evaluated CFs and 2FIs was a significant predictor of the RV.

Table 33

Summary of Relationships Between CFs, 2FIs, and Response Variables

	AGE	GDR	ACC	ARR	ROT	AGE * ACC	ACC * ARR	GDR * ACC	ACC * ROT	AGE * ARR	AGE * GDR	AGE * ROT	GDR * ARR	ARR * ROT	GDR* ROT	Adj. R^2
F1	P			P						M		I	M	M		0.125
F2																<.018
F3																0.054
F4	P	P							I							0.134
F5	M			P				I		M	M					0.096
F6	P		M		M		M			I	I	M	M			0.161
F7																0.024
F8																0.001
F9											I					0.037
F10																0.045
F11																0.039
F12				M	P										M	0.045
F13																0.037
F14	P	P	M		P			M			I	M	M			0.106
F15																0.041

Note. This table summarizes the relationships between the RVs and CFs according to their statistical significance. CFs that were significant predictors of the RV are marked as predictors (P); moderators of the relationship between the RV and other CFs are marked as moderators (M), and statistically significant 2FIs are marked as interactions (I).

Results of Post-hoc Analyses of Statistical Tests

Post-hoc analyses were done to check the residuals for normality using a normal probability plot (P-P plot) as well as post-hoc Levene's test on the final model. These post-hoc analyses were included in the statistical analysis finding presented earlier in this chapter.

Workers' Views of the Culture Within in the Canadian CEI Work Environment

Participants described their personal health and experiences with negative acts within the Canadian CEIs as part of the COPSOQ survey. Further, some workers volunteered to provide additional qualitative feedback through personal communication. While these data were not included as part of the statistical analysis, it does offer valuable insight into the worker experience and culture of the work environment within the Canadian CEIs. Moreover, the CSA (2013) and ISO (2021) recommended the inclusion of additional psychosocial hazards identified by workers as part of PRM. For those reasons, qualitative data were included as part of this study. What follows is a description of the data provided by workers pertaining to their personal health and experiences with undesirable acts.

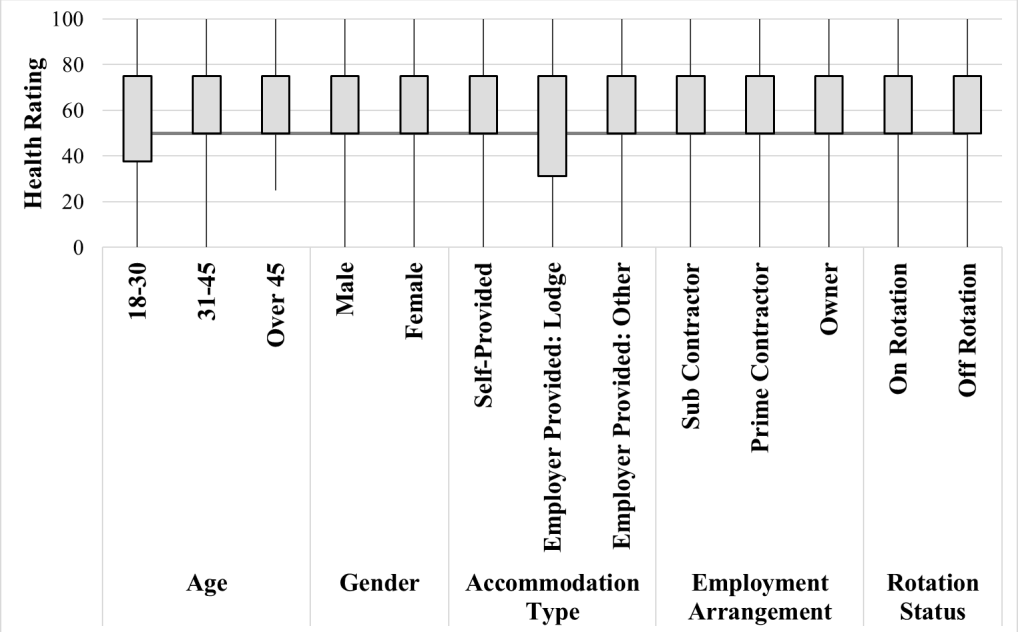
Personal Health

Five types of personal health questions are included in the COPSOQ and relate to sleep quality, physical and emotional energy, stress and tension, physical aches and pains, and mental capacity. Participants were asked to evaluate their general health and the frequency of commonly identified issues related to aspects of health. Participants indicated the frequency of issues by selecting the most appropriate choice to a Likert-type question. The options provided to participants included the following: All the time, a large part of the time, part of the time, a small part of the time, or not at all. Questions about personal health were answered by not less than 96% of participants on any single question. Workers' self-reported general health was typically reported as "good" (42%),

but also, “very good” (30%), “fair” (16%), “excellent” (9%), and “poor” (3%). Figure 64 provides a summary of workers’ health evaluations.

Figure 64

Self-Rated General Health of Canadian CEI Workers, by Group/Level



A description of workers’ responses by group and level is provided in Table 34 and offers additional insight into the varied experiences of workers. Workers aged 18-30 years were most likely to report “poor” health while those over 45 years of age did not report any instances. Workers residing in lodges or camps were more likely to report lower levels of health as compared to workers in other types of accommodation. Some commonality was observed across groups as well. For example, workers evaluated their general health nearly identically whether they were on rotation or off and workers in different employment arrangements generally reported similar levels of health.

Table 34

Self-Assessed General Health of Workers: Detailed View

Group / Level	N	Poor		Fair		Good		Very Good		Excellent	
		n	%	n	%	n	%	n	%	n	%
Age											
18-30	11	2	18.2%	1	9.1%	3	27.3%	4	36.4%	1	9.1%
31-45	85	4	4.7%	12	14.1%	37	43.5%	26	30.6%	6	7.1%
Over 45	78	0	0.0%	14	17.9%	33	42.3%	23	29.5%	8	10.3%
Gender											
Male	111	4	3.6%	19	17.1%	49	44.1%	32	28.8%	7	6.3%
Female	63	2	3.2%	8	12.7%	24	38.1%	21	33.3%	8	12.7%
Accommodation Type											
Self-Provided	51	3	5.9%	4	7.8%	21	41.2%	18	35.3%	5	9.8%
Employer Provided: Lodge	90	2	2.2%	21	23.3%	31	34.4%	28	31.1%	8	8.9%
Employer Provided: Other	33	1	3.0%	2	6.1%	21	63.6%	7	21.2%	2	6.1%
Employment Arrangement											
Subcontractor	87	5	5.7%	12	13.8%	37	42.5%	27	31.0%	5	5.7%
Prime Contractor	35	2	5.7%	6	17.1%	13	37.1%	9	25.7%	4	11.4%
Owner	52	1	1.9%	8	15.4%	23	44.2%	17	32.7%	4	7.7%
Rotation Status											
On Rotation	95	2	2.1%	16	16.8%	39	41.1%	29	30.5%	9	9.5%
Off Rotation	79	4	5.1%	11	13.9%	34	43.0%	24	30.4%	6	7.6%

Workers provided insight to their general health by evaluating the frequency of problems known to be related to sleep quality, energy (both physical and emotional), stress and tension, physical aches and pains, and their mental capacity for thinking, decision making, and memory. Table 35 displays mean scores for subsets of questions related to the health topic by group and level. Higher scores reflect an increased frequency of problems in that area.

Table 35

Frequency of Topical Health Problems

Group / Level	N	Sleep Quality	Physical and Emotional Energy	Stress and Tension	Physical Aches and Pains	Mental Capacity
Age						
18-30	78	49.69	56.25	48.48	27.11	36.70
31-45	85	42.77	59.75	54.54	30.21	39.96
Over 45	11	39.58	70.83	56.25	33.33	33.33
Gender						
Male	111	46.11	57.57	50.23	27.73	37.73
Female	63	45.16	60.79	54.74	31.13	38.81
Accommodation Type						
Self-Provided	90	44.58	56.95	51.90	27.57	37.50
Employer-provided: Lodge	33	48.63	63.67	49.41	29.88	37.50
Employer-provided: Other	51	46.00	58.75	53.38	30.87	39.63
Employment Arrangement						
Subcontractor	87	45.46	56.03	49.93	27.17	34.63
Prime Contractor	35	46.88	63.24	57.17	31.43	42.10
Owner	52	45.50	60.38	51.63	30.38	41.50
Rotation Status						
On Rotation	95	45.87	58.24	52.66	26.98	38.36
Off Rotation	79	45.63	59.33	50.89	31.39	37.82

Workers generally described having poor sleep quality part of the time due to bad or restless sleep and workers over 45 tended to have issues with waking too early and being able to get back to sleep. Workers indicated they regularly felt irritability, tension, and stress. Workers aged 18-30 reported feeling tired most of the time and experienced physical and emotional exhaustion more than other groups. Stress and tension were commonplace across all groups and was again more problematic for workers in the 18-30 age group. Physical aches and pains were occasional for all groups and seemed to increase in frequency with age. Female workers experienced headaches more often than

males who experienced them a small part of the time. However, workers aged 18-30 also experienced headaches at least a small part of the time. Workers living in lodge style accommodation reported a lower frequency of muscle tension than those in other accommodations. Prime contractor workers reported the most frequent issues with concentration and thinking clearly when compared to other employment arrangements.

Workplace Culture

Those who volunteered to share their experiences in depth commented that the Canadian CEIs embrace a traditionally male attitude and that there is an overemphasis on traits such as dominance, aggression, emotional suppression, and the rejection of qualities traditionally associated with femininity. This sentiment was further supported by "Jack," an ironworker from Alberta, who declined to complete the survey but eagerly agreed to share his opinion:

> I'll tell you right now. There's mental health everywhere. I'm an ex oil rigger. I'm an ironworker by trade. Our environments we work in (physical environment and emotional environment) are absolutely shit. Not fit for human presence. But we signed up for the job. And it's jobs like these that separate the men from the boys. So please don't bring light to our environment as (sic) last thing we need is new protocols about catering to the boys. While the men are accustomed to it. Please stay out of the trades dear, please leave us alone.

Participant "Emily," a female subcontractor in her mid-30s indicated that negative perceptions around mental health and wellbeing are widespread and prevent workers from seeking support for fear of being viewed as weak; however, she also believed,

"perceptions and stigmas are beginning to change for the better, particularly compared with previous generations."

Exposure to Undesirable Acts

Five types of undesirable acts are included in the COPSOQ: unwanted sexual attention, threats of violence, physical violence, bullying, and discrimination. Participants were asked to evaluate their exposure to these acts in two different contexts: exposures where the acts were aimed at the worker and where they observed acts aimed at others. Participants indicated whether they had been exposed to the act and the frequency of the exposure by selecting the most appropriate choice to a Likert-type question. The options provided to participants included the following: no; yes, a few times; yes, monthly; yes, weekly; yes, daily. They were asked the role of the perpetrator (options included the following: colleagues; manager; supervisor; subordinates; clients/customers; other) and could select more than one option. Questions about undesirable acts were answered by not less than 94% of participants on any single question.

Exposure to undesirable acts was common with 57% (n = 99) of workers experiencing at least one type of negative over the past year and 43% (n = 75) reporting no exposure or providing no response. Bullying was reported by a significant portion of workers (40%), followed by discrimination (31%), sexual attention (18%), threats of violence (11%), and physical violence (7%). Data indicated that while exposure to these acts is experienced across demographic levels, some worker groups were more likely to be exposed than others. A summary of workers' reported exposures to undesirable acts

aimed at themselves is provided in Table 36. The frequency of undesirable acts varied based on type of act and is illustrated in Figure 65.

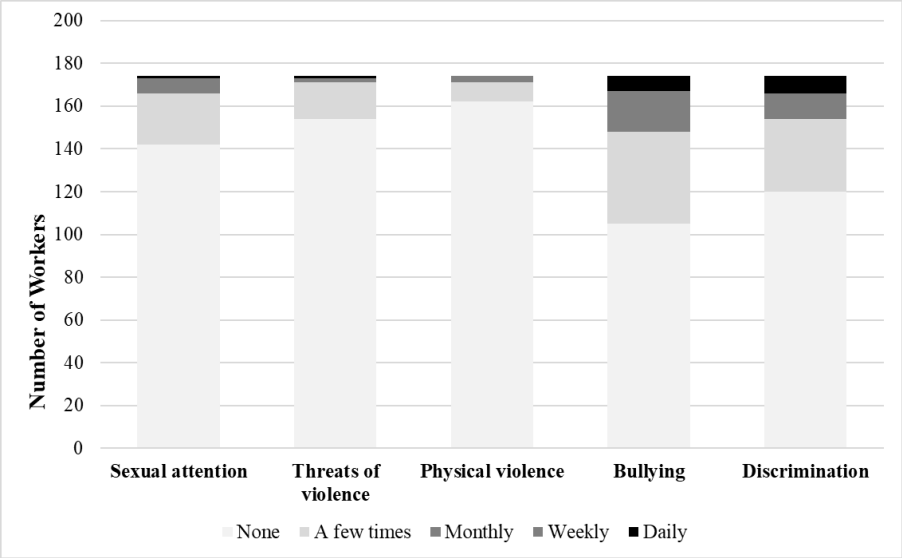
Table 36

Undesirable Acts Aimed at Workers Over Past 12 Months

Demographic Characteristic	N	Sexual attention		Threats of violence		Physical violence		Bullying		Discrimination	
		n	%	n	%	n	%	n	%	n	%
Age											
18-30	11	5	45.5%	1	9.1%	0	0.0%	5	45.5%	5	45.5%
31-45	85	18	21.2%	10	11.8%	7	8.2%	34	40.0%	26	30.6%
Over 45	78	9	11.5%	9	11.5%	5	6.4%	30	38.5%	23	29.5%
Gender											
Male	111	4	3.6%	14	12.6%	6	5.4%	37	33.3%	20	18.0%
Female	63	28	44.4%	6	9.5%	6	9.5%	32	50.8%	34	54.0%
Accommodation Type											
Self-Provided	51	12	23.5%	7	13.7%	2	3.9%	19	37.3%	15	29.4%
Employer Provided: Lodge	90	15	16.7%	9	10.0%	10	11.1%	36	40.0%	25	27.8%
Employer Provided: Other	33	5	15.2%	4	12.1%	0	0.0%	14	42.4%	14	42.4%
Employment Arrangement											
Subcontractor	87	4	4.6%	6	6.9%	3	3.4%	15	17.2%	12	13.8%
Prime Contractor	35	14	40.0%	6	17.1%	6	17.1%	17	48.6%	15	42.9%
Owner	52	14	26.9%	8	15.4%	3	5.8%	37	71.2%	27	51.9%
Rotation Status											
On Rotation	95	24	25.3%	12	12.6%	7	7.4%	39	41.1%	29	30.5%
Off Rotation	79	8	10.1%	8	10.1%	5	6.3%	30	38.0%	25	31.6%

Figure 65

Frequency of Undesirable Acts Aimed at Workers Over Past 12 Months



Exposure to threats towards others was common with 68% (n = 119) of workers observing at least one type of negative over the past year and 32% (n = 55) reporting no observations or providing no response. Bullying was reported by over half of workers (51%), followed closely by discrimination (48%) and sexual attention (36%); then threats of violence (21%) and physical violence (15%). A summary of workers' exposure to undesirable acts aimed at others over the past 12 months is provided in Table 37. The frequency of undesirable acts varied based on type of act and is illustrated in Figure 66.

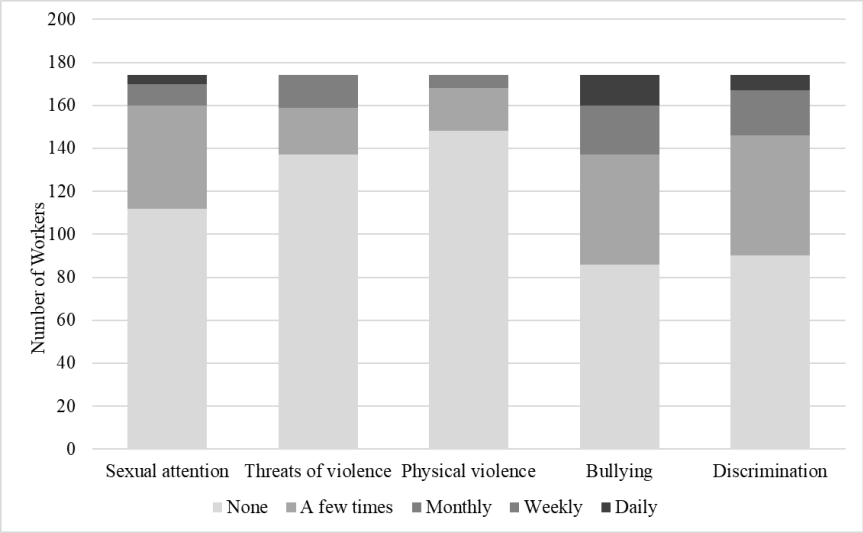
Table 37

Undesirable Acts Aimed at Others Over Past 12 Months

Demographic Characteristic	N	Sexual attention		Threats of violence		Physical violence		Bullying		Discrimination	
		n	%	n	%	n	%	n	%	n	%
Age											
18-30	7	63.6%	2	18.2%	1	9.1%	5	45.5%	7	63.6%	7
31-45	23	27.1%	17	20.0%	13	15.3%	43	50.6%	38	44.7%	23
Over 45	32	41.0%	18	23.1%	12	15.4%	40	51.3%	39	50.0%	32
Gender											
Male	111	35	31.5%	21	18.9%	14	12.6%	52	46.8%	45	40.5%
Female	63	27	42.9%	16	25.4%	12	19.0%	36	57.1%	39	61.9%
Accommodation Type											
Self-Provided	51	17	33.3%	11	21.6%	9	17.6%	24	47.1%	25	49.0%
Employer Provided: Lodge	90	33	36.7%	20	22.2%	14	15.6%	47	52.2%	42	46.7%
Employer Provided: Other	33	12	36.4%	6	18.2%	3	9.1%	17	51.5%	17	51.5%
Employment Arrangement											
Sub Contractor	87	12	13.8%	9	10.3%	4	4.6%	23	26.4%	22	25.3%
Prime Contractor	35	26	74.3%	17	48.6%	12	34.3%	25	71.4%	27	77.1%
Owner	52	24	46.2%	11	21.2%	10	19.2%	40	76.9%	35	67.3%
Rotation Status											
On Rotation	95	42	44.2%	22	23.2%	14	14.7%	50	52.6%	46	48.4%
Off Rotation	79	20	25.3%	15	19.0%	12	15.2%	38	48.1%	38	48.1%

Figure 66

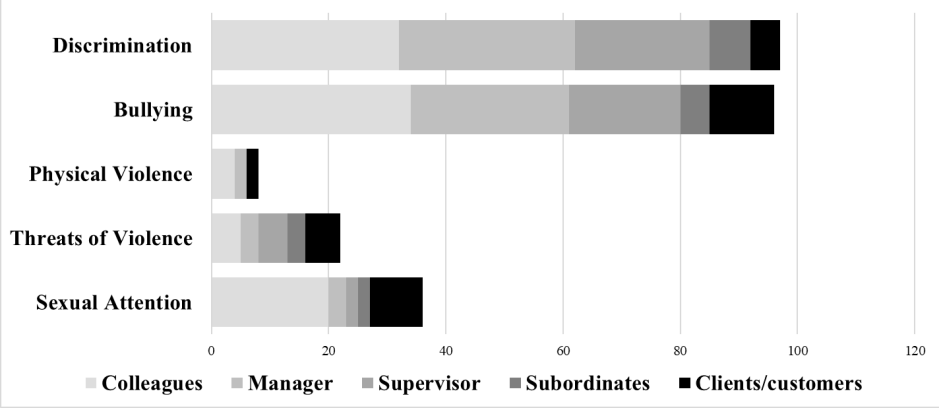
Frequency of Undesirable Acts Aimed Towards Others Over Past 12 Months



Workers provided 259 data points related to the sources of undesirable acts and indicated, most frequently, colleagues (37%), followed by managers (25%), supervisors (19%), clients/customers (13%), and subordinates (7%). The source of threat varied somewhat based on the nature of the undesirable act as illustrated in Figure 67.

Figure 67

Source of Undesirable Acts Over Past 12 Months



Unwanted Sexual Attention. Unwanted sexual attention was reported by all demographic groups at all levels with 32 (18%) of the 174 participants indicating they had experienced it personally at least a few times over the past year. Primarily, it was female workers (28, 16%) compared to male workers (4, 2%) who experienced the unwanted act. Both genders reported experiencing the situation most frequently with a colleague or a client/customer, and several workers indicated experiences with senior leaders or other contractors outside their employment group.

Two groups stood out as having a higher prevalence of reported exposure to unwanted sexual attention: young workers and female workers. Workers aged 18-30 years were aligned in their reported frequency of exposure, indicating that it happened *a few times* over the past 12 months. Comparatively, a more varied experience was reported by female workers (a few times, 75%; monthly, 4%; weekly, 18%; daily, 4%). Young workers and female workers also reported among the highest prevalence of observation of unwanted sexual attention towards others, along with prime contractor workers, and workers over 45 years of age.

Threats of Violence. Those working for subcontractors indicated exposure to threats of violence more than other work arrangements; and indicated threats occurred *a few times* in the past year. Female workers, young workers, and those employed by owners indicated the lowest prevalence of threats of violence. When reporting exposure to threats of violence towards others, the average prevalence nearly doubled (threat to themselves, 11.7%; threat to others, 21.7%).

Physical Violence. Physical violence was the least prevalent undesirable act according to participants. However, experiences varied across age and employment arrangement. For example, workers aged 18-30 reported no exposure to the threat while those in other age categories did (31-45 years, 8%; over 45 years, 6%); and workers living in other types of employer-provided accommodation reported no exposure unlike those in other accommodations (self-provided, 4%; employer provided: lodge, 11%). Like threats of violence, when reporting exposure to physical violence towards others, the average prevalence more than doubled (threat to self, 6%; threat to others, 15%).

Bullying. Bullying was the most consistently reported undesirable act across the different groups with between 32.7%-54% of workers reporting at least a few instances over the past year. Participants cited colleagues (20%), Managers (16%), and Supervisors (11%) as the primary sources of bullying. The factor with the largest difference between levels was gender in which 51% of female workers experienced bullying compared with 33% of male workers. Although a similar percentage of workers experienced bullying a few times per year (males, 62%; females 63%), frequency was different for daily exposure (males, 8%; females 13%); weekly exposure (males, 11%; females 22%); and monthly exposure (males, 19%; females 3%). On average, more than half the participants (51%) indicated they were aware of bullying towards others and the threat was most prevalent with workers employed by subcontractors (66%) and female workers (57%). Participant “David,” a male, over-45, sub-contract worker, described the rationale he perceived to be behind the chronic bullying, saying, “I think it’s about control. If I

threaten somebody, they're going to do what I want. And I know they're probably not brave enough to come forward and say anything… it's a tactic used to manage people."

Discrimination. Discrimination was widely reported across all groups with an average of 34% of workers reporting exposure at least a few times per year. Participants cited colleagues (18%), Managers (17%), and Supervisors (13%) as the primary sources of discrimination and described situations where they were excluded from workplace training or cut out of decision-making processes that fell within their job description. Female workers reported discrimination three times more than male workers and, when it did occur, at a greater frequency than reported by males: a few times (males, 70%; females, 59%); daily exposure (males, 10%; females 18%); weekly exposure (males, 20%; females 9%); and monthly exposure (males, 0%; females 15%).

Nearly half of workers aged 18-30 reported periodic discrimination, citing cronyism, nepotism, agism, and sexism as types of discrimination encountered. Those living in other types of employer-provided accommodation reported exposure to discrimination (42%) and listed racism as a common issue. While a third of workers reported experiencing discrimination firsthand, over half (51%) experienced discrimination towards others. Some groups reported widespread observation of discrimination against others, such as subcontract workers (63%); workers aged 18-30 (64%); and female workers (62%).

Summary

To understand more about how workers evaluate PRFs in the Canadian CEIs, I conducted this research to answer this question: What is the relationship between five

demographic CFs and PRFs in the Canadian CEIs as measured by 15 RVs? I examined the relationship between a set of five demographic CFs (listed in Table 1) and PRFs in the Canadian CEIs as measured by 15 RVs (listed in Table 2). Using a purposeful sequential model-building process, I developed statistically significant predictive models for seven RVs: *F1*, *F4*, *F5*, *F6*, *F9*, *F12*, and *F14*. Each of those models indicated a relationship with a unique subset of CFs (shown in Table 35). For the other RVs (*F2*, *F3*, *F7*, *F8*, *F10*, *F13*, and *F15*) no significant relationships with the CFs were identified.

I evaluated the hypotheses of each RV which demonstrated a significant predictive model. For each of the CFs and 2FIs in the final models, I rejected the null hypothesis that the means were equal for the RV for each level of the CF levels and concluded there was sufficient evidence that the alternate hypothesis is true and that there was a difference of means for the RV among various levels of the CFs. For each of the CFs and 2FIs that were eliminated in the model building process, I failed to reject the null hypothesis and concluded that there was insufficient evidence to conclude that the means of the RV different among different levels of the CFs.

From the results, I identified the following key findings:

- There is a relationship between five demographic CFs and seven PRFs (*F1*, *F4*, *F5*, *F6*, *F9*, *F12*, and *F14*) in the Canadian CEIs.
- There is no relationship between five demographic CFs and eight PRFs (*F2*, *F3*, *F7*, *F8*, *F10*, *F13*, and *F15*) in the Canadian CEIs.

- For the significant relationships, some CFs including *age*, *gender*, *employment arrangement,* and *rotation status* were frequent components of the predictive models.
- There were several insightful 2FIs, including *gender*employment arrangement*, *age*rotation status*, and *age*employment arrangement*, among the significant predictive models that indicate some moderation of the relationships between significant CFs and the RVs.
- Some PRFs were explained by a single significant predictor (*F5, F6,* and *F12*) while others had two or more significant predictors (*F1*, *F4*, and *F14*).
- The goodness of fit for each of the significant models was low (< 0.162) and indicated other significant variables were not included in the models.

Further, I provided rich and descriptive qualitative information about workers' experiences in the Canadian CEIs and brought light to other types of PRFs that are known to exist within the industry but are rarely addressed in research. The results of this study will be discussed further in Chapter 5 where I provide a review of the purpose of the study, interpret the findings, review the limitations of the study, and provide recommendations for further research.

Chapter 5: Discussion, Conclusions, and Recommendations

Workers' mental health has become increasingly important to organizations because of rising claims costs and a changing landscape of social and legal expectations (CAMH, 2020). Effective management of PRFs is crucial for organizations to protect their productivity and social license to operate. The purpose of this quantitative study was to examine the relationship between 15 measures of Canadian CEI workers' perspective of PRFs (RVs) and five demographic CFs. The nature of the study was nonexperimental and correlational, and data were collected from workers within the Canadian CEIs using an electronic questionnaire that operationalized the Canadian version of the COPSOQ. The study was conducted to address gaps in the practical and academic knowledge related to PRM and bridge the distance between these two realms by creating a more cohesive understanding of PRM and PRFs within these unique industries. This chapter provides my interpretation of the findings followed by a discussion of study limitations as well as recommendations for further research, practical implications of the study, and a conclusion.

Interpretation of Findings

Several findings resulted from this study and were itemized in Chapter 4. These findings confirm and extend the results of other studies, demonstrating that factors of age, gender, accommodation type, employer arrangement, and rotation status influence workers' views of PRFs. I also confirmed prior research related to the culture of the CEIs through workers reports of health and exposure to unwanted sexual attention, threats of violence, acts of physical violence, bullying and discrimination. In this section, I provide

an interpretation of each of the findings and their operational significance in real-world application. Then, I discuss how the findings relate to prior research, theories, and concepts before, finally, explaining the deeper insights that arose from the findings.

Interpretation and Operational Meaning of Six Key Findings

Evidence of Significant Relationships Between Demographic CFs and PRFs

My study provides evidence that the five demographic CFs of age, gender, accommodation type, employer arrangement, and rotation status are significant predictors of seven PRFs (quantitative demands, influence at work, possibilities for development, meaning of work and work commitment, role conflict, social community, and work life conflict). The best predictive models showed that the CFs explained a small amount of the variation in workers' views of these PRFs. Practically speaking, the results highlight the significance of demographic factors as predictors of PRFs while emphasizing the need for a more nuanced understanding that considers the limited explanatory power of these variables and the likely influence of other factors on workers' views. The study underscores the importance of recognizing and addressing individual differences shaped by demographic characteristics when designing interventions or policies aimed as PRM in the workplace.

Lack of Evidence of Significant Relationships Between Demographic CFs and PRFs

I did not find evidence that the five demographic CFs age, gender, accommodation type, employer arrangement, and rotation status are significant predictors of seven PRFs (work pace, emotional demands, predictability and rewards, role clarity, quality of leadership, social support from supervisor, job insecurity and satisfaction, and

vertical trust and organizational justice). Although there were indications of a relationship, the evidence did not reach statistical significance. From a practical perspective, the lack of evidence is meaningful because it demonstrates that the five CFs, particularly age and gender, are not predictors on their own. The results may signify either a consistent experience for all workers concerning this subset of PRFs or a more intricate interplay of factors that remains elusive.

Four CFs are Critical to the Worker Experience

Where significant relationships were identified, the CFs of age, gender, employment arrangement, and rotation status were frequent components of the predictive models. *Age* played a role in four PRFs, including quantitative demands, influence at work, meaning of work and work commitment, and work life conflict. Gender was influential in influence at work and work life conflict. Employment arrangement was significant to quantitative demands and possibilities for development. Rotation status was significant to social community and work life conflict.

These findings underscore the significance of these factors in shaping workers' experiences with PRFs. It provides practical significance in several ways. First, by providing leaders and decision makers with information that can be used to make more informed decisions about a wide range of preventative and protective risk strategies, including those related to work organization, social factors, and the work environment. Second, the findings bring forward additional avenues for targeted PRM through clear labour management expectations that are specified within the contracting chain; the benefit of which is greater equity across worker groups (Llorens et al., 2010).

Furthermore, understanding how age and gender impact the experiences of workers could be used to gain strategic advantage for recruiting and retaining new worker types within the Canadian CEIs.

Seven 2FI are Influential to the Worker Experience

My study identified seven significant 2FIs that impacted workers' perspectives on six PRFs; and while some were anticipated, others brought new knowledge forward. The interaction of age and gender was expected to affect PRFs based on information from past research (see, for example, Brown et al., 2021; Dong et al., 2022). Possibilities for development were influenced by the interaction of gender and accommodation type; in turn, accommodation type interacted with rotation status to shape workers views on their influence at work. Age, when factored with employment arrangement, played a role in workers' perceptions of the meaning of work and work commitment; and quantitative demands when factored with rotation status. These findings have practical meaning because they expand knowledge by considering variables that have not yet benefited from academic research yet are pertinent to the working environment within the CEIs. The findings give CEI leaders and decision makers new insight into ways workers may be affected by the organization of work which may help to make more informed decisions regarding PRM. Additionally, they illustrate the interconnected nature of PRFs and how changes in workers' views of one PRF may affect others.

Differences in the Complexity of Workers' Views of PRFs

Some PRFs were explained by a single significant predictor (possibilities for development, meaning of work and work commitment, and social community) while

others had two or more significant predictors (quantitative demands, influence at work, and work life conflict). This finding is important from a practical standpoint because it suggests differences in the complexity of factors influencing each specific PRF. When a single significant predictor is identified for a PRF, it implies that one demographic CF plays a prominent and distinctive role in shaping workers' perspectives on that particular PRF. On the other hand, when two or more significant predictors are involved for a PRF, it suggests that the interplay of multiple demographic factors is necessary to understand and predict workers' views on that aspect of psychosocial risk.

The identification of the complexity in workers' views serves as a valuable starting point for organizations seeking to investigate and enhance their psychosocial culture. By recognizing the unique combination of demographic factors influencing psychosocial risk, organizations can embark on a more targeted and efficient exploration of their work environment. This knowledge becomes instrumental in fast-tracking efforts to comprehend the intricacies of the psychosocial climate within the organization.

There's More to Learn About Workers' Views of PRFs

The goodness of fit for each of the significant models was modest (adjusted $R^2 <$ 0.162) and indicated other significant variables were not included in the models. The low adjusted R^2 indicates there is limited ability of the models to explain the variability of workers' views of PRFs. Practically speaking, this information is helpful because it allows CEI workers and leaders to recalibrate pre-conceived perceptions of risk associated with how old a worker is, what gender they are, who they work for, where they live, and whether they are currently working or not. It simultaneously confirms the

importance of the factors while demonstrating that they are not comprehensive. This nuanced understanding equips leaders to shape responses to PRFs, recognizing these demographic variables' significance without relying on them exclusively for strategic determinations.

Relationship to Prior Research, Theories, and Concepts

The findings of this study broadly confirm the concepts of risk management theory and the findings of prior research that individuals assess risk differently (see, for example, Alrawad et al., 2022; Siegrist & Árvai, 2020; Slovic et al., 1985). More specifically, the findings support Brown et al. (2021) related to the different perspectives that arise due to gender and Chaswa et al. (2020) regarding differences of views based on demographic and occupational characteristics.

From the study, there is also support for using the concept of using PRFs as a term that describes both PHs and amplifiers because of the interconnected nature of PRFs and their demonstrated ability to influence the perceived risk associated with other factors. In this way, the findings support the CSA (2013), Chan et al. (2020), and Frimpong et al. (2022).

Additionally, I identified the intricate and nuanced nature of workers' experiences particular to psychosocial health, supporting the insights of Boschman et al. (2014), Carvajal-Arango et al. (2021), Clarke and Cooper (2000), Dorow et al. (2019), Ramkissoon et al. (2019), and Wright and Griep (2018) regarding individual risk perception and the complex interplay of factors influencing vulnerability to stress. Simultaneously, the absence of significant relationships between demographic factors and

certain PRFs aligns with the prior conclusions of Dorow et al. (2019) and Wright and Griep (2018), underscoring the gaps in understanding the variation in workers' experiences.

This study supported previous research findings (see, for example, Dorow et al., 2021; Lekchiri & Kamm, 2020; Murphy et al., 2021; Tijani, Jin, & Osei-kyei, 2020) that the female experience in the CEIs is marred by pervasive challenges, including heightened vulnerability to sexual attention, bullying, and discrimination. The findings of Dorow et al. (2021), Eyllon et al. (2020), and Tijani, Jin, and Osei-kyei (2020) related to gender and the likelihood of females to experience stress at higher rates than males were confirmed. Notably, the findings affirm the influence of age and gender, both individually and in interaction, on workers' views of PRFs, in line with the prior studies of Dorow et al. (2021), Frimpong et al. (2022), and Ramkissoon et al. (2019). The results also echo the nuanced conclusions of Ramkissoon et al., highlighting gender differences, particularly among females aged 18-30, while simultaneously revealing few disparities among subgroups.

The study pushes the boundaries of knowledge by examining novel demographic aspects of CEI work, as advocated by Dorow et al. (2021), such as accommodation type, employee arrangement, and rotation status, which have been unexplored quantitatively in relation to PRFs. Notably, the findings related to employment arrangement across owner, prime contractor, and subcontractor levels advances our comprehension of PRF views in the Canadian CEIs, extending the insights of Dorow et al. and supporting Kunyk et al.'s (2016) findings on hierarchical impacts on psychosocial health and safety.

Deeper Meaning to be Gleaned from the Findings

The findings revealed a compelling contradiction in the experiences of female workers concerning PRFs, highlighting significant variability based on subgroup membership, particularly related to age and employment arrangement. While encounters were consistently widespread in terms of exposure to unwanted sexual attention, bullying, and discrimination, the simultaneous diversity in exposure to various PRFs, may foster a situation where the only shared commonality among women is their experience with undesirable acts. In such a subculture, the social amplification of risk may distort workers' perceptions of their experiences, contributing to a complex interplay of perceptions within the work environment that is not yet understood.

The findings also help to dispel any preconceived notions that workers' experiences with PRFs in the Canadian CEIs can be reliably formed solely based on demographic variables. This information holds paramount importance from a practical standpoint as the CEI workforce must undergo a transformation from its traditional male-dominated state to adapt to the changing labour market conditions; and this new knowledge, particularly as it relates to age and gender, will be helpful in developing future PRM strategies.

Limitations

Generalizability is limited if the sample is not representative of the population (Fitzgerald et al., 2004; Shadish et al., 2002). To manage this limitation, I solicited responses from specific demographic groups through online and interpersonal promotion. I used non-probability sampling which may have resulted in self-selection bias among the

participants with those who chose to participate representing a sub-group of the Canadian CEI population. As a result, my study's findings may reflect the experiences of people who hold a higher value on workplace mental health and PRM.

A further limitation was the relatively low participation rate which resulted in an unequal distribution of participants across groups. To address that limitation, I used ANOVA which is robust in applications of unbalanced designs. Another limitation was that my study used the terms "on rotation" and "off rotation" which may have been interpreted differently by participants as either being employed but not currently working or not employed and not currently working. To manage this limitation, I considered both interpretations when analyzing the findings to ensure they remained accurate.

Recommendations for Further Research

To strengthen future research and ensure a representative population, I recommend researchers provide extended data collection periods and promote increased participation through strategic partnerships with industry groups, unions, and government, where possible.

Throughout my research I observed a lack of consensus in the terminology used to discuss psychosocial risks and a general hesitancy to label a psychosocial threat a *hazard*. I recommend researchers use established risk management terms when discussing psychosocial risks in the workplace to foster a more accurate and standardized knowledge base that aligns with the principles of risk management and promotes normalization of PRM within real-world settings.

A further recommendation is continued research that focuses on the nuanced experience of workers with regard to PRFs within the CEIs. Areas that may benefit from further study are the intricate culture and enculturation processes; the effect of gender and age on views of PRFs; and individual and organizational measures of control for exposure to PRFs. Studies of both a cross-sectional and longitudinal nature are recommended. Such investigations will contribute to a deeper understanding of the multifaceted challenges facing workers and employers alike; facilitating the development of targeted interventions and improved psychosocial well-being strategies.

Implications

The findings of my study largely echo the findings of past research and provide confirmation of their applicability to the Canadian CEIs. By taking a unique approach and examining a full set of 15 PRFs, the study illuminated the interconnected nature of the risks. This insight is immensely valuable because it offers a shift in thinking of PRFs as discrete hazards towards a more realistic view of the interdependency of PRFs.

Through my research and analysis, I provide industry leaders with a uniquely candid look at a complicated problem by investigating workers' views towards a complete set of PRFs along with rich information about their individual, self-assessed health, and exposure to harmful acts aimed at themselves and others. The evidence from my research and analysis could be used to support PRM efforts within the CEIs by helping organizational leaders to better understand the nature of PRFs in the CEIs and the unique ways workers are impacted by similar hazards. I provide information using the

framework of risk management, a familiar concept in the CEIs, which could help to break down some of the barriers felt by leaders when faced with PRM in the workplace.

The study may have positive social change implications given that the study brought awareness of mental health and the challenges related to PRF exposure to the participants and those invited to participate. As a result of the findings, employers may be better equipped to effectively manage PRFs in the workplace, contributing to more effective policies, procedures, and programs related to worker mental health; and by extension, an improvement to the quality of their lives and those of their families.

There are several implications to theory as well, primarily in the form of new knowledge about how workers in the Canadian CEIs perceive PRFs, particularly as it relates to female workers and workers of different age groups. The findings present new knowledge related to the factors of accommodation type and employment arrangement and help to build the academic literature pertaining to CEIs in Canada. A further implication is a more cohesive understanding of a complete set of PRFs which is rarely available in academic research.

Conclusion

Psychosocial risk management is an area where problems are outpacing knowledge, particularly within high-risk industries. In the face of the trillion-dollar mental health problem, decision makers are immobilized by fear of doing the wrong thing and facing punishment socially, legally, and financially. The lack of action is resulting in the formation of a new kind of industry culture where psychosocial hazards are left uncontrolled, and workers are conditioned to fit in or find other work.

From a risk management perspective, the deeply entrenched and fundamentally flawed culture within Canadian CEIs seemingly contributes to a pronounced tolerance for psychosocial risk and the normalization of harmful practices, especially as they pertain bullying, discrimination, and unwanted sexual attention. This creates a paradox wherein both those perpetrating harm and those bearing its consequences are ensnared in a cycle that hinders change. Particularly at risk within this culture are female workers.

The findings revealed a compelling contradiction in the experiences of female workers concerning PRFs, highlighting a significant variability based on sub-group membership. While encounters were consistently widespread in terms of exposure to unwanted sexual attention, bullying, and discrimination, the simultaneous diversity in exposure to various PRFs, may foster a situation where the only shared commonality among women is their experience with undesirable acts. In such a sub-culture, the social amplification of risk may distort workers' experiences and expectations, contributing to a complex interplay of perceptions within the work environment that is not yet understood.

Further complicating the issue of PRM are issues of contractual hierarchy. Such structures hold significance, particularly in the context of worker welfare, as the requirements and expectations established by owners are often eroded as risk is shifted through contract chains. This illustrates the intricate challenges in maintaining consistent and thorough worker welfare standards throughout the multi-tiered contracting process, emphasizing the need for a vigilant and nuanced approach to risk management across each level of the hierarchy.

Workplace management of psychosocial risk is an extension of occupational health and safety risk management and should be treated as such. The application of prudent risk management practices, including identification, assessment, evaluation, and control, would allow for a systemized approach of managing risks in line with business goals and objectives. Now is an excellent time for the industries that perfected risk management to go back to occupational health and safety basics to tackle this new type of risk.

References

Ajayi, S. O., Jones, W., & Unuigbe, M. (2019). Occupational stress management for UK construction professionals. *Journal of Engineering, Design and Technology*, *17*(4), 819–832. https://doi.org/10.1108/jedt-09-2018-0162

Alfreahat, D., & Sebestyén, Z. (2022). A construction–specific extension to a standard project risk management process. *Organization, Technology and Management in Construction: An International Journal*, *14*(1), 2666–2674. https://doi.org/10.2478/otmcj-2022-0011

Alomari, K., Gambatese, J., Nnaji, C., & Tymvios, N. (2020). Impact of risk factors on construction worker safety: A Delphi rating study based on field worker perspective. *Arabian Journal for Science and Engineering*, *45*(10), 8041–8051. https://doi.org/10.1007/s13369-020-04591-7

Alrawad, M., Lutfi, A., Alyatama, S., Elshaer, I. A., & Almaiah, M. A. (2022). Perception of occupational and environmental risks and hazards among mineworkers: A psychometric paradigm approach. *International Journal of Environmental Research and Public Health,* 2022(19), 1-12. https://doi.org/10.3390/ijerph19063371

American Psychological Association. (2020). *Publication manual of the American Psychological Association* (7th ed.). https://doi.org/10.1037/0000165-000

American Society of Safety Professionals. (2011). *Risk management principles and guidelines* (ANSI/ASSE Z690.2). https://www.assp.org/standards

Asare, B.-A., Kwasnicka, D., Powell, D., & Robinson, S. (2021). Health and well-being of rotation workers in the mining, offshore oil and gas, and construction industry: A systematic review. *BMJ Global Health*, *6*(7), e005112. https://doi.org/10.1136/bmjgh-2021-005112

Asare, B.-A., Powell, D., Robinson, S., & Kwasnicka, D. (2023). Rotation work in the resources sector: A systematic review of the impact on workers' families. *Psychology & Health*, 1–30. https://doi.org/10.1080/08870446.2023.2190348

Asare-Doku, W., Rich, J., Kelly, B., & James, C. (2020). Mental health interventions in the mining industry: A narrative review. *Mental Health Review Journal*, *25*(2), 153–167. https://doi.org/10.1108/mhrj-10-2019-0039

Asenahabi, B. M. (2019). Basics of research design: A guide to selecting appropriate research design. *International Journal of Contemporary Applied Researches*, *6*(5), 76–89.

Assaad, R., Elsayegh, A., Ali, Gasser, Nabi, M. A., & El-adaway, I. H. (2020). Back-to-back relationship under standard subcontract agreements: Comparative study. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 12*(3). https://doi.org/10.1061/(ASCE)LA.1943-4170.0000406

Attridge, M. (2019). A global perspective on promoting workplace mental health and the role of employee assistance programs. *American Journal of Health Promotion*, *33*(4), 622–629. https://doi.org/10.1177/0890117119838101c

Bartholomew, S. H. (2022). *Construction contracting: Business and legal principles* (2nd ed.). The Open Education Initiative at the University Libraries at Virginia Tech.

Baynton, M. A., & Fournier, L. (2017). *The evolution of workplace mental health in Canada - Toward a standard for psychological health and safety*. The Great-West Life Assurance Company. https://wsmh-cms.mediresource.com/wsmh/assets/bbeq7vtdx9ckgc4o

BC Building Trades. (2020, May 6). *83% of construction workers have experienced a mental health issue*. Retrieved February 8, 2023, from https://bcbuildingtrades.org/83-of-construction-workers-have-experienced-a-mental-health-issue/

BC Hydro. (2023). *Site C Employment by Month* (February 2023). https://www.sitecproject.com/sites/default/files/February%202023%20Workforce%20Report.pdf

Bergh, L. I., Leka, S., & Zwetsloot, G. I. (2018). Tailoring psychosocial risk assessment in the oil and gas industry by exploring specific and common psychosocial risks. *Safety and Health at Work, 9*(2018), 63-70. https://doi.org/10.1016/j.shaw.2017.05.001

Bouchard-Bastien, E., & Gervais, M.-C. (2017). *Social and psychological dimensions of mining activities and impacts on quality of life*. Institut National de Santé Publique du Québec. https://www.inspq.qc.ca/sites/default/files/publications/2403_social_psychological_dimensions_mining_activities_impacts.pdf

Brossoit, R. M., Crain, T. L., Leslie, J. J., Hammer, L. B., Truxillo, D. M., & Bodner, T. E. (2019). The effects of sleep on workplace cognitive failure and safety. *Journal*

of Occupational Health Psychology, *24*(4), 411–422. https://doi.org/10.1037/ocp0000139

Brown, G. D., Largey, A., & McMullan, C. (2021). The impact of gender on risk perception: Implications for EU member states' national risk assessment processes. *International Journal of Disaster Risk Reduction*, *63*, 102452. https://doi.org/10.1016/j.ijdrr.2021.102452

BuildForce Canada. (2018). *Representation of indigenous Canadians and women in Canada's construction and maintenance workforce*. https://www.buildforce.ca/en/terms?fid=318

Burr, H., Berthelsen, H., Moncada, S., Nübling, M., Dupret, E., Demiral, Y., Oudyk, J., Kristensen, T. S., Llorens, C., Navarro, A., Lincke, H.-J., Bocéréan, C., Sahan, C., Smith, P., & Pohrt, A. (2019). The third version of the Copenhagen psychosocial questionnaire. *Safety and Health at Work*, *10*(4), 482–503. https://doi.org/10.1016/j.shaw.2019.10.002

Butters, L. (2020). Identifying a fly-in/fly-out source-hub community: The case of Deer Lake, Newfoundland and Labrador. *Extractive Industries and Society*, *7*(4), 1401–1410. https://doi.org/10.1016/j.exis.2020.09.011

Canadian Centre for Occupational Health and Safety. (2017, February 15). *Hazard and risk*. CCOHS. Retrieved April 10, 2023, from https://www.ccohs.ca/oshanswers/hsprograms/hazard/risk_assessment.html

Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, & Social Sciences and Humanities Research Council. (2018).

Tri-council policy statement: Ethical conduct for research involving humans (TCPS2 2018). Government of Canada. https://ethics.gc.ca/eng/documents/tcps2-2018-en-interactive-final.pdf

Canadian Standards Association. (2013). *National standard of Canada for psychological health and safety in the workplace* (CAN/CSA-Z1003-13/BNQ 9700-809/2013). CSA Group. https://doi.org/https://mentalhealthcommission.ca/national-standard/

Canadian Standards Association. (2019a). *Occupational health and safety management* (CSA Z1000-14). CSA Group. https://www.csagroup.org/store/product/2702406/

Canadian Standards Association. (2019b). *Occupational health and safety management systems — requirements with guidance for use* (CSA Z45001:19). CSA Group. https://www.csagroup.org/store/product/CSA%20Z45001%3A19/

Canadian Standards Association. (2022). *Hierarchy of control*. CSA Group. Retrieved April 16, 2023, from https://www.csagroup.org/wp-content/uploads/Hierarchy_of_Controls_Infographic.pdf

Canadian Standards Association. (2023). *About CSA group*. CSA Group. Retrieved February 9, 2023, from https://www.csagroup.org/about-csa-group/

Carvajal-Arango, D., Vásquez-Hernández, A., & Botero-Botero, L. (2021). Assessment of subjective workplace well-being of construction workers: A bottom-up approach. *Journal of Building Engineering*, *36*, 102154. https://doi.org/10.1016/j.jobe.2021.102154

Centre for Addiction and Mental Health. (2020, January 6). *Workplace mental health: A review and recommendations* [Report]. www.camh.ca. Retrieved June 24, 2022,

from https://www.camh.ca/-/media/files/workplace-mental-health/workplacementalhealth-a-review-and-recommendations-pdf.pdf?la=en

Chan, A. P. C., Nwaogu, J. M., & Naslund, J. A. (2020). Mental ill-health risk factors in the construction industry: Systematic review. *Journal of Construction Engineering and Management*, *146*(3). https://doi.org/10.1061/(asce)co.1943-7862.0001771

Chaswa, E., Kosamu, I., Kumwenda, S., & Utembe, W. (2020). Risk perception and its influencing factors among construction workers in Malawi. *Safety*, *6*(2), 33. https://doi.org/10.3390/safety6020033

CIBC. (2023, June 20). If they come you will build it: Canada's construction labour shortage. *CIBC Capital Markets*. https://economics.cibccm.com/cds?id=c3793f6c-c629-49eb-9fe6-6a0598c6fd2b&flag=E

Clarke, S. G., & Cooper, C. L. (2000). The risk management of occupational stress. *Health, Risk & Society*, *2*(2), 173–187.

Clarke, S.G., & Cooper, C.L. (2004). *Managing the risk of workplace stress: Health and safety hazards* (1st ed.). Routledge.

Coastal GasLink. (2022). *SEEMP status report no. 8* (June to November 2022). https://www.coastalgaslink.com/siteassets/pdfs/about/regulatory/cgl-seemp-status-report-no.-8.pdf

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* Lawrence Erlbaum Associates.

Cohen, J. (1992). Statistical power analysis. *Current Directions in Psychological Science*, *1*(3), 98–101. https://doi.org/10.1111/1467-8721.ep10768783

Cole, D. A. (1987). Utility of confirmatory factor analysis in test validation research. *Journal of Consulting and Clinical Psychology*, *55*(4), 584–594. https://doi.org/10.1037/0022-006x.55.4.584

Cooke, D. C., Kendall, G., Li, J., & Dockery, M. (2019). Association between pregnant women's experience of stress and partners' fly-in-fly-out work. *Women and Birth*, *32*(4), e450–e458. https://doi.org/10.1016/j.wombi.2018.09.005

Cooper, C. L., & Cartwright, S. (1994). Healthy mind; healthy organisation - a proactive approach to occupational stress. *Human Relations*, *47*, 455–471.

COPSOQ International Network. (2021). *COPSOQ III. Guidelines and questionnaire*. https://www.copsoq-network.org/assets/Uploads/COPSOQ-network-guidelines-an-questionnaire-COPSOQ-III-131119-signed.pdf

COPSOQ Network. (2023). *Welcome to COPSOQ international network*. COPSOQ International Network. Retrieved April 29, 2023, from https://www.copsoq-network.org/

Crockford, G. N. (1982). The bibliography and history of risk management: Some preliminary observations. *Geneva Papers on Risk and Insurance*, *7*(23), 169–179.

Deacon, L., Papineau, J. W., & Lamanes, T. (2017). Transiency, fly-in-fly-out workers, and sustainability: Perceptions from within a resource-based community. *WIT Transactions on Ecology and the Environment*, *226*, 95–105. https://doi.org/10.2495/SDP170091

Deady, M., Johnston, D. A., Glazier, N., Milne, D., Choi, I., Mackinnon, A., Mykletun, A., Calvo, R. A., Gayed, A., Bryant, R., Christensen, H., & Harvey, S. B. (2018). A smartphone application for treating depressive symptoms: Study protocol for a randomized control trial. *BMC Psychiatry, 18*. https://doi.org/10.1186/s12888-018-1752-5

Derdowski, L., & Mathisen, G. (2023). Psychosocial factors and safety in high-risk industries: A systematic literature review. *Safety Science*, *157*, 105948. https://doi.org/10.1016/j.ssci.2022.105948

Dimoff, J. K., & Kelloway, E. (2019). With a little help from my boss: The impact of workplace mental health training on leader behaviors and employee resource utilization. *Journal of Occupational Health Psychology*, *24*(1), 4–19. https://doi.org/10.1037/ocp0000126

Dionne, G. (2013). Risk management: History, definition and critique. *Risk Management and Insurance Review*, *16*(2), 147–166.

Dionne, G. (2019). *Corporate risk management: Theories and applications*. John Wiley & Sons.

Dittman, C. K., Henriquez, A., & Roxburgh, N. (2016). When a non-resident worker is a non-resident parent: Investigating the family impact of fly-in, fly-out work practices in Australia. *Journal of Child and Family Studies*, *25*(9), 2778–2796. https://doi.org/10.1007/s10826-016-0437-2

Dixon, S. (2022, October 18). *Social networking in Canada*. Statista. Retrieved May 18, 2023, from https://www.statista.com/topics/2729/social-networking-in-canada/#topicOverview

Dobson, K. S., Szeto, A., & Knaak, S. (2019). The working mind: A meta-analysis of a workplace mental health and stigma reduction program. *Canadian Journal of Psychiatry, 64*(Supplement 1), 39S-47S. https://doi.org/10.1177/0706743719842559

Dong, X., Brooks, R. D., Brown, S., & Harris, W. (2022). Psychological distress and suicidal ideation among male construction workers in the United States. *American Journal of Industrial Medicine*, *65*(5), 396–408. https://doi.org/10.1002/ajim.23340

Doorn, N. (2015). The blind spot in risk ethics: Managing natural hazards. *Risk Analysis*, *35*(3), 354–360. https://doi.org/10.1111/risa.12293

Dorow, S., & Jean, S. (2022). Managing liminal time in the fly-in fly-out work camp. *Human Relations*, *75*(4), 681–704. https://doi.org/10.1177/0018726721989792

Dorow, S., O'Leary, V., Hilario, C., Cherry, N., Daigle, A., Kelly, G., Lindquist, K., Garcia, M. M., & Shmatko, I. (2021). *Mobile work and mental health: A preliminary study of fly-in fly-out workers in the Alberta oil sands*. University of Alberta. https://doi.org/10.7939/r3-yqtg-m927

Ensign, P. C., Giles, A. R., & Oncescu, J. (2014). Natural resource exploration and extraction in northern Canada: Intersections with community cohesion and social welfare. *Journal of Rural and Community Development*, *9*(1), 112–133.

Evensen, D., & Stedman, R. (2018). 'fracking': Promoter and destroyer of 'the good life'. *Journal of Rural Studies*, *59*, 142–152. https://doi.org/10.1016/j.jrurstud.2017.02.020

Eyllon, M., Vallas, S. P., Dennerlein, J. T., Garverich, S., Weinstein, D., Owens, K., & Lincoln, A. K. (2020). Mental health stigma and wellbeing among commercial construction workers. *Journal of Occupational and Environmental Medicine, 62*(8), e423-e430. https://doi.org/10.1097/jom.0000000000001929

Fang, H., Tu, S., Sheng, J., & Shao, A. (2019). Depression in sleep disturbance: A review on a bidirectional relationship, mechanisms and treatment. *Journal of Cellular and Molecular Medicine*, *23*(4), 2324–2332. https://doi.org/10.1111/jcmm.14170

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/brm.41.4.1149

Field, A. (2018). *Discovering statistics using IBM SPSS statistic* (5th ed.). SAGE Publications.

Fitzgerald, S. M., Rumrill, P. D., & Schenker, J. D. (2004). Correlational designs in rehabilitation research. *Journal of Vocational Rehabilitation, 20*(2), 143-150.

Fordjour, G. A., Chan, A. P., & Tuffour-Kwarteng, L. (2020). Exploring construction employees' perspectives on the potential causes of psychological health conditions in the construction industry: A study in Ghana. *International Journal of Construction Education and Research, 17*(4), 373-393. https://doi.org/10.1080/15578771.2020.1804491

Foster, J., Cake, S., & Barnetson, B. (2022). Profits first, safety second. *Labour / Le Travail*, *90*, 179–202. https://doi.org/10.52975/llt.2022v90.007

Friesen, J. (2015, February 25). *Wood Buffalo's temporary-worker influx means no two censuses are alike*. The Globe and Mail. Retrieved May 3, 2023, from https://www.theglobeandmail.com/news/national/wood-buffalos-temporary-worker-influx-means-no-two-censuses-are-alike/article23194059/

Frimpong, S., Sunindijo, R., Wang, C., & Boadu, E. (2022). Domains of psychosocial risk factors affecting young construction workers: A systematic review. *Buildings*, *12*(3), 335. https://doi.org/10.3390/buildings12030335

Gallagher, R. B. (1956). Risk management: New phase of cost control. *Harvard Business Review*, *34*(5), 75–86.

Gardner, B., Alfrey, K.-L., Vandelanotte, C., & Rebar, A. L. (2018). Mental health and well-being concerns of fly-in fly-out workers and their partners in Australia: A qualitative study. *BMJ Open*, *8*(3), e019516. https://doi.org/10.1136/bmjopen-2017-019516

Gibson, G., Yung, K., Chisholm, L., Quinn, H., & Lake Babine Nation and Nak'azdli Whut'en. (2017, February). *Indigenous communities and industrial camps: Promoting healthy communities in settings of industrial change* [PDF]. The Firelight Group. Retrieved July 7, 2021, from https://firelight.ca/wp-content/uploads/2016/03/Firelight-work-camps-Feb-8-2017_FINAL.pdf.

Godfrey, P. S. (1996). *Control of risk. A guide to the systematic management of risk from construction* (Special Issue 125). Construction Industry Research and Information Association.

Goodwin, R. D., & Marusic, A. (2008). Association between short sleep and suicidal ideation and suicide attempt among adults in the general population. *Sleep*, *31*(8), 1097–1101. https://doi.org/10.5665/sleep/31.8.1097

Grisafi, L. (2020). Living in the blast zone: Sexual violence piped onto native land by extractive industries. *Columbia Journal of Law & Social Problems*, *53*(4), 509–539.

Harrington, S. E., & Niehaus, G. R. (2003). *Risk management and insurance* (2nd ed.). Irwin/McGraw-Hill.

Heinze, G. & Dunkler, D. (2017). Five myths about variable selection. *Transplant International*, *30*, 6-10. https://doi.org/10.1111/tri.12895

Heinze, G., Wallisch, C., & Dunkler, D. (2018). Variable selection – A review and recommendations for the practicing statistician. *Biometrical Journal*, *60*, 431–449. https://doi.org/10.1002/bimj.201700067

Holtom, B., Baruch, Y., Aguinis, H., & A Ballinger, G. (2022). Survey response rates: Trends and a validity assessment framework. *Human Relations*, *75*(8), 1560–1584. https://doi.org/10.1177/00187267211070769

Hudson, J. (2016). *What's the problem? risk assessment using the HSE stress management standards indicator* [Conference paper]. British Psychological

Society, division of Occupational Psychology Annual Conference, Nottingham, England. https://doi.org/10.13140/rg.2.1.1216.6803

Huebner, M., Vach, W., le Cessie, S., Schmidt, C., & Lusa, L. (2020). Hidden analyses: A review of reporting practice and recommendations for more transparent reporting of initial data analyses. *BMC Medical Research Methodology*, *20*(1). https://doi.org/10.1186/s12874-020-00942-y

Hulls, P. M., de Vocht, F., Martin, R. M., & Langford, R. M. (2022). We are our own worst enemy: A qualitative exploration of work-related stress in the construction industry. *International Journal of Workplace Health Management, 15*(5), 609-622. https://doi.org/10.1108/IJWHM-11-2021-0213

International Organization for Standardization. (2018a). *Occupational health and safety management systems - requirements with guidance for use* (ISO 45001:2018).

International Organization for Standardization. (2018b). *Risk management - guidelines* (ISO 31000:2018(E)).

International Organization for Standardization. (2021). *Occupational health and safety management — Psychological health and safety at work — Guidelines for managing psychosocial risks* (ISO 45003). ISO.

International Organization for Standardization. (2023). *About us*. ISO. Retrieved February 9, 2023, from https://www.iso.org/about-us.html

Jacobs, J. C., Yaquian, E., Burke, S. M., Rouse, M., & Zaric, G. (2017). The economic impact of workplace wellness programmes in Canada. *Occupational Medicine*, *67*(6), 429–434. https://doi.org/10.1093/occmed/kqx075

Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., Kasperson, J. X., & Ratick, S. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis, 8*(2), 177-187. https://doi.org/10.1111/j.1539-6924.1988.tb01168.x

Kirsh, B., Krupa, T., & Luong, D. (2018). How do supervisors perceive and manage employee mental health issues in their workplaces? *Work*, *59*(4), 547–555. https://doi.org/10.3233/wor-182698

Klasic, M., Schomburg, M., Arnold, G., York, A., Baum, M., Cherin, M., Cliff, S., Kavousi, P., Miller, A., Shajari, D., Wang, Y., & Zialcita, L. (2022). A review of community impacts of boom-bust cycles in unconventional oil and gas development. *Energy Research & Social Science*, *93*, 102843. https://doi.org/10.1016/j.erss.2022.102843

Knutson, K. L. (2010). Sleep duration and cardiometabolic risk: A review of the epidemiologic evidence. *Best Practice & Research Clinical Endocrinology & Metabolism*, *24*(5), 731–743. https://doi.org/10.1016/j.beem.2010.07.001

Kosinski, M., Matz, S., Gosling, S., Popov, V., & Stillwell, D. (2015). Facebook as a research tool. *American Psychologist*, *70*(6), 543.

Kotera, Y., Green, P., & Sheffield, D. (2020). Work-life balance of UK construction workers: Relationship with mental health. *Construction Management and Economics, 38*(3), 291-303. https://doi.org/10.1080/01446193.2019.1625417

Kowshik, K., & Deepak, K. (2017). Issues related to subcontracting practices in construction projects. *International Journal of Civil Engineering and Technology, 8*(1), 363-369.

Kristensen, T. S., Hannerz, H., Høgh, A., & Borg, V. (2005). The Copenhagen psychosocial questionnaire—a tool for the assessment and improvement of the psychosocial work environment. *Scandinavian Journal of Work, Environment & Health*, *31*(6), 438–449. https://doi.org/10.5271/sjweh.948

Kunyk, D., Craig-Broadwith, M., Morris, H., Diaz, R., Reisdorfer, E., & Wang, JianLi. (2016). Employers' perceptions and attitudes toward the Canadian national standard on psychological health and safety in the workplace: A qualitative study. *International Journal of Law and Psychiatry, 44*(2016), 41-47. https://doi.org/10.1016/j.ijlp.2015.08.030

Labra, O., Brouillette, C., Gingras-Lacroix, G., Cousineau, T., & Quirion, J. (2022). The overall health of men who do fly-in fly-out work in the mining sector. *American Journal of Men's Health*, *16*(5). https://doi.org/10.1177/15579883221126310

Laerd Statistics. (2018). *Spearman's rank-order correlation*. Retrieved April 29, 2023, from https://statistics.laerd.com/statistical-guides/spearmans-rank-order-correlation-statistical-guide.php

Lecomte, T., Potvin, S., Corbière, M., Guay, S., Samson, C., Cloutier, B., Francoeur, A., Pennou, A., & Khazaal, Y. (2020). Mobile apps for mental health issues: Meta-review of meta-analyses. *JMIR mHealth and uHealth*, *8*(5), e17458. https://doi.org/10.2196/17458

Leka, S., Cox, T., & Zwetsloot, G. I. (2008). The European framework for psychosocial risk management (PRIMA-EF). The European Framework for Psychosocial Risk Management: PRIMA-EF, Leka S and Cox T (Eds.), 1-16. https://repository.tudelft.nl/islandora/object/uuid:465ef8b8-03db-4fe9-a8bf-5860217c55f4/datastream/URL/download#page=10

Lekchiri, S., & Kamm, J. D. (2020). Navigating barriers faced by women in leadership positions in the US construction industry: A retrospective on women's continued struggle in a male-dominated industry. *European Journal of Training and Development*, *44*(6/7), 575–594. https://doi.org/10.1108/ejtd-11-2019-0186

Levine, D. M., Berenson, M. L., Krehbiel, T. C., & Stephan, D. F. (2011). *Statistics for managers using MS Excel*. Prentice Hall/Pearson.

Liu, Q., Feng, Y., & London, K. (2021). Theorizing to improve mental health in multicultural construction industries: An intercultural coping model. *Buildings*, *11*(12), 662. https://doi.org/10.3390/buildings11120662

Llorens, C., Alós, R.,Cano, E., Font, A., Jódar, P., López, V., Navarro, A., Sánchez, A., Utzet, M., & Moncada, S. (2010). Psychosocial risk exposures and labour management practices. An exploratory approach. *Scandinavian Journal of Public Health, 38*(S3), 125-136. https://doi.org/10.1177/1403494809354363

LNG Canada Development. (2023). *LNG Canada: 2022 Q4 social management roundtable / CLISMP update*. https://www.lngcanada.ca/wp-content/uploads/LNG-Canada-Q4-2022-SMR-Summary-report.pdf

Lock, A. M., Bonetti, D. L., & Campbell, A. K. (2018). The psychological and physiological health effects of fatigue. *Occupational Medicine*, *68*(8), 502–511. https://doi.org/10.1093/occmed/kqy109

London, K., Meade, T., & McLachlan, C. (2022). Healthier construction: Conceptualising transformation of mental health outcomes through an integrated supply chain model. *Sustainability*, *14*(15), 9460. https://doi.org/10.3390/su14159460

Low, B. K. L., Man, S. S., Chan, A. S., & Alabdulkarim, S. (2019). Construction worker risk-taking behavior model with individual and organizational factors. *International Journal of Environmental Research and Public Health*, *16*(8), 1–13. https://doi.org/10.3390/ijerph16081335

Malin, S. A. (2020). Depressed democracy, environmental injustice: Exploring the negative mental health implications of unconventional oil and gas production in the United States. *Energy Research & Social Science*, *70*, 101720. https://doi.org/10.1016/j.erss.2020.101720

Manuele, F. A. (2010). Acceptable risk: Time for SH&E professional to adopt the concept. *Professional Safety*, *55*(5), 30–38.

Martin, J. (2020). FIFO rosters and workers' health and safety: A case study of the impacts of extended shift rosters on electrical workers in construction in the resources sector. *Labour & Industry: A journal of the social and economic relations of work*, *30*(4), 378–400. https://doi.org/10.1080/10301763.2020.1865087

Mason, C. H., & Perreault, W. D., Jr. (1991). Collinearity, power, and interpretation of multiple regression analysis. *Journal of Marketing Research*, *28*(3), 268–280. http://www.jstor.org/stable/3172863?origin=JSTOR-pdf

McAllister, B. (2022, September 4). *Analysis of variance (ANOVA): What you should know*. Beyond PhD Coaching. Retrieved May 3, 2023, from https://www.beyondphdcoaching.com/statistical-analysis/analysis-of-variance/

McAllister, B. (2023). *Simulation-based performance assessment: Planning and executing quantitative analysis of real-world systems, including weapon systems and their models.*

McMillan, J. H. (2000, April 24). *Examining categories of rival hypotheses for educational research* [Paper presentation]. Annual Meeting of the American Educational Research Association, New Orleans, LA, United States.

McNeish, D. (2017). Missing data methods for arbitrary missingness with small samples. *Journal of Applied Statistics, 44*(1), 24-39. https://doi.org/10.1080/02664763.2016.1158246

Measham, T. G., Fleming, D. A., & Schandl, H. (2016). A conceptual model of the socioeconomic impacts of unconventional fossil fuel extraction. *Global Environmental Change*, *36*, 101–110. https://doi.org/10.1016/j.gloenvcha.2015.12.002

Mehr, R. I., & Hedges, B. A. (1963). *Risk management in the business enterprise*. RD Irwin.

Mental Health Commission of Canada. (2023). *The Working Mind*. Retrieved April 17, 2023, from https://www.theworkingmind.ca/

Metzler, Y. A., von Groeling-Müller,G., & Bellingrath, S. (2019). Better safe than sorry: Methods for risk assessment of psychosocial hazards. *Safety Science, 114*, 122-139. https://doi.org/10.1016/j.ssci.2019.01.003

Miller, P., Brook, L., Stomski, N. J., Ditchburn, G., & Morrison, P. (2020). Depression, suicide risk, and workplace bullying: A comparative study of fly-in, fly-out and residential resource workers in Australia. *Australian Health Review*, *44*(2), 248. https://doi.org/10.1071/ah18155

Milner, A., Law, P., Mann, C., Cooper, T., Witt, K., & LaMontagne, A. (2018). A smart-phone intervention to address mental health stigma in the construction industry: A two-arm randomised controlled trial. *SSM - Population Health*, *4*, 164–168. https://doi.org/10.1016/j.ssmph.2017.12.007

Milot, M. (2019). The impact of a Canadian external employee assistance program on mental health and workplace functioning: Findings from a prospective quasi-experimental study. *Journal of Workplace Behavioral Health*, *34*(3), 167–191. https://doi.org/10.1080/15555240.2019.1609978

Mining Industry Human Resources Council. (2016). *Exploring gender inclusion*. https://mihr.ca/wp-content/uploads/2020/03/MiHR_Gender_Report_EN_WEB.pdf

Mohd-Rani, N. D., Kamarunzaman, N. Z., & Jia, L. (2022). Pattern of psychosocial challenges among oil & gas workers: A systematic review. *Proceedings of the*

10th Asian Conference on Environment-Behaviour Studies, 431-438. https://doi.org/10.21834/ebpj.v7i20.3491

Molek-Winiarska, D., & Żołnierczyk-Zreda, D. (2018). Application of mindfulness-based stress reduction to a stress management intervention in a study of a mining sector company. *International Journal of Occupational Safety and Ergonomics*, *24*(4), 546–556. https://doi.org/10.1080/10803548.2018.1452843

Mongin, P. (1998). Expected utility theory. In J. Davis, W. Hands, & U. Maki (Eds.), *Handbook of economic methodology* (pp. 342–350). Edward Elgar.

Montgomery, D. C. (2020). *Design and analysis of experiments* (10th ed.). Wiley.

Murphy, K., Strand, L., Theron, L., & Ungar, M. (2021). "I just gotta have tough skin": Women's experiences working in the oil and gas industry in Canada. *The Extractive Industries and Society*, *8*(2), 1–11. https://doi.org/10.1016/j.exis.2021.02.002

Nichols Applied Management. (2018). *FIFO in the oil sands: Fly-in/Fly-out operations in the RMWB* [Position paper]. http://www.nicholsappliedmanagement.com/WP/wp-content/uploads/2018/05/FIFO-in-the-Oil-Sands-Fly-InFly-Out-Operations-in-the-RMWB1.pdf

Northern Health. (2012). *Understanding the State of Industrial Camps in Northern BC* [Report]. https://www.northernhealth.ca/sites/northern_health/files/about-us/leadership/documents/industrial-camps-bkgrd-p1v1.pdf

Nwaogu, J. M., Chan, A. P., Hon, C. K., & Darko, A. (2019). Review of global mental health research in the construction industry. *Engineering, Construction and Architectural Management, 27*(2), 385-410. https://doi.org/10.1108/ECAM-02-2019-0114

Oakman, J., Weale, V., Kinsman, N., Nguyen, H., & Stuckey, R. (2022). Workplace physical and psychosocial hazards: A systematic review of evidence informed hazard identification tools. *Applied Ergonomics*, *100*, 103614. https://doi.org/10.1016/j.apergo.2021.103614

Orpana, H., Vachon, J., Dykxhoorn, J., McRae, L., & Jayaraman, G. (2016). Monitoring positive mental health and its determinants in Canada: The development of the positive mental health surveillance indicator framework. *Health Promotion and Chronic Disease Prevention in Canada*, *36*(1), 1–10. https://doi.org/10.24095/hpcdp.36.1.01

Padkapayeva, K., Gilbert-Ouimet, M., Bielecky, A., Ibrahim, S., Mustard, C., Brisson, C., & Smith, P. (2018). Gender/sex differences in the relationship between psychosocial work exposures and work and life stress. *Annals of Work Exposures and Health*, *62*(4), 416–425. https://doi.org/10.1093/annweh/wxy014

Pepinsky, T. B. (2018). A note on listwise deletion versus multiple imputation. *Political Analysis, 26*, 480-488. https://doi.org/10.1017/pan.2018.18

Powell, R., & Copping, A. (2010). Sleep deprivation and its consequences in construction workers. *Journal of Construction Engineering and Management*, *136*(10), 1086–1092. https://doi.org/10.1061/(asce)co.1943-7862.0000211

Quinane, E., Bardoel, E. A., & Pervan, S. (2021). CEOs, leaders and managing mental health: A tension-centered approach. *The International Journal of Human Resource Management*, *32*(15), 3157–3189. https://doi.org/10.1080/09585192.2021.1925325

Ramkissoon, A., Smith, P., & Oudyk, J. (2019). Dissecting the effect of workplace exposures on workers' rating of psychological health and safety. *American Journal of Industrial Medicine*, *62*(5), 412–421. https://doi.org/10.1002/ajim.22964

Randolph, J. J. (2009). A guide to writing the dissertation literature review. *Practical Assessment, Research & Evaluation*, *14*(14), 1–13. https://doi.org/10.7275/b0az-8t74

Rhubart, D. C., & Brasier, K. J. (2019). Arrest rates during natural resource development: Drilling, drinking and disorderly conduct in the Marcellus shale region. *Society & Natural Resources*, *32*(6), 675–692. https://doi.org/10.1080/08941920.2019.1574046

Roberts, D., & Graves, R. (2020). Risk assessment myth busters: Defining risk management processes and terminology. *IEEE Industry Applications Magazine*, *26*(3), 22–28. https://doi.org/10.1109/mias.2019.2943642

Ross, V., Mathieu, S., Wardhani, R., Gullestrup, J., & Kõlves, K. (2022). Suicidal ideation and related factors in construction industry apprentices. *Journal of Affective Disorders*, *297*, 294–300. https://doi.org/10.1016/j.jad.2021.10.073

Roughton, J., Crutchfield, N., & Waite, M. (2019). *Safety culture: An innovative leadership approach.* Butterworth-Heinemann.

Roussos, P. L. (2023). The psychosocial risks and impacts in the workplace assessment tool: Construction and psychometric evaluation. *Behavioural Sciences, 13*(2), 1-14. https://doi.org/10.3390/bs13020104

Roy, A. D. (1952). Safety first and the holding of assets. *Econometrica*, *20*, 431–449.

Ruddell, R. (2011). Boomtown policing: Responding to the dark side of resource development. *Policing*, *5*(4), 328–342. https://doi.org/10.1093/police/par034

Rural Health Services Review Committee. (2015). *Rural Health Services Review Final Report* [Report]. Government of Alberta. https://alberta.cmha.ca/wp-content/uploads/2017/01/Rural-Health-Services-Review-2015.pdf

Ryser, L., Markey, S., & Halseth, G. (2016). The workers' perspective: The impacts of long distance labour commuting in a northern Canadian small town. *The Extractive Industries and Society*, *3*(3), 594–605. https://doi.org/10.1016/j.exis.2016.02.002

Samra, J. (2017). *The evolution of workplace mental health in Canada: Research report (2007-2017).* https://www.yorku.ca/well-being/wp-content/uploads/sites/549/2021/11/The-Evolution-of-Workplace-Mental-Health-in-Canada.pdf

Saxinger, G. (2022). The FIFO social overlap: Success and pitfalls of long-distance commuting in the mining sector. In C. Southcott, F. Abele, D. Natcher, & B. Parlee (Eds.), *Extractive industry and the sustainability of Canada's arctic*

communities (pp. 123–145). McGill Queen's University Press. https://boris.unibe.ch/id/eprint/180586

Schenker, J. D., & Rumrill, Jr., P. D. (2004). Causal-comparative research designs. *Journal of Vocational Rehabilitation*, 117–121.

Schneider, D., & Harknett, K. (2019). What's to like? Facebook as a tool for survey data collection. *Sociological Methods & Research*, *51*(1), 108–140. https://doi.org/10.1177/0049124119882477

Seaton, C. L., Bottorff, J. L., Oliffe, J. L., Medhurst, K., & DeLeenheer, D. (2019). Mental health promotion in male-dominated workplaces: Perspectives of male employees and workplace representatives. *Psychology of Men & Masculinities*, *20*(4), 541–552. https://doi.org/10.1037/men0000182

Serdar, C., Cihan, M., Yücel, D., & Serdar, M. A. (2021). Sample size, power and effect size revisited: Simplified and practical approaches in pre-clinical, clinical and laboratory studies. *Biochemia medica*, *31*(1), 27–53. https://doi.org/10.11613/bm.2021.010502

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin.

Shandro, J. A., Veiga, M. M., Shoveller, J., Scoble, M., & Koehoorn, M. (2011). Perspectives on community health issues and the mining boom–bust cycle. *Resources Policy*, *36*(2), 178–186. https://doi.org/10.1016/j.resourpol.2011.01.004

Shaw, K., Hill, S. D., Boyd, A. D., Monk, L., Reid, J., & Einsiedel, E. F. (2015). Conflicted or constructive? exploring community responses to new energy developments in Canada. *Energy Research & Social Science*, *8*, 41–51. https://doi.org/10.1016/j.erss.2015.04.003

Sheikh, M. S., Smail-Crevier, R., & Wang, J. (2018). A cross-sectional study of the awareness and implementation of the National Standard of Canada for Psychological Health and Safety in the Workplace in Canadian employers. *The Canadian Journal of Psychiatry*, *63*(12), 842–850. https://doi.org/10.1177/0706743718772524

Siegrist, J. (1996). Adverse health effects of high-effort/low-reward conditions. *Journal of Occupational Health Psychology*, *1*(1), 27–41. https://doi.org/10.1037/1076-8998.1.1.27

Siegrist, M., & Árvai, J. (2020). Risk perception: Reflections on 40 years of research. *Risk Analysis*, *40*(S1), 2191–2206. https://doi.org/10.1111/risa.13599

Slovic, P. (1987). Perception of risk. *Science*, *236*, 280–285. https://doi.org/10.1126/science.3563507

Slovic, P., Fischoff, B., & Lichtenstein, S. (1985). Characterizing perceived risk. In R. W. Kates, C. Hohenemser, & J. X. Kasperson (Eds.), *Perilous progress: Managing the hazards of technology* (pp. 91–125). Westview.

Statistics Canada. (2023). *Table 14-10-0023-01 Labour force characteristics by industry, annual* [Data table]. https://doi.org/10.25318/1410002301-eng

Sterne, J. C., White, I. R., Carlin, J. B., Spratt, M., Royston, P., Kenward, M. G., Wood, A. M., & Carpenter, J. R. (2009). Multiple imputation for missing data in epidemiological and clinical research: Potential and pitfalls. *BMJ*, *338*, b2393–b2393. https://doi.org/10.1136/bmj.b2393

Stratton, S. J. (2021). Population research: Convenience sampling strategies. *Prehospital and Disaster Medicine*, *36*(4), 373–374. https://doi.org/10.1017/s1049023x21000649

StressAssess. (2023). *Welcome*. Retrieved April 29, 2023, from https://stressassess.ca/index.php?lang=en

Stretesky, P., & Grimmer, P. (2020). Shale gas development and crime: A review of the literature. *Extractive Industries and Society*, *7*(3), 1147–1157. https://doi.org/10.1016/j.exis.2020.06.008

Sue, V. M., & Ritter, L. A. (2012). *Conducting online surveys* (2nd ed.). SAGE Publications. https://doi.org/10.4135/9781506335186

Sun, C., Hon, C. K., Way, K. A., Jimmieson, N. L., & Xia, B. (2022). The relationship between psychosocial hazards and mental health in the construction industry: A meta-analysis. *Safety Science*, *145*, 105485. https://doi.org/10.1016/j.ssci.2021.105485

Tam, V. W., Shen, L., & Kong, J. S. (2011). Impacts of multi-layer chain subcontracting on project management performance. *International Journal of Project Management*, *29*(1), 108–116. https://doi.org/10.1016/j.ijproman.2010.01.005

The Strategic Counsel. (2021). *Trends in internet use and attitudes: Findings from a survey of Canadian internet users* [Report]. Canadian Internet Registration Authority (CIRA). https://static.cira.ca/2021-07/CIRA%202021%20Canada's%20Internet%20Factbook%20Report-public.pdf

Tijani, B., Falana, J. N., Jin, X., & Osei-Kyei, R. (2023). Suicide in the construction industry: Literature review. *International Journal of Construction Management, 23*(10), 1684-1693. https://doi.org/10.1080/15623599.2021.2005897

Tijani, B., Jin, X., & Osei-Kyei, R. (2020). A systematic review of mental stressors in the construction industry. *International Journal of Building Pathology and Adaptation*, *39*(2), 433–460. https://doi.org/10.1108/ijbpa-02-2020-0011

Tijani, B., Osei-Kyei, R., & Feng, Y. (2020). A review of work-life balance in the construction industry. *International Journal of Construction Management*, *22*(14), 2671–2686. https://doi.org/10.1080/15623599.2020.1819582

Trans Mountain. (2022). *2021 environmental, social & governance report*. TransMountain. https://docs.transmountain.com/ESG-Reports/TransMountain_2021-ESG-Report_ENGLISH_28jun2022_highres.pdf

Truchon, M., Gilbert-Ouimet, M., Zahiriharsini, A., Beaulieu, M., Daigle, G., & Langlois, L. (2022). Occupational health and well-being questionnaire (OHWQ): An instrument to assess psychosocial risk and protective factors in the workplace. *Public Health*, *210*, 48–57. https://doi.org/10.1016/j.puhe.2022.06.008

Van den Broeck, J., Argeseanu Cunningham, S., Eeckels, R., & Herbst, K. (2005). Data cleaning: Detecting, diagnosing, and editing data abnormalities. *PLoS Medicine*, *2*(10), e267. https://doi.org/10.1371/journal.pmed.0020267

Warner, R. M. (2013*). Applied statistics: From bivariate through multivariate techniques.* Sage.

Williams, C. A., & Heins, R. M. (1964). *Risk management and insurance.* McGraw-Hill.

Wilson, C. R., J. R., Oandasan, I. F., & Bosco, C. (2020). Progress made on access to rural health care in Canada. *Canadian Family Physician*, *66*(3), 31–36.

Wilson, J. R., & Sharples, S. (2015). *Evaluation of human work* (4th ed.). CRC Press.

World Health Organisation. (2022). *WHO guidelines on mental health at work*. https://www.who.int/teams/mental-health-and-substance-use/promotion-prevention/mental-health-in-the-workplace

Wright, A. C., & Griep, Y. (2019). Burning the midnight oil: Examining wellbeing and vulnerability in Alberta's oil patch. *Extractive Industries and Society*, *6*(1), 77–84. https://doi.org/10.1016/j.exis.2018.10.001

Appendix A: Sample Social Media Survey Promotion

Promotion of the survey through social media will use a graphic (see Figure A1) in conjunction with invitation text which will be included in the body of the social media posts (see Appendix B). By clicking on the survey link, individuals will be taken to the survey platform.

Figure A1

Example of Image for Social Media Survey Promotion

Note. Image dimensions will vary slightly in accordance with the requirements for individual social media platforms. Hard hat image from Microsoft Office 365.

Appendix B: Survey Invitation

Subject line:

Survey of Canadian Construction and Extractive Industry Workers

Message:

There is a new study about workers' perspectives of psychosocial risks in the Canadian construction and extractive industries that could help leaders in industry and government to better understand workplace mental health risks and improve risk management strategies. For this study, workers are invited to complete a 15–minute online questionnaire about their views of psychosocial risks in the workplace.

About the study:

- One 15-minute online questionnaire
- The survey is completed anonymously.

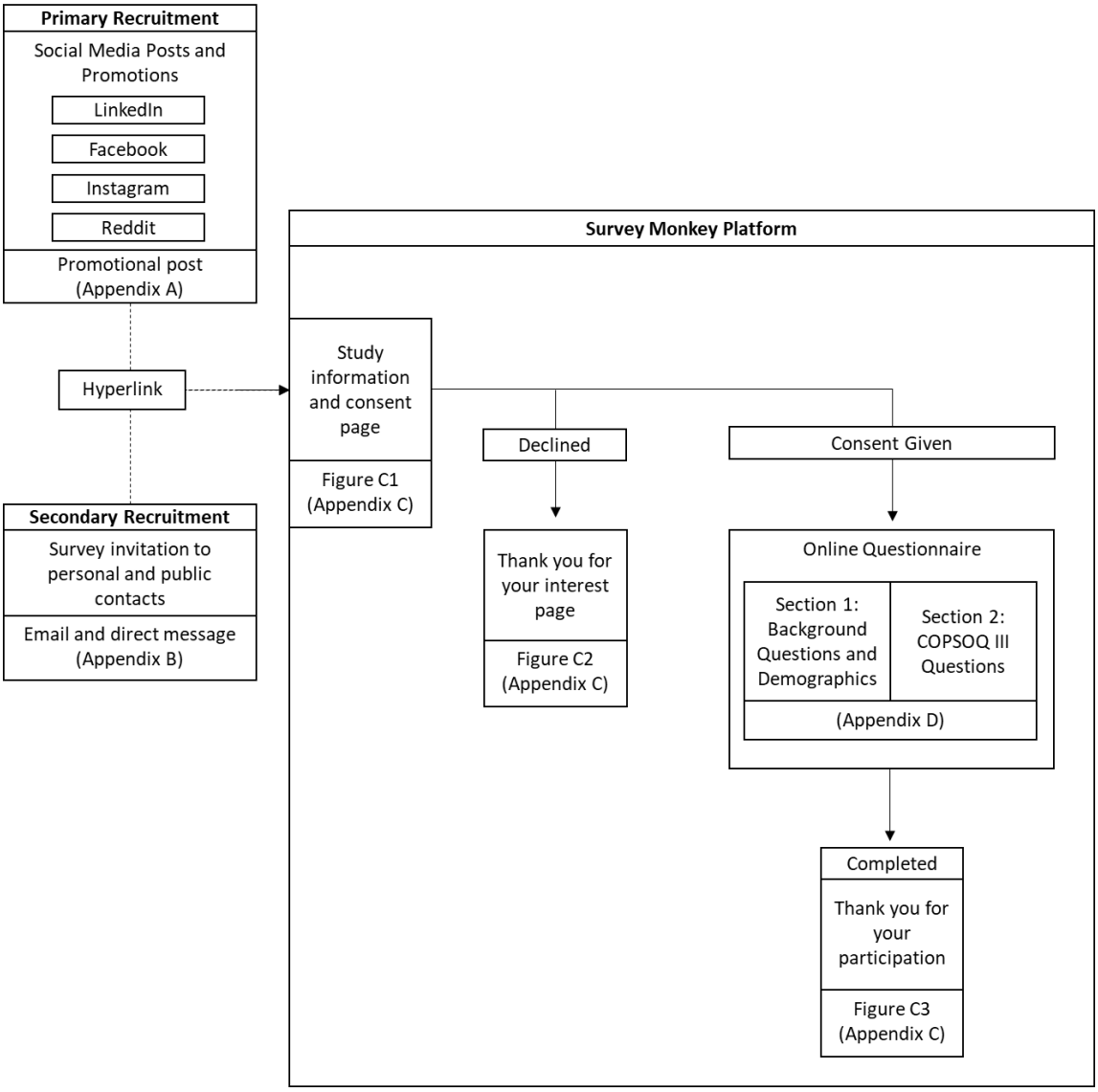
Volunteers must meet these requirements:

- 18 years old or older
- Employed within the past one year in the Canadian construction or extractive industries.
- Site-based work is a component of your employment.

This questionnaire is part of the doctoral study for Denaige McDonnell, a Ph.D. student at Walden University. The questionnaire will be open August 1, 2023 through August 31, 2023 and may be accessed here: https://www.surveymonkey.com/r/psychosocialriskCEIs

Please forward this email to others who might be interested.

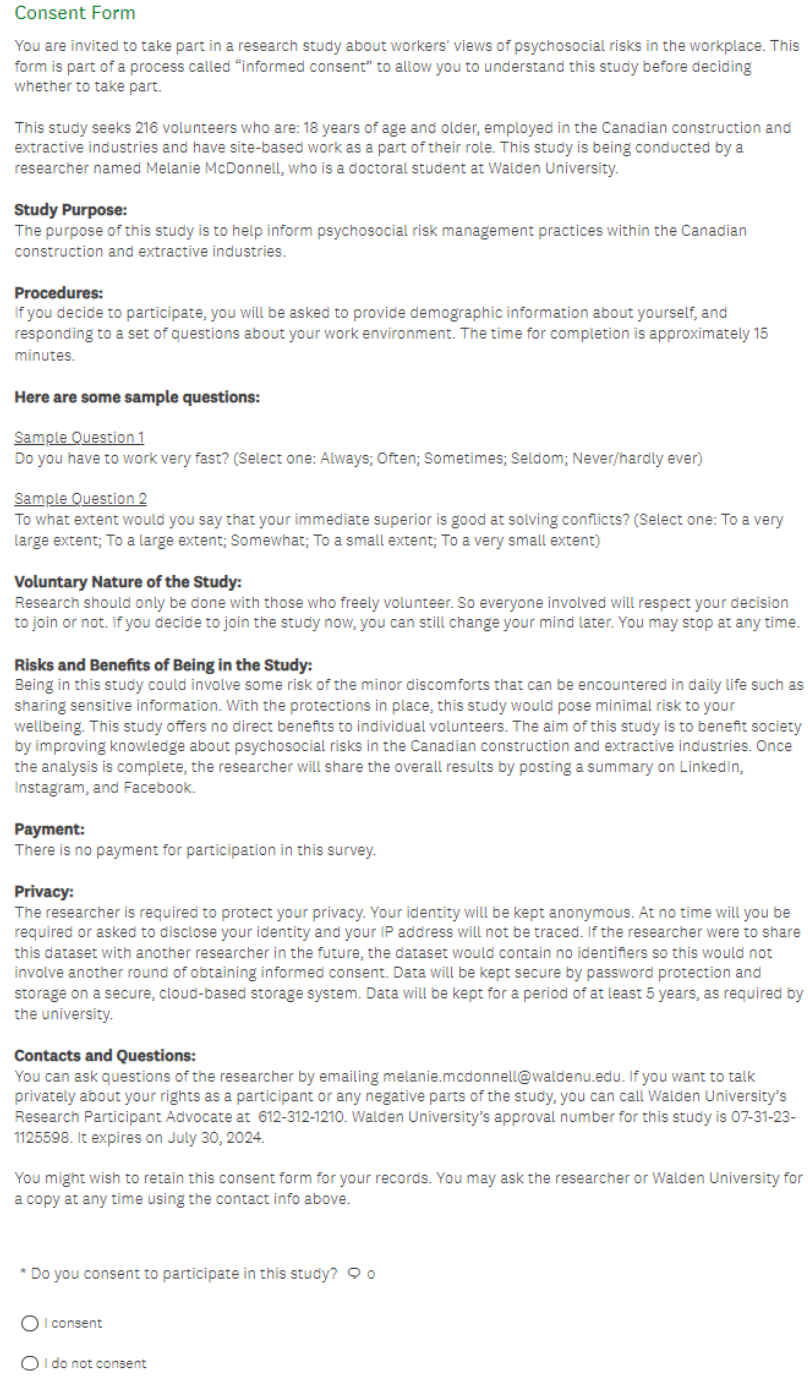
Appendix C: Recruitment and Participation Process



Appendix D: Survey Platform Pages

Figure D1

Survey Platform Consent Page



Consent Form

You are invited to take part in a research study about workers' views of psychosocial risks in the workplace. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study seeks 216 volunteers who are: 18 years of age and older, employed in the Canadian construction and extractive industries and have site-based work as a part of their role. This study is being conducted by a researcher named Melanie McDonnell, who is a doctoral student at Walden University.

Study Purpose:
The purpose of this study is to help inform psychosocial risk management practices within the Canadian construction and extractive industries.

Procedures:
If you decide to participate, you will be asked to provide demographic information about yourself, and responding to a set of questions about your work environment. The time for completion is approximately 15 minutes.

Here are some sample questions:

Sample Question 1
Do you have to work very fast? (Select one: Always; Often; Sometimes; Seldom; Never/hardly ever)

Sample Question 2
To what extent would you say that your immediate superior is good at solving conflicts? (Select one: To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

Voluntary Nature of the Study:
Research should only be done with those who freely volunteer. So everyone involved will respect your decision to join or not. If you decide to join the study now, you can still change your mind later. You may stop at any time.

Risks and Benefits of Being in the Study:
Being in this study could involve some risk of the minor discomforts that can be encountered in daily life such as sharing sensitive information. With the protections in place, this study would pose minimal risk to your wellbeing. This study offers no direct benefits to individual volunteers. The aim of this study is to benefit society by improving knowledge about psychosocial risks in the Canadian construction and extractive industries. Once the analysis is complete, the researcher will share the overall results by posting a summary on LinkedIn, Instagram, and Facebook.

Payment:
There is no payment for participation in this survey.

Privacy:
The researcher is required to protect your privacy. Your identity will be kept anonymous. At no time will you be required or asked to disclose your identity and your IP address will not be traced. If the researcher were to share this dataset with another researcher in the future, the dataset would contain no identifiers so this would not involve another round of obtaining informed consent. Data will be kept secure by password protection and storage on a secure, cloud-based storage system. Data will be kept for a period of at least 5 years, as required by the university.

Contacts and Questions:
You can ask questions of the researcher by emailing melanie.mcdonnell@waldenu.edu. If you want to talk privately about your rights as a participant or any negative parts of the study, you can call Walden University's Research Participant Advocate at 612-312-1210. Walden University's approval number for this study is 07-31-23-1125598. It expires on July 30, 2024.

You might wish to retain this consent form for your records. You may ask the researcher or Walden University for a copy at any time using the contact info above.

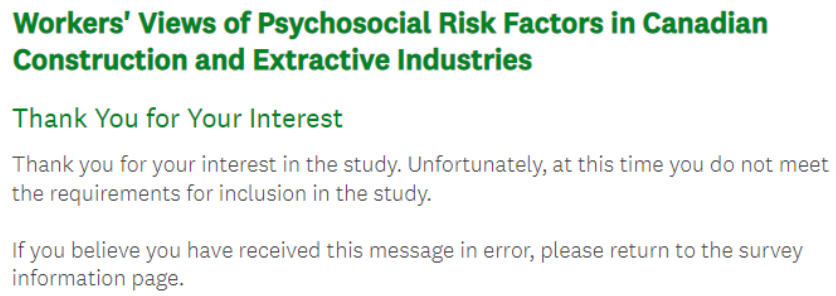
* Do you consent to participate in this study? o

◯ I consent

◯ I do not consent

Figure D2

Survey Platform Disqualification Page



Note. The image shows a screen shot of the disqualification page which will be displayed to prospective participants who do not meet the inclusion criteria.

Figure D3

Survey Platform Completion Page

Note. The image shows a screen shot of the exit page which will be displayed to participants who have completed the questionnaire.

Appendix E: Online Questionnaire

Section 1: Background Questions and Demographics

The first part of the questionnaire relates to a participant's demographic information. This study will never share information about individual participants. You may choose not to answer any question throughout the survey.

1) What is your age? (18-30, 31-45, over 45)
2) What is your gender? (Male; Female; Other)
3) What best describes your accommodation when working at site? (self-provided; employer-provided: camp/lodge accommodation; employer-provided: other)
4) What best describes your work arrangement? (I work for the project/operation owner; I work for the/a prime contractor; I work for a subcontractor)
5) What is your work rotation status? (On rotation; Off rotation)

Section 2: COPSOQ III

Each of the following items asks you about your experience with psychosocial risks in the workplace. Please select the response that best describes your experience. There are no right or wrong answers.

QD2. How often do you <u>not</u> have time to complete all your work tasks (Always; Often; Sometimes; Seldom; Never/hardly ever)

QD3. Do you get behind with your work? (Always; Often; Sometimes; Seldom; Never/hardly ever)

QD4. Do you have enough time for your work tasks? (Always; Often; Sometimes; Seldom; Never/hardly ever)

WP1. Do you have to work very fast? (Always; Often; Sometimes; Seldom; Never/hardly ever)

WP2. Do you work at a high pace throughout the day? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

WP3. Do you feel comfortable going to your supervisor to discuss workload issues? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

ED1. Does your work put you in emotionally disturbing situations? (Always; Often; Sometimes; Seldom; Never/hardly ever)

EDX2. Do you have to deal with other people's personal problems as part of your work? (Always; Often; Sometimes; Seldom; Never/hardly ever)

ED3. Is your work emotionally demanding? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

Section 3: Influence and Opportunity

Each of the following items asks you about your experience with influence on your work and the possibility for development. Please select the response that best describes your experience.

INX1. Do you have a large degree of influence on the decisions concerning your work? (Always; Often; Sometimes; Seldom; Never/hardly ever)

IN3. Can you influence the amount of work assigned to you? (Always; Often; Sometimes; Seldom; Never/hardly)

PD1. Does your work require you to take the initiative? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

PD2. Do you have the possibility of learning new things through your work? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

PD3. Can you use your skills or expertise in your work? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

Section 4: Meaning of Work and Role Clarity

Each of the following items asks you about your experience with the meaning of your work, recognition, and role clarity. Please select the response that best describes your experience.

MW1. Is your work meaningful? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

MW2. Do you feel that the work you do is important? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

CW2. Do you feel that your place of work is of great importance to you? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

CWX3. Would you recommend other people to apply for a position at your workplace? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

PR1. At your place of work, are you informed well in advance concerning, for example, important decisions, changes, or plans for the future? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

PR2. Do you receive all the information you need in order to do your work well? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

RE1. Is your work recognized and appreciated by the management? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

RE3. Are you treated fairly at your workplace? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

CL1. Does your work have clear objectives? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

CL3. Do you know exactly what is expected of you at work? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

CO2. Are contradictory demands placed on you at work? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

CO3. Do you sometimes have to do things which ought to have been done in a different way? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

IT1. Do you sometimes have to do things that seem to be unnecessary? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

Section 5: Supervision and Support

Each of the following items asks you about your experience with supervision, social support, and working conditions. Please select the response that best describes your experience.

QL2. To what extent would you say that your immediate superior gives high priority to job satisfaction? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

QL3. To what extent would you say that your immediate superior is good at work planning? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

QL4. To what extent would you say that your immediate superior is good at solving conflicts? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

SSX1. How often is your immediate superior willing to listen to your problems at work, if needed? (Always; Often; Sometimes; Seldom; Never/hardly ever)

SSX2. How often do you get help and support from your immediate superior, if needed? (Always; Often; Sometimes; Seldom; Never/hardly ever)

SCX1. How often do you get help and support from your colleagues, if needed? (Always; Often; Sometimes; Seldom; Never/hardly ever)

SW1. Is there a good atmosphere between you and your colleagues? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

JI1. Are you worried about becoming unemployed? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

JI3. Are you worried about it being difficult for you to find another job if you became unemployed? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

IW1. Are you worried about being transferred to another job against your will? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

JS4. Regarding your work in general, how pleased are you with your job as a whole, everything taken into consideration? (Very satisfied; Satisfied; Neither satisfied nor unsatisfied; Unsatisfied; Very unsatisfied)

Section 6: Work-Life Balance and Organizational Trust

Each of the following items asks you about your experience with work-life balance, organizational trust, and organizational justice. Please select the response that best describes your experience.

WFX1. Are there times when you need to be at work and at home at the same time? (Always; Often; Sometimes; Seldom; Never/hardly)

WF2. Do you feel that your work drains so much of your energy that it has a negative effect on your private life? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

WF3. Do you feel that your work takes so much of your time that it has a negative effect on your private life? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

TM1. Does the management trust the employees to do their work well? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

TMX2. Can the employees trust the information that comes from the management? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

JU1. Are conflicts resolved in a fair way? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

JU4. Is the work distributed fairly? (To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent)

Section 7: Personal Health and the Work Environment

Each of the following items asks you about your experience with your health. Please select the response that best describes your experience.

GH1. In general, would you say your health is: (Excellent; Very good; Good; Fair; Poor)

SL_T. These questions are about how you have been in the last 4 weeks: (All the time; A large part of the time; Part of the time; A small part of the time; Not at all)

SL1. How often have you slept badly and restlessly?

SL2. How often have you found it hard to go to sleep?

SL3. How often have you woken up too early and not been able to get back to sleep?

SL4. How often have you woken up several times and found it difficult to get back to sleep?

BO_T. These questions are about how you have been in the last 5 weeks: (All the time; A large part of the time; Part of the time; A small part of the time; Not at all)

BO1. How often have you felt worn out?

BO2. How often have you been physically exhausted?

BO3. How often have you been emotionally exhausted?

BO4. How often have you felt tired?

ST_T. These questions are about how you have been in the last 5 weeks: (All the time; A large part of the time; Part of the time; A small part of the time; Not at all)

ST1. How often have you had problems relaxing?

ST2. How often have you been irritable?

ST3. How often have you been tense?

ST4. How often have you been stressed?

SO_T. These questions are about how you have been in the last 5 weeks: (All the time; A large part of the time; Part of the time; A small part of the time; Not at all)

SO1. How often have you had a stomachache?

SO2. How often have you had a headache?

SO3. How often have you had palpitations?

SO4. How often have you had tension in various muscles?

CS_T. These questions are about how you have been in the last 5 weeks: (All the time; A large part of the time; Part of the time; A small part of the time; Not at all)

CS1. How often have you had problems concentrating?

CS2. How often have you found it difficult to think clearly?

CS3. How often have you had difficulty in taking decisions?

CS4. How often have you had difficulty with remembering?

Section 8: Undesirable Behaviour in the Workplace

Each of the following items asks you about your experience with undesirable behaviour in the workplace. Please select the response that best describes your experience.

SH1. Have you been exposed to undesired sexual attention at your workplace during the last 12 months? (Yes, daily; Yes, weekly; Yes, monthly; Yes, a few times; No)

SH2. If yes, from whom? (Colleagues; Manager; Supervisor; Subordinates; Clients/customers; Other)

TV1. Have you been exposed to threats of violence at your workplace during the last 12 months? (Yes, daily; Yes, weekly; Yes, monthly; Yes, a few times; No)

TV2. If yes, from whom? (Colleagues; Manager; Supervisor; Subordinates; Clients/customers; Other)

PV1. Have you been exposed to physical violence at your workplace during the last 12 months? (Yes, daily; Yes, weekly; Yes, monthly; Yes, a few times; No)

PV2. If yes, from whom? (Colleagues; Manager; Supervisor; Subordinates; Clients/customers; Other)

BU1. Have you been exposed to bullying at your workplace during the last 12 months? (Yes, daily; Yes, weekly; Yes, monthly; Yes, a few times; No)

BU2. If yes, from whom? (Colleagues; Manager; Supervisor; Subordinates; Clients/customers; Other)

DN1. Have you been exposed to discrimination at your workplace during the last 12 months? (Yes, daily; Yes, weekly; Yes, monthly; Yes, a few times; No)

DN2. If yes, from whom? (Colleagues; Manager; Supervisor; Subordinates; Clients/customers; Other)

DN3. If yes, why type of discrimination was it?

OB1. Have you witnessed any of these offensive behaviours aimed at others than yourself at your workplace in the past 12 months? (Yes, daily; Yes, weekly; Yes, monthly; Yes, a few times; No)

a) Undesired sexual attention
b) Threats of violence
c) Physical violence
d) Bullying
e) Discrimination

OB2. If yes, from whom? (Colleagues; Manager; Supervisor; Subordinates; Clients/customers; Other)

Appendix F: COPSOQ Approval for Use

Hello Denaige,

The English version of COPSOQ III that is available for general/research use. You can access a copy at https://www.copsoq-network.org/licence-guidelines-and-questionnaire/.

Evidence for its validity and reliability has been published in the following paper: https://www.sciencedirect.com/science/article/pii/S2093791118302725. Further evidence for its validity for use in the Canadian working population was published in a second paper: https://onlinelibrary.wiley.com/doi/full/10.1002/ajim.22964. More details can also be found at: https://www.copsoq-network.org/assets/Uploads/Oudyk-Psychometric-Properties-of-the-Canadian-EN-FR-COPSOQ-III.pdf. This evidence is the basis for the version that we use in our www.StressAssess.ca tool.

Furthermore, the Canadian version (StressAssess) is a hybrid of selected scales and questions which include the COPSOQ III CORE but also include selected scales/questions from the medium and long versions (if you wish to see the full Canadian survey it can be found here: https://www.ohcow.on.ca/edit/files/mip/UsingCOPSOQ.pdf). Therefore, you need to take into consideration which scales/questions that we used and which ones you would like to use if you wish to attempt any sort of comparison.

Let us know if we can be of any further assistance,

John Oudyk MSc CIH ROH
Occupational Hygienist
Occupational Health Clinics for Ontario Workers

Hi John,
My name is Denaige McDonnell and I am a PhD student interested in exploring psychosocial risks in the Canadian construction and extractive industries. I'm based in Calgary, AB. I am just at the prospectus stage and committee assignment. The COPSOQ appears to be a validated measure that could be useful in my study and I came across your name as a contact, along with a PPT presentation you gave related to Stress Assess and a tool developed for Canada.

I am hoping that you can provide me with some more information on the tool that is being used to measure workplace risks in hopes it might be suitable for my studies.

Appreciate your time and any information you can provide.

Best regards,
Denaige

Sent from Mail for Windows

Appendix G: Transformation of Variables

Table G1

Response Scales Applied to Variables

Response Option	Scale	Items
1	Always (100); Often (75); Sometimes (50); Seldom (25); Never/hardly (0)	QD2, QD3, WP1, ED1, EDX2, INX1, IN3, SSX1, SSX2, SCX1, WFX1
1R	Always (0); Often (25); Sometimes (50); Seldom (75); Never/hardly ever (100)	QD4
2	To a very large extent (100); To a large extent (75); Somewhat (50); To a small extent (25); To a very small extent (0)	WF2, WF3, WP2, WP3, ED3, PD1, PD2, PD3, MW1, MW2, CW2, CWX3, PR1, PR2, RE1, RE3, CL1, CL3, CO2, CO3, IT1, QL2, QL3, QL4, SW1, JI1, JI3, IW1, TM1, TMX2, JU1, JU4
4	Yes, daily; Yes, weekly; Yes, monthly; Yes, a few times; No	SH1, TV1, PV1, BU1, DN1, OB1
5M	Colleagues, Manager/superior, Subordinates, Clients/customers/patients (Multiple response options)	SH2, TV2, PV2, BU3, DN2, OB2
6	Very satisfied (100), Satisfied (75), Neither/Nor (50), Unsatisfied (25), Very unsatisfied (0)	JS4
7	Excellent (100), Very good (75), Good (50), Fair (25), Poor (0)	GH1
9	All the time (100); A large part of the time (75); Part of the time (50); A small part of the time (25); Not at all (0)	SL1, SL2, SL3, SL4, BO1, BO2, BO3, BO4, ST1, ST2, ST3, ST4, SO1, SO2, SO3, SO4, CS1, CS2, CS3, CS4
12	undesired sexual attention, threats of violence, physical violence, bullying, discrimination	OB3