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**Influence of Employee Well-Being on Workplace Injuries:
A Study of Safety Climate as a Potential Mediator**

A thesis
submitted in partial fulfilment
of the requirements for the degree
of
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Abstract

Being at work constitutes a considerable part of our lives and research on employee well-being and safety-related outcomes at the workplace can help to improve people's work lives. This study examined the work-related employee well-being and individual workplace injuries relationship and how safety climate potentially mediates the association. The current research sets out to (1) examine the connection of employee well-being with workplace injuries, and the influence of safety climate on this relationship, and (2) assesses the level of employee well-being, safety climate and its association with injuries in a global city country in South East Asia, Singapore.

This study adopted a cross-sectional design utilising self-reported data from 147 participants aged 21 to 69 with work experience ranging from 6 months to 37 years across various industries within the manufacturing sector. Results of the current study illustrate that when employee well-being increases, safety climate also increases. In addition, when employee well-being and safety climate improves, individual workplace injury reduces. Among employee well-being and safety climate dimensions, having meaning and positive emotions at work and management's attitude, behaviour and actions profoundly influence injuries in the workplace. Long working hours negatively affect safety climate and workplace injuries. Age and experience have a small to medium effect on injuries at the workplace, with employees aged between 45-49 years old and those with work experience between 16-25 years reporting more injuries. Management staff reported better employee well-being and lower injuries, while shift workers indicated weaker safety climate. Respondents also indicated that approximately 50% of workplace injuries were unreported, but when employees display appropriate behaviour in reporting workplace injuries, they experience higher employee well-being and safety climate. Mediation analysis indicated that safety climate did act as a mediator between employee well-being and workplace injuries. The mediation model including four control variables age, tenure, hierarchy and work hours, accounted for approximately 20% of the variance in individual injuries at the workplace.

Practically, utilising established employee well-being and safety climate construct, together with commonly available demographic variables, organisations can combat workplace injuries. Theoretically, these findings from Singapore contribute to the literature of employee well-being from a positive psychology perspective and extend the safety climate literature in an Asian context. Moreover, this study suggests cross-cultural applicability for the relevant measures, having utilised a Hungarian employee well-being measure and a Norwegian safety climate instrument for an Asian sample. Overall, to tackle safety-related outcomes, employers must first take care of employee's well-being at work and management-related factors towards safety perception.

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List of Abbreviations

ANOVA	Analysis of Variance
APA	American Psychological Association
Bca	Bias Corrected and Accelerated
CEO	Chief Executive Officer
CI	Confidence Interval
CSR	Corporate social responsibilities
EWB	Employee Well-being
GDP	Gross Domestic Product
HQ	Head Quarters
HR	Human Resource
HRM	Human Resource Management
HSE	Health and Safety Executive
ILO	International Labour Organisation
LTFR	Lost-Time Frequency Rate
MNC	Multi-National Company
MOM	Ministry of Manpower
NOSACQ-50	Nordic Safety Climate Questionnaire
OCB	Organisational Citizen Behaviour
OSC	Organisational Safety Climate
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration

PPE	Personal Protective Equipment
PsyCap	Psychological Capital
PTSD	Post-Traumatic Stress Disorder
ROI	Return of Investment
SCO	Safety Critical Organisation
SCQ	Safety Climate Questionnaire
SME	Small-Medium Enterprise
SMF	Singapore Manufacturing Federation
SPSS	Statistical Package for Social Science
UK	United Kingdom
USA	United States of America
WHO	World Health Organisation
WPL	Workplace Literacy Assessment
WSH	Workplace Safety and Health
WSS	Workplace Safety Scale

Chapter One: Introduction

Employee well-being (EWB) is a context-specific construct of the broader construct of well-being. EWB is well-established to associate with numerous organisational outcomes and also facilitate many work-related issues, especially around safety concerns. Buehler, Werna, and Brown (2017) found that from the global labour force, 24% were disengaged at work, 38% suffers from excessive pressure, and overall workers are stressed, unhappy and even unsafe at work. According to International Labour Organisation (2018), globally 2.78 million fatal work-related injuries and illnesses were recorded each year and the economic impact on these injuries is approximately 3.94% of the global gross domestic product, GDP. Therefore, there is an urgency for organisational leaders to foster a culture passionate about health, safety and wellness. Interventions can start by establishing governance and engagement awareness between employer and employee to discuss and address issues proactively. The employer can generate a protective feeling in the organisation to improve employees' perception by increasing workers' mental, emotional and psychological well-being through social stability and security, technology and professional development (Champions Group, 2005; S. E. Chia et al., 2015; Cohen, 2004; Fenton, Pinilla Roncancio, Sing, Sadhra, & Carmichael, 2014; Harter, Schmidt, & Keyes, 2003).

In exploring current gaps in positive psychology literature, safety climate research, and workplace injuries in Singapore, the present study makes two contributions. Firstly, it examines the role of EWB from a positive psychology perspective using the PERMA model and the association with workplace injuries, via safety climate (see Figure 1). Secondly, it assesses the presences of well-established constructs of EWB, safety climate and injuries in a global hub island city in South East Asia, Singapore for their manufacturing sector. These three variables, EWB, safety climate, and workplace injuries will be discussed throughout. In the following chapters, hypotheses denoted 1, 2 and 3 will represent association with EWB, safety climate and injuries respectively.

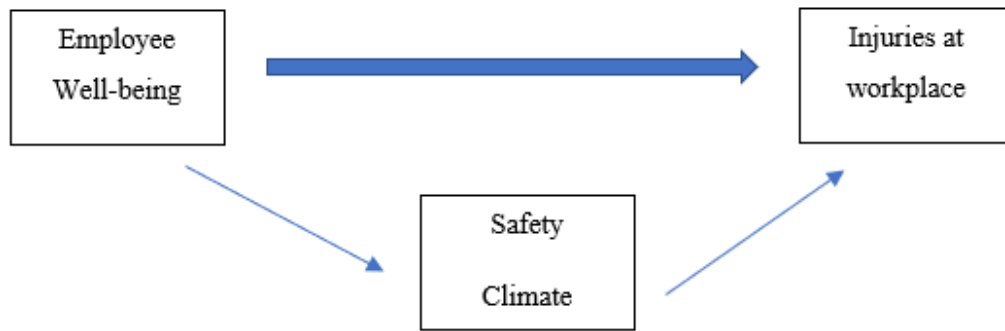


Figure 1. Model of relationship between EWB, safety climate and injuries

1.1 Well-Being

The term “well-being” is a broad concept which encompasses a spectrum of dimensions in a variety of ways. Hence, the definition of well-being is dependent on the method of conceptualisation. For instances, one of the earliest definitions of well-being is by the World Health Organisation, WHO that advocates health as a form of well-being. WHO defines well-being when an individual has “a state of complete physical, mental, and social well-being and not merely the absence of disease and infirmity” (World Health Organization, 1948). The method of conceptualisation can be further classified as context-free or context-specific examination, as it will impact various aspects of life from the government, education, teaching and how we perceive the society and ourselves (Ryan & Deci, 2001). According to a review of well-being instruments, Cooke, Melchert, and Connor (2016) have narrowed down to five main concepts of well-being namely quality of life, wellness, hedonic well-being, eudaimonic well-being and the fifth concept is the combination of the first four mentioned. Each of these main concepts will now be reviewed in the following segment.

Quality of life is one of the broad concepts of well-being which takes the salutogenesis approach looking at causes of health and how to optimise inherent potential (Lent, 2004). Hence, quality of life can be used interchangeably with well-being from this perspective. For instance, Frisch, Cornell, Villanueva, and Retzlaff (1992) formulated the quality of life inventory to determine the subjective well-being and life satisfaction of both medical and non-medical related participants from 17 areas covering dimensions of physical health, psychological status, level of independence, social and environmental relationships. Quality of life concept of

well-being is associated with studies looking at mainstream education and special education coupled with other psychological needs, physical health, mental and behavioural health, mental and intellectual disabilities, ageing, family-centred issues and other predictors. Furthermore, quality of life is applicable at three levels, microsystem to enhance personal well-being through personal growth and development opportunities; mesosystem to implement programs and apply environment enhancement techniques within communities or workplace to reduce the discrepancies between an individual and their environment; macrosystem where change and enhancement is done at a national level via social policies (Schalock, Verdugo, & Braddock, 2002).

Wellness is another wide-ranging concept of well-being which includes five dimensions namely emotional, intellectual, physical, social, and spiritual wellness (Roscoe, 2009). According to Hattie, Myers, and Sweeney (2004) who studied wellness evaluation of lifestyle, it mentions a holistic approach referring to the healthy functioning of the individual. Therefore, wellness and well-being are commonly used interchangeably. Subsequent researchers have looked at the wellness of individuals such as prison officers (Awani, 2012) and students pursuing a qualification in the helping profession (Snell, 2012). The wellness evaluation of lifestyle is also applicable to other culture outside western societies such as Turkey (Doğan, Yıldırım, & Myers, 2012) and Korea (Chang & Myers, 2003).

The hedonic concept of well-being is a third broad concept, which is slightly narrower as compared to the quality of life and wellness. Kahneman, Diener, and Schwarz (1999) studied well-being from a hedonic approach focusing on life experiences where people seek pleasure and circumvent to sufferings objectively from the subjective perception of the individual at any one point in time. One of the salient hedonic models is the tripartite model of subjective well-being by Diener (1984) which comprises three components namely life satisfaction, the presence of positive affect and the absence of negative affect. Subsequent researches may operationalise life satisfaction alone to represent well-being or happiness to represent positive and negative affect. Therefore, the term subjective well-being, well-being and happiness can also be used interchangeably within this regime of conceptualisation.

Over the years, subjective well-being has illustrated construct validity from extensive research findings. Factors associated with subjective well-being includes personality traits, health, income, religion, marriage, age, gender, work-related well-being, education, intelligence and other factors are still amidst discoveries (Diener, Suh, Lucas, & Smith, 1999). Furthermore, subjective well-being is utilised to represent an individual's well-being even on a national level, providing valuable insights for policymakers and overall monitoring of citizens welfare (Waldron, 2010). Research in subjective well-being at the workplace also shows association with job-related outcomes, not limiting to job satisfaction, work performance and organisational citizen behaviour (OCB) (Russell, 2008).

The eudaimonic concept of well-being is the fourth concept which can be distinguished from hedonic well-being. Eudaimonic well-being focus on psychological health such as growth, seeking meaning and purpose in one's life (Lent, 2004), and when an individual is at equilibrium from within, it is where one achieves eudaimonic well-being (Ryan & Deci, 2001). One of the salient eudaimonic models is the six-dimensional model of psychological well-being by Ryff (1989) which consists of autonomy, personal growth, self-acceptance, life purpose, mastery, and positive relatedness that contributes to human flourishing. Subsequent researches may operationalise well-being in various combinations of these six dimensions of psychological well-being. Thus, the term psychological well-being and well-being are commonly used interchangeably as well.

A longitudinal study on the general population shows long-term variation in one's psychological well-being (Abbott, Ploubidis, Huppert, Kuh, & Croudace, 2010). Cross-culturally, psychological well-being was also examined in Hong Kong (Cheng & Chan, 2005), Sweden (Lindfors, Berntsson, & Lundberg, 2006), and Spain (Van Dierendonck, Díaz, Rodríguez-Carvajal, Blanco, & Moreno-Jiménez, 2007) for a non-American perspective. Psychological well-being studies were also conducted in areas of development and ageing, personality correlations, family experiences, work and other life engagements, health and biological research, clinical and intervention (Ryff, 2013). As society progresses, the arena of eudaimonic conceptualisation of well-being will continue to gain attention.

Summary

From the four conceptualisations, there are significant overlapping constructs such as subjective perspective, psychological perspective, life satisfaction, physical health, and self-sufficient ability. Besides, the apparent intent of conceptualisation is to evaluate and measure the well-being of humanity to propose improving measures and be more proactive for the better good. In this study, well-being will take the fifth conceptualisation which is the combination of the two broad concepts of hedonic and eudaimonic approach. The positive psychology perspective of well-being is one of those that incorporated both of these approaches.

1.1.1 PERMA model of well-being.

The American Psychological Association (APA) president, Seligman, M. has made positive psychology a focus for future research (Fowler, Seligman, & Koocher, 1999). He mentioned that in the past research had focused significantly on restoring impairment within human functioning which is a reactive approach. For example, in the treatment of depression, despite tremendous efforts in finding antecedents, current data indicates that depression is more severe and found in the younger population as compared to decades ago. Therefore, there is an urgency to emphasise growth and flourishing within individual and community which is considered as a proactive approach (Fowler et al., 1999). Furthermore, researchers Ryan and Deci (2001) also suggested that individuals need to strike a balance between hedonic and eudaimonic well-being. According to Seligman (2012), he postulated that well-being consists of five elements namely positive emotions, engagement, meaning, relationships, and accomplishment. These five elements of positive psychological well-being form the acronym PERMA which represents the nurturing and flourishing of individual strengths. These five elements of well-being from a positive psychology perspective is also applicable to the workplace and has become a prevailing trend in aspects of EWB.

Positive emotions are the key to leading a pleasant life because the type of emotions an individual experience will shape the perspectives of their well-being (Seligman, 2012). People like to do things that make them feel good and upbeat, such as travelling, reading, exercising, and so forth (Kahneman et al., 1999). Therefore, these good feelings stimulate an individual's thoughts to produce an action which can lead to an upward spiral for increasing personal resources (Jeffrey,

Mahony, Michaelson, & Abdallah, 2014). Furthermore, positive emotions are an antecedent for group cohesiveness at multiple levels (Ashkanasy, 2003). For instance, positive emotions at work can influence an employee's performance through improved physical health, stronger co-worker relationships and maintain optimism for their future (Ágota, Balogh, & Krasz, 2017). Thus, it is even more crucial to elicit positive emotions among employees due to the interrelatedness of these levels. These virtuous cycles of goodness will lead to a group of people who can work well together to achieve a common goal.

Engagement is about finding flow in everyday life which contributes to well-being (Csikszentmihalyi, 1997). Flow is said to be the full immersion of oneself into an activity, that an individual becomes oblivious to its surroundings which result in a blissful state and usually only in retrospective does one realise (Seligman, 2012). Hence, an individual needs to have their thoughts, emotions, physical behaviours synchronised to be fully engaged with the task at hand. For example, when you are engaged with doing your project, communicating with your co-worker, or working in a team, it is the act of being immersed in whatever you do. The connection will be reflected in the employee's performance; the engagement can be perceived and exchanged with their co-workers and supervisors. Hence, if more employees can display such behaviours, it will be beneficial for organisations at multiple levels. For instance, if employees were to attain engagement at work, it will be a win-win situation as the organisation reap the fruit of productive employees and employees themselves also discharge positivity (Ágota et al., 2017).

Relationships are the connection and interaction an individual has with their family, friends, co-workers and any others which provides various avenues of support (Jeffrey et al., 2014). The availability of human relationships supplements the well-being of an individual, especially during times of adversity and is proven to mitigate physical and psychological health risk (Miller, 2011). Furthermore, support from these relationships act as a buffer during stressful events and also encourages positive psychological states (Cohen, 2004). Hence, it is important for an organisation to facilitate strong ties between supervisor and employee and among co-workers, as their positive relationships act as strong foundation at the workplace which can influence their well-being (Ágota et al., 2017).

Meaning is about having a sense of purpose in life, pursuing and fulfilling a goal that is bigger than oneself which an individual enjoys doing and feels great as a result. For example, volunteering work, community or religious services or any activity that gives an individual a sense of meaning (Seligman, 2012). Individuals who reported a more meaningful life are associated with being more satisfied as a whole, although their meaningful life may not always relate to being happy (Baumeister, Vohs, Aaker, & Garbinsky, 2013). Therefore, in an organisation, employees need to know how their role contributes to achieving organisational goals. This knowledge allows the employee to attach meaning and purpose to their job so that they can feel satisfaction at work (Ágota et al., 2017). Furthermore, employees of organisations that are involved in corporate social responsibilities (CSR) which have relevance to their line of work experience higher well-being (Jeffrey et al., 2014). Overall, having meaning in one's life helps anchor one to their actions and behaviour.

Accomplishment is about achieving one's goal or fulfilling a mission, it can lead to a sense of satisfaction on a fundamental level, or it can result in recognition from an external level. On a fundamental level, for example, a mother will have a sense of accomplishment for raising her children and taking care of family despite no external awards given for the energy spent (Butler & Kern, 2016). On an external level, for instance, a doctor will have a sense of accomplishment when he or she have achieved certain professional recognition (Hojat, Kowitt, Doria, & Gonnella, 2010). Having a sense of accomplishment allows an individual to reflect on their lives knowing that he or she has led a meaningful life. Thus, organisations need to enable employees to set challenging yet realistic goals for them to identify their contributions as an accomplishment (Ágota et al., 2017).

Summary

Overall, positive psychology focus on developing the strengths of individual and this non-deficit approach allows the organisation to create positive group interactions which enhance overall engagement and productivity. Seligman and Csikszentmihalyi (2000) reinforced that future research should focus on developing what is right about people rather than fixing what is wrong with them. This approach allows policymakers or those in a position to foster these human strengths and

virtues in the current and future generation. Hence this study utilises the PERMA model approach to measure EWB.

1.1.2 Employee well-being.

We have discussed well-being as context-free, evaluating an individual perception of their well-being at any one point of their life. Individual perception is a matter of comparison and judgement of current events with a similar experience previously encountered (Kahneman et al., 1999). Additionally, being more context-specific streamlines and increases the predictive power of outcome variables involved. This research will be looking at the context-specific well-being of the employee at the workplace. Well-being at the workplace has been associated with substantial personal and organisational outcomes, and work-related well-being has been studied since the 1930s (Mayo, 1934).

The importance of EWB continues to rise due to the changing needs of the businesses. Employees are confronted with more highly integrated work processes, intense competition among common trades and increase demand on being customer-centric; these changes will influence the EWB (Warr, 2007). Improving EWB at the workplace is a worthy goal, and it stretches beyond what seems to be apparent interventions of weight loss, stop smoking campaign, eat healthily or fitness programs. Moving forward, organisations can proceed to intervene at the psychological and behavioural levels with training revolving mindfulness (Klatt, Sieck, Gascon, Malarkey, & Huerta, 2016; Roche, Haar, & Luthans, 2014), psychological capital, PsyCap (Avey, Reichard, Luthans, & Mhatre, 2011; Luthans, Avolio, Walumbwa, & Li, 2005; Yongduk & Dongseop, 2014), and positive leadership (Arnold, Turner, Barling, Kelloway, & McKee, 2007; Li, Xu, Tu, & Lu, 2014; Liu, Siu, & Shi, 2010). Furthermore, changes within an individual spread outward to the people within the proximity (Fowler & Christakis, 2008). Hence the enhanced well-being of an employee concerning the PERMA model will be contagious, and the positive vibes will diffuse to its surrounding co-workers and teammates (Jeffrey et al., 2014).

EWB not only benefit the organisations, but it also benefits the employee as an individual. Research based on the PERMA well-being model shows how having meaning and engagement at work can cause an upward spiral effect on a person.

When an organisation is well equipped with a good policy and is concerned about employee's well-being, they create a culture that helps develop employees' positivity and their true identities on the job, allowing them to perform to their real potential. In contrast, other organisations that fail to see their employee as assets and only focus on conventional contribution to the bottom line, will have employees who have less room to flourish and have reduced access to personal resources when faced with challenges at work (Roberts, Dutton, Spreitzer, Heaphy, & Quinn, 2005).

Experts have recommended the organisation to use a positive approach to EWB by focusing on their strengths rather than their flaws, to achieve excellence. Praising and reminding employees of their values and strengths, enhancing feedback and communication allow employees to know their contributions and accomplishments can help employees to buffer against stressors and anxiety at work which is proven even at a hormonal level (Creswell et al., 2005; Sherman, Bunyan, Creswell, & Jaremka, 2009). Thus, when the employee can indeed be themselves, feel appreciated and valued by their organisations who know their merits, these will influence the perception of the employee. These perceptions allow the employee to be not only physically present at work and also have a sense of presence during work (Kahn, 1992).

Forming a cohesive team is always challenging even with the presences of team building initiatives and having teams in organisations are inevitable where core processes involves managing projects, departments, processes or some groups. Bubshait and Farooq (1999) mentioned that EWB is one of the ten characteristics that contribute to the critical ingredients of teambuilding, project success and an efficacious organisation. With individual EWB improved, the broader effect will also foster collaborative relationships within co-workers and effective team players (Jeffrey et al., 2014). Data analysis of 42 manufacturing plants from 35 companies found that increased interaction among co-workers regardless work-related, social or both are essential for minimising variability within-group agreements (Klein, Conn, Smith, & Sorra, 2001). Hence, having good working relationships can increase harmony within the team and department, and those departments with a higher level of team-member exchange are found to have better departmental productivity over time (Seers, Petty, & Cashman, 1995). Overall, co-worker plays an integral part in social and working relationships within an organisation due to the

inter-connectedness. The above are instances reflecting the PERMA well-being model of how having positive work relationships among employees is beneficial at a group level.

In the competitive labour market, when an organisation is equipped with flexible well-being approach tailored for various generation workers ("Work redefined: A new age of benefits," 2017), holistic policies and culture that focus on EWB (Roberts et al., 2005) will have an advantage to attract and retain talent. An organisation that is willing to look at long-term investment in EWB will gain more in terms of employee's physical and psychological health, employee engagement, reduced absenteeism and eventually reduced health care costs as compared to those organisations that only focus on short-term or instant gratification (Baicker, Cutler, & Song, 2010; Kumar, McCalla, & Lybeck, 2009; Yen, Schultz, Schaefer, Bloomberg, & Edington, 2010). However, organisations need to be aware that EWB takes time to surface and is the result of a thorough culture revamp and not something achievable overnight after a couple of generic off-the-shelf interventions. Organisations with patience can then reap the fruit of enhanced EWB from tangible sources such as increased profitability, performance of the business unit as a whole (Harter, Schmidt, & Keyes, 2003), and also from intangible sources such as reputation and the appeal of the organisation to the talented workforce (Hoff, 2013; McCoy, 2016).

1.1.3 Employee well-being measurements.

There is no lack of instruments that measure EWB. Depending on the school of thoughts and conceptualisation of the researcher, there is no "one size fits all" method. The traditional approach to measuring EWB involves workaholism, burnout and work engagement coupled with other variables such as excessive working hours, job characteristics, demands, resources, work outcomes, social relations and perceived health to form a composite status (Schaufeli, Taris, & Van Rhenen, 2008). The four broad concepts of well-being earlier mentioned in section 1.1 (e.g., quality of life, wellness, hedonic well-being and eudaimonic well-being) have also adapted for context-specific settings for the workplace. The adaptations are quality of work life (Chan & Wyatt, 2007; Nadler & Lawler, 1983; Panda, 2013; Sirgy, Efraty, Siegel, & Lee, 2001; Swamy, Nanjundeswaraswamy, & Rashmi, 2015; Walton, 1973), wellness at work (Awanis, 2012; De Klerk, 2005), subjective

well-being at work (Russell, 2008) and psychological well-being at work (Cheng & Chan, 2005; Lindfors et al., 2006; Wright & Cropanzano, 1997).

Other researchers integrate and develop tailored version of EWB measures for various needs such as from the national level (Jeffrey et al., 2014; Van Aerden, Moors, Levecque, & Vanroelen, 2015), organisation's perspectives (Orsila, Luukkaala, Manka, & Nygard, 2011; Wilson, Dejoy, Vandenberg, Richardson, & Mcgrath, 2004), and for different culture (Demo & Paschoal, 2016; Kathirasan, 2015; Zheng, Zhu, Zhao, & Zhang, 2015). Singapore being a multi-culture country, it is essential that the well-being instrument used in the research is suitable to ensure the validity of the measured outcomes.

1.1.3.1 Positive psychology employee well-being measures.

Since Seligman and Csikszentmihalyi (2000) introduced positive psychology, researchers started to measure and evaluate happiness at the workplace from a positive psychology perspective, and three relevant measures will be reviewed in this section.

Based on reviews of factors contributing to EWB and positive psychology, Parker and Hyett (2011) developed a comprehensive model using participants from the various work environment and job levels. The final four-factor model comprises of work satisfaction, organisational respect for the employee, employer care which represents positive construct and intrusion of work into private life which represents a negative construct. This model accounts for 52.5% of the variance.

Butler and Kern (2016) developed a well-being measure based on the PERMA model of well-being: positive emotions, engagement, relationships, meaning, and accomplishment with additional filler items covering negative emotions and physical health known as the PERMA-Profiler. Participants vary in age, nationality, educational background and employment status; this allows the instrument to have more extensive diversity. However, when applied in Malaysia a three-factor model of PERMA-Profiler suits the Malaysian sample as compared to the original five-factor model of PERMA-Profiler which the author postulated to the strong religious presences and cultural differences (Khaw & Kern, 2014).

Ágota et al. (2017) gathered a six members team of psychologists and postgraduate psychology students to construct a work-related well-being instrument

for employees. This team derived questions closely related to each factor of the PERMA model of well-being, and they also include a negative aspect relevant to work. The six-factor model is responsible for approximately 58.3% of the variance.

This study decided to use the work-related well-being instrument developed by Ágota and her team (2017) because their questionnaire account for the most variance among the three, the questions follow closely to the PERMA model of well-being, and the participants are all working adults which provides a suitable representation of workforce. Although this instrument was initially developed for a Hungarian population which may be culturally different from Singapore (Hofstede Insights, 2010), this will be an excellent opportunity to test its cross-culture generalisability.

1.2 Safety Climate

Occupational health psychology takes into consideration employee health, safety, and well-being at the workplace (Spector, 2012). All workplaces possess risk and hazards; some more than others. For example, safety-critical organisation (SCO) such as construction, mining, manufacturing, petrochemical or oil rig industries where employees are exposed to higher physical risk as compared to an office setting (Nielsen, Mearns, Matthiesen, & Eid, 2011).

Although the toll of industrial accidents is not high, it does account for significant direct and indirect costs such as property damage, production losses, social disruption, emergency planning and response. Furthermore, the shockwave repercussion to its surrounding community and across the globe continues even decades after the disaster. For instance, the Bhopal chemical release tragedy that happened in India more than 30 years ago is still negatively affecting the locals. Investigation reports indicated that apart from equipment and plant design issues, there were other factors relating to poor safety climate such as inadequate worker training and competency, lack of management commitment to safety issues, organisation turning a blind eye on past injuries and minor chemical leaks, and poor enactment of safety policies (Eckerman, 2004). Other large-scale industrial accidents that were involved with poor human and organisational management had also occurred in developed countries, including major industry giants such as Shell

chemical plant in Texas (EPA/OSHA, 1998); BP Texas City refinery (CSB, 2005) and Deepwater Horizon drilling oil rig in USA (CSB, 2010).

The conventional approach to manage workplace hazards is using the hierarchy of controls. Starting from the top of the hierarchy which is also the most effective method is the elimination control (e.g., removing hazards), followed by substitution (e.g., replacing hazard with a safer option), engineering control (e.g., isolate people from hazard) and lastly is administrative control (e.g., change the way people work with hazard) which is the least effective (Occupational Safety and Health Administration, 2018a). Despite the development in technology and refinement of conventional control of hierarchy, industrial safety seems to have hit a plateau for advancement. More often than not, working in SCOs does have its limitation in utilising the elimination or substitution controls due to the nature of the work environment. Industrial leaders are sourcing other organisational and psychosocial approaches that can help broaden the perspective of safety prevention, and one such approach is safety climate.

1.2.1 History of safety climate.

Safety climate research started more than thirty years ago, and one of the salient contributors is Zohar (1980), who evaluated the employees' perception of safety for twenty various manufacturing factories in Israel. His research discovered eight dimensions of safety climate namely importance of safety training programs, management attitudes toward safety, effects of safe conduct on promotion, level of risk at the workplace, effects of required work pace on safety, the status of safety officer, effects of safe conduct on social status, and status of the safety committee. Since 1980, more safety climate-related research has been conducted, and there was a gradual increase from the late 1990s onwards (Huang, Chen, & Grosch, 2010). The past three decades of research has confirmed safety climate as one of the leading predictors of safety outcomes across industries and countries (Zohar, 2010). Occupational safety researchers have illustrated that employers should adopt a multi-level perspective of workplace safety by integrating conventional hierarchy of control with safety climate to provide a more holistic approach for improving employee's safety at work (Hofmann, Burke, & Zohar, 2017).

Zohar (1980, p. 96) first defined the term safety climate as “shared employee perceptions about the relative importance of safe conduct in their occupational behaviour”. After two decades of safety climate studies, researchers have examined different dimensions of safety climate with other safety outcomes at the group and organisational levels. Zohar (2000) refined the definition of safety climate as “shared perceptions about the priority of safety policies, procedures, and practices and the extent to which safety compliant or enhancing behaviour is supported and rewarded at the workplace”. Along the way, other researchers have defined safety climate with slight variations, but it still revolves around employee’s perception based on observations of incidents and activities regarding the physical safety associated with a job, and the interaction with others in the workplace (Barling & Frone, 2004; Huang, Ho, Smith, & Chen, 2006).

Zohar (2014), mentioned that a good safety climate indicates a higher occurrence of safe behaviour from employees at the workplace. The increase in safety behaviour is potentially due to safety policies being coherent and exhaustive, coupled with effective communication of safety procedures and enactment of these safety practices. The safety behaviours mentioned above allow employees to witness the organisational commitment to safety, whereby the management prioritises over-conflicting demands such as production. This positive employee perception of safety not only benefits the individual to work more safely; it also increases awareness of co-workers safety, which is advantageous to the organisation (Zohar, 2014). On an individual level, the research found that a strong safety climate attenuates job insecurities on safety-related outcomes such as safety knowledge, safety compliance, personal accidents, near-miss incidents, and injuries at the workplace (Probst, 2004). On a group level, the strength of safety climate is an indication of the association with safety-related outcomes, meaning higher safety climate scores indicates a more significant association with safety-related outcomes (Beus, Payne, Bergman, & Arthur Jr, 2010). On an organisational level, positive the safety climate indicates a lesser inconsistency between the injuries reported and unreported (Probst & Estrada, 2010).

On the contrary, Zohar (2014) stated that poor safety climate emerges when management’s action concerning safety is inconsistent; it does not reflect the managerial commitment level as declared in organisational policy. On an

organisational level, poor safety climate will increase the discrepancy of reported and unreported injuries where everyone reported the case; there are at least three or more unreported cases (Probst & Estrada, 2010). Therefore, a poor safety climate score is equivalent to the less shared perception of safety occurrences and activities in the workplace, which in turn have less impact on safety behaviour and safety-related outcomes (Tholén, Pousette, & Törner, 2013).

1.2.2 Importance of safety climate.

Safety climate, being multi-dimensional and multi-level concept is well-established, whereby perceptions regarding safety at the workplace are not only experienced by oneself but also shared with co-workers, across groups, organisations, and even on a national level (Griffin & Curcuruto, 2016). For instance, two safety climate and injury-related meta-analysis reviews have been conducted, one by Clarke (2010) which covers 32 studies from the year 1986 to 2005, and another by Beus et al. (2010) which includes 29 studies for the period between 1991 to 2009. Clarke (2010) illustrates that safety climate is indeed a mediating factor between organisational factors and safety-related outcomes which eventually affect workplace accidents, and Beus et al. (2010) demonstrate the bidirectional relationships of safety climate-injuries and injuries-safety climate at an organisational level and an individual level. Furthermore, with the diversity of safety climate studies and the collaboration with other well-known constructs, safety climate has become an essential connection with non-safety related organisational and psychological processes. This additional connection provides the employer with more avenues to combat safety-related challenges in the workplace (Barling & Frone, 2004).

Influences from co-workers are inevitable as there are different departments, work teams and shift groups in an organisation (Khandan, Maghsoudipour, & Vosoughi, 2011). Studies illustrate the presences of micro-climates within an organisation (Tharaldsen, Olsen, & Rundmo, 2008). Although perception data shows homogeneity within groups, there is still a significant difference between groups, and this is reflected both in the western and eastern countries (Kwon & Kim, 2013; Probst, 2004; Zohar, 2002). This observation is plausible as the operation process and leadership style also varies across groups. Despite standard organisation policies and regulations, the interpretation, implementation, and enactment

processes are dependent on the person in charge of the group (Griffin & Curcuruto, 2016; Zohar, 2000). Therefore, group-level climate also influences the safety climate and safety-related outcomes such as supervisor leadership practices and safety behaviour (Kapp, 2012), and supervisor enforcement and accident reporting (Probst, 2015).

An organisation is a bigger group level, and safety climate measurement provides “a snapshot of the prevailing state of safety in the organisation at a discrete point in time” (Huang et al., 2006). When an organisation achieves a favourable safety climate, it is an indication that the safety perception within the organisation is relatively homogenous with minimum inconsistency between organisational safety policies, group level interpretation, implementation and enactment, up to the individual perception of the workplace. Likewise, when the safety climate is poor within an organisation, the opposite is true which indicates more significant disparity across multiple levels. Nevertheless, with safety climate being a multidimensional construct, results from the safety climate score show which dimension is lacking, and organisation can be alerted to implement countermeasures (Probst, 2004).

Overall safety climate involves the intertwining of multiple levels within an organisation. For macro-level, organisation contributes by providing tangible commitment towards safety, creating a safe environment for employees, and empower key personnel such as managers and group supervisors with appropriate leadership skills to ensure safety participation and safety compliance as a form of resources for the employees. At group-level, an organisation can look at promoting quality relationship exchange among team members to ensure safety behaviour is enacted, and the environment is psychologically safe to highlight safety related issues. For micro-level, individual employees need to understand the implications of potential hazards at their workplace. When human lives are at stake, it is only right to fail proof every layer of safety contribution.

1.2.3 Outcomes and antecedents of safety climate.

Occupational safety has evolved over the past ten decades. After the start of industrialisation, official legislation was introduced in the 1800s to standardise and improve worker’s workplace condition and productivity. This was followed by focusing on worker’s compensation in the 1900s due to industrial accidents resulting

in a massive fatality traced back to the negligence of the employer. Subsequently, more studies started observing and measuring hazards in the workplace and work role. Shortly after, researchers adopted a holistic approach to occupational safety by analysing work environment, developing accident simulations and conducting safety training to reduce fatalities, injuries and unsafe acts. Gradually, the scope of occupational safety broadened to include studying human behaviour and safety performance. This expansion leads to the establishment of government agencies dedicated to workplace safety and health (Hofmann et al., 2017). For example, in the United Kingdom (UK) is known as the Health and Safety Executive (HSE), in the United States of America (USA) is known as the Occupational Safety and Health Administration (OSHA), and in Singapore is known as the Workplace Safety and Health (WSH). These agencies standardised guidelines in their respective countries for an employer to meet specific requirements to ensure the safety of worker and worksite.

Researchers then started to examine the antecedent of safety outcomes, and this is where the safety climate was introduced in 1980. Safety outcomes primarily focus on accidents and injuries (Beus et al., 2010; Hayes, Perander, Smecko, & Trask, 1998; Huang et al., 2006; Nielsen, Rasmussen, Glasscock, & Spangenberg, 2008; Smith et al., 2009; Zohar, 1980, 2000). Progressively the analysis expanded to safety behaviours, safety compliance, knowledge, and participation (Clarke, 2006a; Griffin & Curcuruto, 2016; Griffin & Neal, 2000; Man, Chan, & Wong, 2017; Probst, 2004), safety citizenship (Hofmann, Morgeson, & Gerras, 2003), safety motivation (Griffin & Neal, 2000; Khalid, Hussain, & Ahmad, 2016; Leng, 2013; Neal & Griffin, 2006), management commitment (Beus et al., 2010; Flin, 2003; Huang et al., 2006), employee engagement (Hystad, Bartone, & Eid, 2014; Nahrgang, Morgeson, & Hofmann, 2011; Zohar, 2014) and other organisational factors (Ayim Gyekye, 2005; Barling, Kelloway, & Iverson, 2003b). From the 2000s onwards, occupational safety research branched out to investigate the antecedents of safety climate instead. This is where studies unveil that potential precursors includes leadership (Clarke, 2013; Zohar, 2002), team and group climate (Kapp, 2012; Neal & Griffin, 2006; Zohar, 2000, 2002), organisational climate (Neal, Griffin, & Hart, 2000; Phipps, Malley, & Ashcroft, 2012), and other personnel-related factors (Beus, Dhanani, & McCord, 2015; Clarke & Robertson,

2005; Satalaksana, Anatasia, & Yassierli, 2016). Therefore, employers need to espouse a multilevel perspective when handling occupational safety.

Hence, this shift in research focus from outcomes to antecedents, naturally puts safety climate as a plausible mediation variable which gives rise to the following hypothesis and is also the main hypothesis of this study:

Hypothesis 2a: Safety climate will mediate the relationship between EWB and individual workplace injuries.

1.2.3.1 Outcomes of safety climate.

Zohar (2010) reviewed the past 30years of safety climate research and results proved that safety climate is a robust leading indicator of safety outcomes globally and industry-wide. This section will review accidents and injuries, and management for outcomes of safety climate, other demographic outcomes will be covered in section 1.4.

Accident and injuries.

Accidents and injuries are one of the primary focus as an outcome of safety climate research. For instance, a study examined the safety climate of white- and blue-collar workers found that safety climate was negatively correlated with accident rates (Hayes et al., 1998). Likewise, another study using workplace health and safety survey for manufacturing firms in Canada, researchers found that better employee perception of health and safety measure resulted in better management attitude and greater worker involvement in safety is associated with lower lost-time frequency rate (LTFR) (Geldart, Smith, Shannon, & Lohfeld, 2010).

As for the predictive power of safety climate on injuries, Zohar (2000) collected the safety climate of employees in a metal-processing plant at point one and obtained the micro-accident records five months later. Results illustrate that employees' safety perception of workplace predicts subsequent accidents. Similarly, a one-year-long study in two chemical manufacturing plants also proved that safety climate has a predictive value of self-reported injuries and accidents (Nielsen et al., 2008). A meta-analysis conducted by Beus et al. (2010) indicates that a supportive safety climate is associated with fewer injuries at the workplace, but the connection from injury to safety climate is slightly stronger than safety climate to injury. Thus, the above review gives rise to the following hypotheses:

Hypothesis 2b: Safety Climate will be negatively associated with individual workplace injuries for the Singapore sample in the manufacturing sector.

Taking into consideration the review of EWB in section 1.1 and safety climate in section 1.2, literature illustrates a wide range of outcomes associated with EWB and the interconnectedness with safety climate. Hence, the following hypothesis is formulated:

Hypothesis 1a: EWB will be positively associated with safety climate for the Singapore sample in the manufacturing sector.

On the contrary, some studies show no significant relation to safety climate and injuries. For instances, research in a car manufacturing multi-national company (MNC) in the UK also indicate no significances between safety climate factors and accidents history in the plant (Clarke, 2006b). Likewise, a study comprises of 18 companies from manufacturing, construction, service, and transportation shows that the path coefficient for safety climate on injuries was not significant (Huang et al., 2006). For predictivity verification, a 2-year longitudinal study of safety climate and accidents for nine oil and gas installation in the North Sea was not statistically significant (Mearns, Whitaker, & Flin, 2001).

Overall safety climate has its practicality as a leading factor, but it may be dependent on the severity of the accident. For instance, safety climate evaluation may have higher validity for low severity accidents such as personal injuries but lower validity for high severity major accidents. In addition, some workplace hazards are industry-specific, and some industries are naturally more hazardous than others which can influence the analysis. On the hindsight, this accident, injuries and near-misses records are based on self-reports which are dependent on other factors. These other factors will be further discussed in section 1.3.2.

Management.

Management in this context is not exactly an outcome of safety climate but a crucial dimension within the safety climate that is almost always associated with safety-related issues. Management attitude is identified from the first safety climate study as one of the most influential dimensions that contribute to safety (Zohar, 1980). This management dimension is most prevalent in safety climate measurement from

standard to high-risk industry (Flin, Mearns, O'Connor, & Bryden, 2000; Håvold, 2005).

Management is commonly operationalised as activities or behaviours from management staff, and its ranges from C-suites and top-management who usually are the policymakers, managerial staff such as a manager and supervisor, or simply employees classified as management such as engineers and team leads. Examples of such activities include safety audits, safety awards, safety promotional campaigns, safety committee meetings; recognition of worker safe behaviour and welfare, enacting safety rules and regulations and decision making on safety-related conflicts. Non-management employees will perceive the management employee's involvement in these activities or behaviours pertaining to safety as management commitment and attitude (Griffin & Curcuruto, 2016). A dimensional-level meta-analysis done for 29 safety climate measures and injury relationship found that management commitment is the most robust predictor of injuries and the strength of the association is stronger than the safety climate scale as a whole. Furthermore, results clearly show how management commitment and injuries relationship is mono-direction and has generalisation validity. Alternative management operationalisation such as management support by verbally encouraging employees and management justices also indicates lower odds of injuries and reduces occurrences of non-reporting by 3.5 times respectively (Lipscomb, Schoenfisch, & Cameron, 2015; Smith et al., 2009). This conveys a strong message to the employer that safety training to management staff can enhance the installation of safety awareness in non-management employees which can directly impact injuries prevention (Beus et al., 2010).

On the contrary, some studies fail to achieve statistical significance when establishing linkage between management and injuries despite results illustrating association. For instance, a study using multi-industries sample in Spain utilised a safety climate scale that operationalised management as safety management which reflects safety priority, initiatives and supports by management. The management dimension of safety climate did not indicate a direct relationship to workplace accidents but is mediated via personal involvement and individual standards of behaviour (Tomás, Cheyne, & Oliver, 2011). Similarly, the manufacturing firms in Canada shows that the rate of frontline management informally acknowledging

employee safety behaviour in an unconstrained manner is associated with lower injuries. Correspondingly, when more safety responsibilities are included in the manager's job descriptions, the frequency of injury appears to be lower (Geldart et al., 2010).

The review of ongoing research observed that employees under management classification regardless of the hierarchy have on safety are idiosyncratic (Flin, 2003; Tucker, Ogunfowora, & Ehr, 2016). Therefore, employees classified as management even those not in managerial position needs to ensure that their action and prioritisation of safety-related matters are visible and communicated to employees, especially walking the talk. Moreover, management employees are in a position to enact and preach safety due to their availability of organisational and personal resources as compared to non-management employees thus management employees need to continually evaluate if their commitment is being conveyed to non-management employees, which entails a long-term approach (Flin, 2003). The review above illustrates how management is associated with safety climate and injuries. Hence the author proposes that EWB may follow similar fashion due to the association of EWB, safety climate and injuries which gives rise to the following hypotheses:

Hypothesis 1b: EWB will be better for management employees than non-management employees for the Singapore sample in the manufacturing sector.

Hypothesis 2c: Safety climate will be better for management employees than non-management employees for the Singapore sample in the manufacturing sector.

Hypothesis 3a: Individual workplace injuries will be lesser for management employees than non-management employees for the Singapore sample in the manufacturing sector.

1.2.4 Conflicts with safety climate.

This section will highlight frequent conflicts experiences by the organisation when dealing with safety climate issues such as production and safety investments. In the manufacturing sector, maximising production is what keeps the business going. The production is managed by organisation operating procedures while taking into

consideration other relevant aspects required to optimised productivity. These operating procedures are written by one group of people known as rule-maker, while the enactment of these procedures is by another group of people known as rule-supervisor, and finally, the execution of these procedures is again by another group of people known as rule-follower. These three groups of people have their own sub-cultures namely management culture, engineering culture, and operations culture respectively (Lofquist, Dyson, & Trønnes, 2017). These sub-cultures are formed due to a different interpretation of safety relationships within the organisation. Different interpretations will result in gaps between these sub-cultures, and these gaps will cause the discrepancy among employee perception of organisational priorities.

It is typical for the manufacturing sector to encounter a situation where safety is threatened due to production-related issues. Striking a balance between production and safety is necessary because whichever side the organisation favours will set precedence and employees will react accordingly (Zohar, 2010). Research shows that prioritising safety over-production is highly correlated with self-report accident rates (Vinodkumar & Bhasi, 2009), and safety production conflict is negatively related to behavioural safety compliance, and less likely to report accidents (Jiang & Probst, 2015).

To manage production risk and operate safely, the organisation needs to invest in the updated safety system, conduct periodic maintenance of safety equipment and install redundant equipment as a standby in case the first layer of safety system fails, regularly provide safety training to enhance safety knowledge (Zohar, 2014). Unfortunately, safety is considered an expenditure which does not have direct monetary returns. Therefore safety-related investments lack justification for decision makers to disperse resources for safety prevention. Additionally, there is no comprehensive calculation on the return of investment (ROI) for investing in a safer system unless it is major accident that requires the organisation to stop production and substantial worker insurance claim. Moreover, the frequency of occurrences is not high; hence, organisations may have been adopting a preventive approach to safety rather than a proactive approach (Griffin & Curcuruto, 2016).

1.2.5 Measurements of safety climate.

Since the first safety climate instrument developed by Zohar (1980), subsequent burgeoning safety climate instruments have a continuum of similar dimensions while some included disparate dimensions depending on the approach of the researchers. For example, Flin et al. (2000) identified common themes for 18 instruments from the year 1980 to 1999 through a thematic analysis. Industries involved were mainly from the energy or petrochemical industries, followed by manufacturing, construction and aviation, excluding healthcare, retail and clerical sectors. The six emergent themes include management, safety system, risk, work pressure, competence, procedures and rules.

Safety climate instruments, regardless if it is a generic instrument that covers all industries or industry-specific or even country-specific due to cultural difference each approach has its purpose and advantage. For instance, a generic instrument allows generalisability across a range of industry settings which is useful for upper level governing bodies, while tailored safety climate measures for specific industry or country offers more detailed understanding, and accumulation of rich knowledge as what applies to an industry may not be applicable in another industry or another cultural setting (Griffin & Curcuruto, 2016). However, before the commencement of safety climate diagnosis of the organisation, the user needs to be clear of the purpose, the extent that the instrument is applicable for the relevant sectors, potential and limitations, as well as their pros and cons. This section will review generic and tailored safety climate instruments that are identified in the safety climate research.

1.2.5.1 Generic safety climate instruments.

From historical records, safety climate instrument is popularised by Zohar (1980) when he established the first measurement of safety perception for manufacturing workers in Israel known as safety climate questionnaire (SCQ). SCQ consists of 40 items and eight dimensions used to assess the individual level of safety perception at the workplace was used as a reference for other safety climate instrument creations such as manufacturing plants in USA (Cooper & Phillips, 2004; Evans, Michael, Wiedenbeck, & Ray, 2005) and petrochemical industry in Iran (Khandan et al., 2011).

Hayes et al. (1998) developed the workplace safety scale (WSS) which consists of 50 items and five dimensions namely job safety, co-worker safety, supervisor safety, management practices, and satisfaction with the safety program. Participants are from multi-sectors across the USA who have been involved in accidents at workplace requiring medical consultation. Similarly, this instrument was also applicable to safety climate researches conducted for industrial workers in West Africa (Ayim Gyekye, 2005) and the steel manufacturing industry in India (Basha & Maiti, 2013).

Cox and Cheyne (2000) were responsible for the “Safety Climate Assessment Toolkit” that was constructed with the partnership between organisations from the UK and the Gulf of Mexico. This tool was initially intended for the UK oil and gas industry, mainly the offshore sectors in the North Sea under the health and safety executive research projects. This toolkit is a multi-methods approach which consists of not only a survey but also informal discussions with individuals, focus groups, document analysis and finally an examination of safety-related records and database. Furthermore, the survey encompasses nine dimensions namely management commitment, communication, the priority of safety, safety rules and procedures, supportive environment, involvement, personal priorities and need for safety, personal appreciation of risk, and work environment. The advantage of this toolkit is that it retrieves safety perception data through both quantitative and qualitative methods, which can provide a more holistic analysis. With continuous research, this instrument was also applicable to the car manufacturing industry in the UK (Clarke, 2006b) and the construction industry in Australia (Mohamed, 2002).

Neal et al. (2000) established a 16 items organisational safety climate (OSC) that includes four dimensions namely management values, safety communication, safety training, and safety systems. OSC was initially created for the healthcare sector in Australia, but it was also utilised for other high-risk industries within the country (Colley, Lincolne, & Neal, 2013). Similarly, this instrument was found appropriate in the manufacturing sector (Probst, 2004) and multi-sectors in the USA (Probst, 2015; Probst & Estrada, 2010).

Kines et al. (2011) developed a questionnaire for measuring safety climate applicable across Nordic countries specifically Denmark, Finland, Iceland, Norway

and Sweden. This tool is known as Nordic Safety Climate Questionnaire (NOSACQ-50) consisting of 50 items covering dimensions based on organisational and safety climate theory, psychological theory, previous empirical research, and empirical results acquired through a developmental process. After four separate studies, the final seven dimensions of safety climate are namely management safety priority, commitment and competence; management safety empowerment; management safety justice; shared perception of worker's safety commitment; worker's safety priority and risk non-acceptance; safety communication, learning, and trust in co-workers' safety competence; and workers' trust in the efficacy of safety systems. This study has developed a reliable and valid psychometric safety climate instruments which are applicable on a large scale for the organisation to explore current safety status.

Additionally, the extensive coverage of this safety climate tool is multi-level, multi-faceted and in-depth perspective with theoretical and practical foundation. Since the development of NOSACQ-50 in 2011, the instrument has proven potential to be generalised to other nations and industrial context. For example, NOSACQ-50 was used in the chemical manufacturing industry in Sweden (Bergh, Shahriari, & Kines, 2013) and also across multiple sectors in Denmark (Ajslev et al., 2017). NOSACQ-50 usage in research outside of Nordic countries include various industries in Indonesia (Sutalaksana et al., 2016) and Iran (Yousefi et al., 2016), agriculture-based industries in Malaysia (Arifin, Abudin, Razman, & Ismail, 2017), port inspectors in Iran (Givvehchi, Hemmativaghef, & Hoveidi, 2017), construction industry in Australia (Nadhim, Hon, Xia, Stewart, & Fang, 2018). Furthermore, this instrument is available in more than 30 languages with continuous contributions to their database from other researchers globally (Det Nationale Forskningscenter for Arbejdsmiljø, 2018).

1.2.5.2 Tailored safety climate instruments.

Take into consideration contextual differences and cultural variations among organisations; there is no “one size fits all” diagnostic instruments. Therefore, this fuels the demand for tailored instruments considering national-context, industrial-context, organisational-context or any other local context unique for that organisation. This section will review 14 safety climate instruments that tailored to a specific culture or industry of the country.

From table 1, even within the same industry, there is still a variation on safety climate dimensions for different countries. For instance, in the manufacturing industry depending on the product that was being produced and if it was from developed countries such as Denmark and USA or developing countries such as Iran, China, India, and Singapore, the safety climate dimensions also vary. Despite these variations, these tailored instruments possessed at least one or more of the common themes namely management, safety system, risk, work pressure, competence, procedures and rules typically found in safety climate scales (Flin et al., 2000).

Table 1

Summary of tailored safety climate instruments

Research Team	Year	Article	Safety Climate Instrument	Industry	SC dimensions	Country	N
Chen, W. T., Liu, S.-S., Liou, S.-W., & Sun, W. Z	2012	Discrepancies between management and labor perceptions of construction site safety	Construction Staff Safety Climate Awareness Survey	construction	1) safety attitude 2) safety training and policies 3) risk decision-making 4) commitment and communication 5) assist fellow peers	Taiwan	335
Choudhry, R. M., Dongping, F., & Lingard, H	2009	Measuring Safety Climate of a Construction Company	no given name	construction	1) management commitment and employee involvement 2) inappropriate safety procedure and work practices	Hong Kong	1120
Fung, I. W. H., Tam, V. W. Y., Sing, C. P., Tang, K. K. W., & Ogunlana, S. O.	2016	Psychological climate in occupational safety and health: The safety awareness of construction workers in South China	psychological safety climate	construction	1) social influence 2) physical working environment 3) negative affectivity 4) perceived usefulness of safety measures 5) degree of safety awareness	China (South)	316
Nkhungulu, C. F.	2014	Explanatory model of antecedents and outcomes of health and safety climate in the South African construction industry	Health & Safety Climate (H & S)	construction	1) management commitment 2) H&S supervisory leadership 3) H&S management systems 4) H&S communication 5) toolbox talks 6) H&S training 7) team H&S 8) individual H&S responsibility	South Africa	851
Singer, S., Meterko, M., Baker, L., Gaba, D., Falwell, A., & Rosen, A	2007	Workforce perceptions of hospital safety culture: Development and validation of the patient safety climate in healthcare organizations survey	Patient safety climate in healthcare organisations (PSCHO)	Healthcare	1) senior managers' engagement 2) organisational resources for safety 3) overall emphasis on safety 4) unit safety norms 5) unit recognition and support for safety efforts 6) fear of shame 7) provision of safe care 8) learning 9) fear of blame	USA	21496

Table 1 (cont'd)

Summary of tailored safety climate instruments

Research Team	Year	Article	Safety Climate Instrument	Industry	SC dimensions	Country	N
Huang, Y.-h., Zohar, D., Robertson, M. M., Garabet, A., Lee, J., & Murphy, L. A	2013	Development and validation of safety climate scales for lone workers using truck drivers as exemplar.	Safety Climate Scales for lone workers	Lone workers (Truck Drivers)	<u>Organisation-Level:</u> 1) proactive practices 2) driver safety priority 3) supervisory care promotion <u>Group-Level:</u> 1) safety promotion 2) delivery limits 3) cell phone disapproval	USA	7466
Ghahramani, A., & Khalkhali, H. R.	2015	Development and validation of a safety climate scale for manufacturing industry	Iranian Safety Climate Scale	manufacturing	1) safety commitment and communication 2) safety involvement and training 3) positive safety practices 4) safety competency 5) safety procedures 6) accountability and responsibility 7) supportive environment	Iran	269
Liu, X., Huang, G., Huang, H., Wang, S., Xiao, Y., & Chen, W	2015	Safety climate, safety behavior, and worker injuries in the Chinese manufacturing industry	Occupational safety climate	manufacturing	1) management commitment 2) safety supervision 3) coworker support 4) safety training	China (south)	3375
Vinodkumar, M. N., & Bhasi, M	2009	Safety climate factors and its relationship with accidents and personal attributes in the chemical industry	no given name	manufacturing (chemical)	1) management commitment and actions for safety 2) workers' knowledge and compliance to safety 3) workers' attitudes towards safety 4) workers' participation and commitment to safety 5) safeness of work environment 6) emergency preparedness in the organisation 7) priority for safety over production 8) risk justification	India	1806

Table 1 (cont'd)

Summary of tailored safety climate instruments

Research Team	Year	Article	Safety Climate Instrument	Industry	SC dimensions	Country	N
Nielsen, K. J., Rasmussen, K., Glasscock, D., & Spangenberg, S	2008	Changes in safety climate and accidents at two identical manufacturing plants	Danish Safety Culture Questionnaire (DSCQ)	manufacturing (turbine blades)	1) immediate supervisor general leadership 2) immediate supervisor safety leadership 3) safety instruction 4) convenience violations 5) safety oversights 6) commitment to the workplace	Denmark	501
Seo, D.-C., Torabi, M. R., Blair, E. H., & Ellis, N. T.	2004	A cross-validation of safety climate scale using confirmatory factor analytic approach	no given name	manufacturing (grain production)	1) management commitment 2) supervisor support 3) coworker support 4) employee participation 5) competence level	USA	722
Wong, D. B., & Lee, S. G.	2016	Modelling the predictors of intention in workplace safety compliance of a multi-ethnic workforce.	no given name	manufacturing (steel fabrication yard)	1) attitude toward safety behaviour 2) subjective norms 3) perceived behavioural control 4) intention	Singapore	341
Hahn, S. E., & Murphy, L. R.	2008	A short scale for measuring safety climate	Global Work Safety Climate (short scale)	multi-sector (health care, nuclear energy plant)	1) management commitment 2) safety performance feedback 3) worker involvement 4) safety behaviour norms	USA	3657
Lin, S.-H., Tang, W.-J., Miao, J.-Y., Wang, Z.-M., & Wang, P.-X.	2008	Safety climate measurement at workplace in China: A validity and reliability assessment	General Safety Climate Assessment	multi-sectors (mainly production)	1) safety awareness and competency 2) safety communication 3) organisational environment 4) management support 5) risk judgement 6) safety precautions 7) safety training	China (South East)	1026

After reviewing this mix of safety climate instruments, this study has decided to use the NOSACQ-50 due to the strong theoretical and empirical support. Besides, the safety climate instrument has been used in both eastern and western countries across multi-industries. Therefore, NOSACQ-50 possessed high compatibility for the employees from the manufacturing sector in Singapore.

1.3 Injuries

In the field of occupational safety and health (OSH), it is commonly associated with injuries (Hofmann et al., 2017). Safety-related outcomes can be classified as leading or lagging indicators. Leading safety indicators are a factor that surface prior to adverse events which provide tell-tale signs, and lagging safety indicators is the adverse events itself. Examples of leading indicators include employee safety perception survey which can be measured by safety climate instrument and the reporting of near-misses or unsafe behaviour. Examples of lagging indicators include fatalities, injuries resulting in first-aid or absence from work, number of industrial fines and worker's compensation claims (De Cieri, Shea, Pettit, & Clarke, 2012).

Injuries were associated with an employee's lack of influence within their job scope and developing a sense of distrust for labourers and tradesperson/apprentices (Barling, Kelloway, & Iverson, 2003a). From the work-life interface perspective, study shows that individuals who were injured at work reported financial difficulties, affecting their presence of meaning in life and influences on the quality and satisfaction of relationship with their loved ones (McEvoy, 2016). Apart from work and life-related impact due to workplace injuries, Malt et al. (1993) found that among employees who experienced workplace accidents, one-third of them described acute psychophysiological stress responses such as heartbeat, tremor, restlessness, and shaking or trembling. Within a day of the workplace accident, employees experienced sleep disturbances which are classified as a common stress symptom. Other symptoms reported include visualising the image of accident recurring, experiencing waves of strong emotions, and repetitive recalling of the accident (Vatshelle & Moen, 1997). Other adverse psychological outcomes, or abnormal metabolic syndrome (Magnavita, 2015) can be experienced in employees of SCO who encounter severe workplace injuries such as electrical burns (Mancusi-Ungaro, Tarbox, & Wainwright, 1986), major

workplace accidents such as explosion (Weisæth, 1989), work-related brain injury (Colantonio et al., 2016), and post-traumatic stress disorder (PTSD) (Yum et al., 2006).

We have seen in section 1.2 that safety climate varies across different occupational groups in the same organisation. The presence of microclimates illustrates the importance of the role of a workgroup in terms of work moral and safety functioning, especially when someone in the team gets injured due to a workplace accident, affecting the other team members (Lawler & Finegold, 2000). Therefore, group-level has a critical influence on the willingness and ability of members to learn, seek feedback and assistance, share information and open communication on safety mistakes (Edmondson, 1999). Furthermore, when employees in an organisation are injured and absent from work or when a major industrial accident occurs, it will negatively impact the safety performance indicator. The safety deficiency may result in psychological and monetary compensation for the organisations due to loss of lives, mandatory stop work notice, the negative reputation of the organisation (B. K. Chia, 2014) (Chia, 2014; CSB, 2005, 2010; EPA/OSHA, 1998; Koh, 2004). Given that the review has provided strong support for individual workplace injuries as a negative safety outcome, the following hypothesis is formed:

Hypothesis 1c: EWB will be negatively associated with individual workplace injuries for the Singapore sample in the manufacturing sector.

1.3.1 Measurement of injuries.

For this study, the safety outcome will be examining non-fatal workplace injuries. Despite injuries being known as a lagging indicator of safety outcomes, it is the most concrete consequences for safety deficiency (Zohar, 2014). Injury measurement is a more common international benchmark that can provide policymakers with tangible justification from the organisation, political or even global levels. However, the definition of an injury can be relatively vague and challenging depending on the adopted measurement (Langley & Brenner, 2004). In this section, we will review how the injury is operationalised in the field of safety and some potential issues regarding the method of operationalisation.

As per the review, Table 3 tabulated the nine common forms of injury operationalisations and they are frequency or injury occurrence, general questioning on injuries with or without criteria, a combination of minor injuries, moderate, severe and near-miss reporting, government legislation, LTFR, and micro-accidents. Furthermore, the approach to injury operationalisation is not restricted to an industry or country.

Table 2

Summary of types of injury operationalisation and recall duration

Types of Injury operationalisation	Description	Scale	Country	Industry	Recall duration (months)	Reference
Frequency of Occurrence	How often workers reported job injuries in your current workplace? (with or without examples of injuries)	5 points scale	USA	Carpentry	12	Lipscomb, Schoenfisch, & Cameron, 2015
			USA	Multi-sectors	3	Tucker, Ogunfowora, & Ehr, 2016
			Canada	F & B	12	Barling, Loughlin, & Kelloway, 2002
General (a)	i) Have you ever been injured in your current company? ii) How many times have you been injured in your current company?	yes/ no number count	Denmark	Multi-sectors	12	Ajslev, Dastjerdi, Dyreborg, Kines, Jeschke, Sundstrup, Jakobsen, Fallentin, Andersen, 2017
			USA	Multi-sectors	for as long as one has worked in the company (less than 1 year to 10years)	Huang, Ho, Smith, & Chen, 2006
			USA	F & B	3	Huang, Verma, Chang, Courtney, Lombardi, Brennan, & Perry, 2012
General (b)	How many times have you been injured in your current company? (with criteria of number of days off work)	number count	Australia	Multi-sectors	12	Barling, Kelloway, & Iverson, 2003
			India	Steel Plant	did not explicitly mention	Basha, & Maiti, 2013
			Spain	Multi-sectors	12	López-Ruiz, Martínez, Gil, Boix, García, Rodrigo, Moreno, Benavides, 2013
			Japan	Healthcare	12	Smith, Mihashi, Adachi, Shouyama, Mouri, Ishibashi, & Ishitake, 2009

Table 2 (cont'd)

Summary of types of injury operationalisation and recall duration

Types of Injury operationalisation	Description	Scale	Country	Industry	Recall duration (months)	Reference
Minor Injuries	Reportable and/ or non-reportable	number count	Canada	Multi-sectors	1	Pek, Turner, Tucker, Kelloway, & Morrish, 2017
Severe/ Moderate injuries	Reportable and/ or non-reportable	number count	China	Manufacturing	12	Liu, Huang, Huang, Wang, Xiao, & Chen, 2015
Severe/ Moderate/ Minor injuries	Reportable and/ or non-reportable	number count	Malaysia	Construction	12	Zerguine, Tamrin, & Jalaludin, 2018
Severe/ Moderate/ Minor injuries + near miss	Reportable and/ or non-reportable	number count	USA	Multi-sectors	12	Hayes, Perander, Smecko, & Trask, 1998
			UK	Offshore Oil and Gas	24	Flin, Mearns, Gordon, & Fleming, 1996
Government legislation standards	Reportable	number count	Multi-national	Multi-sectors	16.20 ± 8.97	Beus, Payne, Bergman, & Arthur Jr, 2010
			USA	Multi-sectors	12	Deborah, & Hendricks, 1995
Lost Time Frequency Rate, LTFR	Reportable	number of lost time/ total hours worked	Canada	Manufacturing	24	Geldart, Smith, Shannon, & Lohfeld, 2010
Micro-accidents	Behaviour base injuries verified by medical professionals	number count	Isarel	Metal Processing	data taken 5/ 6 months after survey	Zohar, 2000; 2002
			Isarel	Millitary	data taken 6 months after survey	Zohar, & Luria, 2004

Additionally, the usage for a wide range of injuries does result in the strength of sample weighted effect size for safety climate and injury correlation, but the strength does not equate to significance (Beus et al., 2010). Hence in this study, injuries will be operationalised using OSHA standard definition of severe (major) and minor injuries which is also adopted by WSH in Singapore.

1.3.2 Potential issues.

There are several known issues when dealing with self-reported injuries regardless of from the employee themselves or through medical professionals. This section will review common issues such as under-reporting, recall duration, cultural influence, and other potential side effects.

1.3.2.1 Under-reporting.

When records were verified with alternative sources, injuries tend to be underreported by between 33% to 69% (Leigh, Marcin, & Miller, 2004). For an American sample, Probst and Estrada (2010) indicate that in poor safety climate there are three unreported accidents for every one reported the accident and the ratio reduces by half when organisation safety climate is perceived to be healthy. Similarly, Probst (2015) also found that stronger supervisory enforcement leads to lesser reported and unreported accidents, while low supervisory enforcement results in higher reported and unreported accidents. On the contrary, safety climate survey in Malaysia found that more than 80% of the employees in the construction industry indicated that they did report their injuries to their organisations (Zerguine, Tamrin, & Jalaludin, 2018). This suggests that the reporting pattern may be culturally influenced.

Injured-related indicators of performance are usually tied in with monetary rewards for employees which can influence under-reporting of accident and injury and in-return, victims may experience incivility as a result of “contributing” to the LTFR or “breaking” the safe man-hours record (Zwetsloot et al., 2017). Other reasons for underreporting include a lack of management safety justice (Lipscomb et al., 2015) or poor reporting attitudes as a result of past negative consequences of reporting an injury (Probst & Graso, 2013). The review above illustrates how underreporting can influence safety climate perception. Hence the author proposes

that EWB and injuries may follow similar fashion which gives rise to the following hypotheses:

Hypothesis 3b: Minor individual workplace injuries will be positively associated with major individual workplace injuries for the Singapore sample in the manufacturing sector.

Hypothesis 1d: EWB will be better for employees who report injuries than not reporting injuries for the Singapore sample in the manufacturing sector.

Hypothesis 2d: Safety Climate will be better for employees who report injuries than not reporting injuries for the Singapore sample in the manufacturing sector.

Hypothesis 3c: Individual workplace injuries will be lesser for employees who report injuries than not reporting injuries for the Singapore sample in the manufacturing sector.

1.3.2.2 Recall ability.

The ability to recall an injury is another possible variance in self-reported injuries. From Table 3, the injury recall duration of safety-related research ranges from as little as one month to as long as two years. Due to the frequency of injury occurrence in the course of work, it is desirable for researchers to collect as many data as possible, which means extending the recall duration. Moreover, the biases of an individual's memory also influence the perception of an event and negative events such as a personal injury usually prevail the positive ones (Kahneman & Tversky, 1979). Although the majority of people will be able to recall if they ever got injured within a 12 months' timeframe, only slightly more than half of the population remembers the detail of diagnosis. This trend suggests that the ability and accuracy of recall may potentially contribute to underreporting and that consideration has to be taken when setting the recall duration (Gabbe, Finch, Bennell, & Wajswelner, 2003).

Deborah and Hendricks (1995) investigated how certain demographic groups and injury severity affect recall ability. The study shows that employees between the age of 18 to 24 years old have the largest underreporting, while older employees above age 55 years old have the least underreporting. Besides, low severity injuries

that do not involve time off work were highly underreported as compared to high severity injuries that require time off work. Furthermore, for the high severity injuries, the age group between 18 to 24 years old displayed the greatest underreporting. Studies illustrate that safety climate predicts the most severe workplace injury over the shortest period, which is approximately three months. The reverse is also valid when the severity of workplace injury increases, the time frame of predictability reduces (Bergman, Payne, Taylor, & Beus, 2014). Likewise results from a meta-analysis show that the length of time moderated the association between safety climate and injury, which is responsible for 39% of the variance. This study proposes that the predictive value of safety climate to workplace injuries reduces as the recall duration increases (Beus et al., 2010). The typical 12 months recall period may need to be revised to a shorter duration for better accuracy. However, the organisation also needs to balance the necessity and additional cost incurred as reduced recall period suggests more frequent survey follow-up and more participation.

1.3.2.3 Other side effects.

Webb, Redman, Wilkinson, and Sanson-Fisher (1989) advocates that there are six levels of filter model for reporting a workplace injury. From the moment when an injury occurs at the worksite and eventually gets reported to the company involves several sequential steps. At level 1 which is the total injury rate in the workplace, it can be influenced by severity, symptoms, and attitudes of co-workers. Level 2 is how an employee defines injury which can be influenced by the proximity of medical assistance or safety attitude and consequences of reporting. For level 3, the supervisor's definition of injury also influences the additional workload on completing an accident report, as well as acting as a communication link between medical staff and top management, and other individuals involved. Next two levels will be at the organisational level, where level 4 is how the medical centre defines the injury, and level 5 is how the organisation define injury. These two levels can be influenced by administrative support of safety office, safety competency, organisation worker's compensation policy, union involvement and government legislation. Lastly, level 6 encompasses how the government on a national level classifies workplace injury which leads to government agencies being accountable

for their actions, compiling injury data, and conducting due diligence on monitoring and enacting of safety rules and regulation.

Therefore, at each stage, multiple potential variables can interfere with the reporting process and the outcome. For instance even at the medical centre, how a professional doctor evaluates an injury and determine if the injury requires days off work is also subjective (Cryer, Langley, Stephenson, Jarvis, & Edwards, 2002). Hence, to minimise potential issues with conventional self-reported injuries, a variety of the injury operationalisation was conceptualised such as obtaining medical records, including near-miss data and using compilations of injury records.

1.4 Demographic Influences

Demographics are easily available to an organisation, yet it is not always incorporated in organisation analysis. Fortunately, demographics are commonly collected during research and much analysis have been conducted and association with EWB, safety climate and injuries is present. This section will review several demographics that is relevant to this study namely working hours, tenure, age, job location and job classification.

1.4.1 Working hours.

The relationship between the number of working hours and well-being status is positively associated, meaning the more hours worked, the better the well-being. However, this association is non-linear, once the hours worked exceeds a certain threshold, the well-being of an individual will start to decline. Furthermore, the threshold is dependent on multiple variables, and there is no universal benchmark (Jeffrey et al., 2014). Certain industries have atypical working hours, such as being on a rotating shift where EWB is already inherently affected negatively (Caza & Wrzesniewski, 2012). For instance, in the manufacturing sector, the frontline operation staff are required to be on 8 hours or 12 hours rotating shift, which makes them more susceptible to lower well-being. Hence it is even more critical for relevant organisations to step up in fostering tailored EWB interventions, as these frontline employees are critical to the organisation's process functions and safety. Besides, culture may be another contributing factor to the number of working hours as Lu and Chou (2017) reviewed that working hours are reported to be longer in eastern cultures as compared to western cultures.

Nevertheless, the amount of job-related stress resulting in anxiety, workplace injuries, turnover and burnout is equally alarming in Japan and the United States (Ruderman, Clerkin, & Deal, 2017). The review above illustrates how working hours are associated with EWB, and considering how EWB is associated with safety climate and workplace injuries in the previous section the author proposes that safety climate and workplace injuries will follow similar fashion which gives rise to the following hypotheses:

Hypothesis 1e: Working hours will be negatively associated with EWB for the Singapore sample in the manufacturing sector.

Hypothesis 2e: Working hours will be negatively associated with safety climate for the Singapore sample in the manufacturing sector.

Hypothesis 3d: Working hours will be positively associated with individual workplace injuries for the Singapore sample in the manufacturing sector.

1.4.2 Tenure.

The influence of tenure on safety perception and safety-related outcomes is commonly being studied, but results seem to be inconclusive. For instance, in a production plant, the demographic evaluation shows that seniority in the incremental group of 5 years each is significantly associated with safety climate perception. Likewise, Vinodkumar and Bhasi (2009) reported that employees with 11 to 20 years of work experience have the lowest safety climate perception. This tendency of middle-aged employees with average work experience becoming more prone to accidents is also supported by Castillo-Rosa, Suárez-Cebador, Rubio-Romero, and Aguado (2017). Conversely, some studies indicate that age and working experience is not statistically significant when correlated with accident rates and safety perception (Basha & Maiti, 2013; Stoilkovska et al., 2015). Despite the mixed research findings, the evidence does illustrate signs of the influence of tenure for safety perception and injuries which suggests that EWB may exhibit similar influence; hence, the following hypotheses were devised:

Hypothesis 1f: EWB will be poorer for short tenure group than long tenure group for the Singapore sample in the manufacturing sector.

Hypothesis 2f: Safety Climate will be poorer for short tenure group than long tenure group for the Singapore sample in the manufacturing sector.

Hypothesis 3e: Individual workplace injuries will be more for short tenure group than long tenure group for the Singapore sample in the manufacturing sector.

1.4.3 Age.

One of the common demographics being analysed with well-being is age. For instances, eudaimonic well-being and age display a U trend with high well-being starting between age 18-25, gradually reducing and the lowest well-being is between age 36-55 before it gradually increases until it arrived at the highest well-being peak at age 66-75 (Cummins, 2013). Coincidentally, people aged between 36 to 55 years old are the main bulk of the workforce and results indicating that the lowest well-being score can be daunting for employees and employers. Correspondingly, for hedonic well-being in relation with age, López Ulloa, Møller, and Sousa-Poza (2013) reviewed that majority of the research found similar U trend, even after controlling for cohort effect and other medical prescription, the lowest well-being falls between the age range specified that of eudaimonic well-being. Likewise, the work-related well-being of older employees reported better wellness than younger employees. Even in a non-western sample like Singapore (Kathirasan, 2015) and Taiwan (Lin, Cheng, & Wang, 2014), studies also display similar U trend when associating age and well-being. Therefore, although employees can work on their well-being, employers need to be more proactive in raising the well-being profile of their employees while tailoring to their age.

Regards to age and safety climate Cooper and Phillips (2004) found that older workers perceived more positive effects on behavioural safety interventions as compared to younger workers. Similarly, Vinodkumar and Bhasi (2009) reported that with increasing age, safety climate perception first reduces then followed with an increasing trend. Although age and injuries were not explicitly research in Singapore, national statistics show that workers above 55 years old have higher injury rates (WSH, 2018). Nevertheless, the majority of prior evidence mentioned suggests that age does influence EWB, safety climate, and workplace injuries which give rise to the following hypothesis:

Hypothesis 1g: EWB will be poorer for young age group than old age group for the Singapore sample in the manufacturing sector.

Hypothesis 2g: Safety Climate will be poorer for young age group than old age group for the Singapore sample in the manufacturing sector.

Hypothesis 3f: Individual workplace injuries will be more for young age group than old age group for the Singapore sample in the manufacturing sector.

1.4.4 Location.

Regardless of being a developed or developing country, presence of industries that operate with complex systems that require tight-knit collaboration of technical and human aspects exist (Perrow, 1984). With either side of the aspect failure, it will cause catastrophic outcomes not only to the organisation but also to the surrounding communities, and shockwaves may even spread to the national level (Murphy, Robertson, & Carayon, 2014). Therefore, the safety climate of the manufacturing sector is especially crucial for a densely populated country like Singapore (Yuen, 2004). Basha and Maiti (2013) show that the work location influence employee's job-risk perception and even organisations in the same sector operating within proximity of each other have significantly different safety climate perceptions (Vinodkumar & Bhasi, 2009). Hence, it is in the effort of a higher governing body such as the government to create opportunities for organisations of similar nature to interact and share safety experiences as an effort to promote industry best practices (Navaratnam, 2011). Globally, developed and developing countries can also learn from one another in common industry best practices since national culture is shown to influence safety climate and safety-related outcomes (Mearns & Yule, 2009). Meanwhile, the prior evidence mentioned suggests that safety climate is closely associated with work location and knowing the relationship between EWB, safety climate and injuries, the following hypotheses were formulated:

Hypothesis 1h: EWB will be poorer for employees working on Jurong Island than on mainland for the Singapore sample in the manufacturing sector.

Hypothesis 2h: Safety climate will be poorer for employees working on Jurong Island than on mainland for the Singapore sample in the manufacturing sector.

Hypothesis 3g: Individual workplace injuries will be more for employees working on Jurong Island than on mainland for the Singapore sample in the manufacturing sector.

1.4.5 Job classification.

From an employee's perspective, it is beneficial to evaluate the self-perception of work environment safety. Safety climate survey allows an individual to be introspective, and potentially generate ideas for improvement such as safety motivation, behaviour, compliance or participation (Neal & Griffin, 2006). An employee can further highlight these with team members during safety meetings or supervisors during a performance review. For example, employees in SCOs who indicate more sleep and health issues needs to be aware that it will affect other safety outcomes. Therefore, for those that have lower safety climate score especially for shift workers, interventions can be done by the individual or by the organisation to assist the situation (Morten Birkeland Nielsen, Hystad, & Eid, 2016).

Shift workers are commonly frontline workers of the revenue generating units. More often than not they are subjected to significant pressure to improve production rate, product quality, and production schedule. This form of pressure commonly leads to unsafe practices such as taking short-cuts, compromising safety rules and regulations which eventually results in injuries and fatalities (Wright, 1986). When a worker is faced with competing demands from production and safety aspects, this situation results in a mental strain. This mental strain will reduce one's control of decision making which subsequently causes errors on the job that includes adverse safety outcomes (Karasek, 1979). Kvalheim and Dahl (2016) found that work pressure is negatively related to safety compliance and accounts for 9% of the variance in safety climate across seven years and consistently within four timeframes. In addition, Man et al. (2017) indicate that work pressure resulting in risk-taking behaviours can be due to internal factors and external factors and they found that work schedule accounted for more than 50% of external factors as a reason for taking risks at the workplace. Hence this gives rise to the following hypotheses:

Hypothesis 1i: EWB will be poorer for shift workers than non-shift workers for the Singapore sample in the manufacturing sector.

Hypothesis 2i: Safety climate will be poorer for shift workers than non-shift workers for the Singapore sample in the manufacturing sector.

Hypothesis 3h: Individual workplace injuries will be more for shift workers than non-shift workers for the Singapore sample in the manufacturing sector.

1.5 Summary of Hypotheses

Hypothesis 1a: EWB will be positively associated with safety climate for the Singapore sample in the manufacturing sector.

Hypothesis 1b: EWB will be better for management employees than non-management employees for the Singapore sample in the manufacturing sector.

Hypothesis 1c: EWB will be negatively associated with individual workplace injuries for the Singapore sample in the manufacturing sector.

Hypothesis 1d: EWB will be better for employees who report injuries than not reporting injuries for Singapore sample in the manufacturing sector.

Hypothesis 1e: Working hours will be negatively associated with EWB for the Singapore sample in the manufacturing sector.

Hypothesis 1f: EWB will be poorer for short tenure group than long tenure group for the Singapore sample in the manufacturing sector.

Hypothesis 1g: EWB will be poorer for young age group than old age group for the Singapore sample in the manufacturing sector.

Hypothesis 1h: EWB will be poorer for employees working on Jurong Island than on mainland for the Singapore sample in the manufacturing sector.

Hypothesis 1i: EWB will be poorer for shift workers than non-shift workers for the Singapore sample in the manufacturing sector.

Hypothesis 2a: Safety Climate will mediate the relationship between EWB and individual workplace injuries.

Hypothesis 2b: Safety Climate will be negatively associated with individual workplace injuries for the Singapore sample in the manufacturing sector.

Hypothesis 2c: Safety Climate will be better for management employees than non-management employees for the Singapore sample in the manufacturing sector.

Hypothesis 2d: Safety Climate will be better for employees who report injuries than not reporting injuries for the Singapore sample in the manufacturing sector.

Hypothesis 2e: Working hours will be negatively associated with safety climate for the Singapore sample in the manufacturing sector.

Hypothesis 2f: Safety Climate will be poorer for short tenure group than long tenure group for the Singapore sample in the manufacturing sector.

Hypothesis 2g: Safety Climate will be poorer for young age group than old age group for the Singapore sample in the manufacturing sector.

Hypothesis 2h: Safety Climate will be poorer for employees working on Jurong Island than on mainland for the Singapore sample in the manufacturing sector.

Hypothesis 2i: Safety Climate will be poorer for shift workers than non-shift workers for the Singapore sample in the manufacturing sector.

Hypothesis 3a: Individual workplace injuries will be lesser for management employees than non-management employees for the Singapore sample in the manufacturing sector.

Hypothesis 3b: Minor individual workplace injuries will be positively associated with major individual workplace injuries for the Singapore sample in the manufacturing sector.

Hypothesis 3c: Individual workplace injuries will be lesser for employees who report injuries than not reporting injuries for the Singapore sample in the manufacturing sector.

Hypothesis 3d: Working hours will be positively associated with individual workplace injuries for the Singapore sample in the manufacturing sector.

Hypothesis 3e: Individual workplace injuries will be more for short tenure group than long tenure group for the Singapore sample in the manufacturing sector.

Hypothesis 3f: Individual workplace injuries will be more for young age group than old age group for the Singapore sample in the manufacturing sector.

Hypothesis 3g: Individual workplace injuries will be more for employees working on Jurong Island than on mainland for the Singapore sample in the manufacturing sector.

Hypothesis 3h: Individual workplace injuries will be more for shift workers than non-shift workers for the Singapore sample in the manufacturing sector.

Chapter Two: Cultural Influence & Singapore

Perceptions are never value-free, they are somehow value-bound, and these values are influenced by our culture (Suh, Diener, Oishi, & Triandis, 1998). Thus, the influence of culture on perceptions for work-related well-being is also inevitable. Foundations of well-being research mainly initiated by white people in western culture. Due to globalisation, there is more cultural diversity which leads to the interest of EWB in a non-western culture. Cross-culture studies allow theories, models, mixed methods research to be tested for transferability and generalisation to other population of interest. Furthermore, this study is conducted in Singapore which represents an Asian culture. Hence, in this chapter the author will review the influences of culture on well-being and safety climate perception; background of Singapore and the relevant EWB, safety climate and workplace injuries research.

2.1 Cultural Perception of Well-Being

Research done in Singapore shows an increase in well-being as income rises (Kathirasan, 2015). However, Diener and Oishi (2000) show that income demonstrates a positive association with a dimension of subjective well-being that is life satisfaction but not the overall subjective well-being. Similarly, Diener, Tay, and Oishi (2013) examined the periods of 2005 to 2011 internationally, and results show that over the years increase in income positively influence the perception of various aspects such as optimism, financial satisfaction and material prosperity which leads to the rise of subjective well-being. However, higher income does not necessarily associate with higher subjective well-being as there may be other possible mediators.

With regards to well-being instruments, researchers used well-being measures developed in western country to test the validity in non-western sample such as Hong Kong (Cheng & Chan, 2005) and found that three dimensions namely autonomy, personal growth and self-acceptance out of Ryff's six-dimensional model of psychological well-being was marginally loaded which indicates that alteration is necessary for a Chinese population. The collective nature of Chinese population influenced their perception of well-being where one's well-being comes from the satisfying others instead of themselves, even if it requires them to withstand adverse

life and work conditions (Diener, 2000). The research found that both employers and employees in China are more adherent towards Confucian values which emphasise on self-cultivation through five virtues namely benevolence, respecting righteousness, appreciate interactions with others, gaining wisdom and being faithful. The Chinese concept is known for their collective orientation where maintaining a harmonious and reciprocal relationship with your supervisor, group members, extended co-workers and customers are more prominent as compared to the individualistic nature of western culture (Zhao & Roper, 2011). This conceptualisation of eastern culture may not be fully applicable to countries outside China, but it maybe relatable to countries in Asia where people are of a Chinese descendant such as Taiwan and Singapore or are influenced by Confucian teachings such as Japan, Korea and Vietnam (Lu & Chou, 2017).

2.2 Cultural Perception of Safety Climate

The relationship established between safety climate and safety-related outcomes appears to be mostly univocal across different countries representing various cultures. For instance, safety climate was negatively associated with workplace injuries and was found significant in USA (Hayes et al., 1998), Denmark (Nielsen et al., 2008), Iran (Zohar, 2000) and Japan (Smith et al., 2009). Among the safety climate dimensions, management-related dimensions are known to be highly correlated to safety climate in developing (Smith et al., 2009; Zohar, 1980) and developed countries (Lipscomb et al., 2015; Tucker et al., 2016). On the broad term, the association is valid but there some cultural elements influencing the responses to the dimensions of safety climate and safety-related outcomes. Two prevalent factors are management practices and behaviour which will be reviewed in this section.

2.2.1 Management practices.

As seen in 1.2.3.1, management-related features have a significant contribution as a dimension in safety climate and are usually one of the most influential dimensions that are associated with safety-related outcomes. However, different cultures have shown different emphasis on management practices concerning safety outcomes. Management practices itself is a broad term outlining the framework of an organisation, and a standard aspect will be human resource (HR) practices. Generally, HR practices can be classified into hiring and selection, incentives and rewards, training and development, communication and feedback, employee

participation, management commitment, performance evaluation, and welfare benefits.

To test the difference in HR practices in the construction industry in the USA and Singapore, Lai, Liu, and Ling (2011) examined how cultural difference contributes the safety-related outcomes. Firstly, results indicated a significant difference in HR practices between both countries. The dissimilarities are that US organisation placed significantly more attention on organisational values and employee's experience as compared to Singapore organisation, and the adoption of buddy system which is to work in pairs is more prevalent in the USA despite being correlated to more frequent workplace accidents. Nevertheless, there are also similarities within HR practices such as using behavioural based questions during the hiring and selection process, giving out incentives base on employee performance and punishing an employee who violates safety regulations at the workplace, scope of safety training, a system for communication, feedback and participation.

The component of training exists from the first safety climate instrument (Zohar, 1980) which have evolved into terms such as safety competence, safety knowledge and safety compliance or variations of the three terms. This training component or its affiliates are also commonly found in safety climate dimensions which are also attributed to the presence of safety training (Flin et al., 2000; Kvalheim & Dahl, 2016). Research has shown that culture may also play a part in the effectiveness of training method, training materials and feedback channel available for workers regarding knowledge acquisition and performance (Hwang, Francesco, & Kessler, 2003). In today's industrialisation, it is common for organisations to be international and culturally diverse. Due to other concerns of operation cost, labour cost, commercial demands or national standard for safety legislation, an organisation may have multiple production sites globally regardless of developed countries or developing countries, with centralised or decentralised management from headquarters (HQ) (Mearns & Yule, 2009). For example, an MNC with training materials and trainer who comes from the HQ may come from a western country, but these resources are applied in the Asian context, on Asian employees; the outcome of the training may vary due to cultural difference. The

cultural aspect is an essential factor for the organisation's consideration when providing safety training and safety feedback.

From the review, it shows that not all management system utilised in western countries is transferable to other countries. The organisation should take note of cultural influence on HR practices, job characteristics and personal values when dealing with management-related areas regardless if it is distal or proximal. Overall, the responsibility lies in the organisation to emphasise cross-cultural implications regarding safety management.

2.2.2 Behaviour.

National cultures can influence safety performance, Mearns and Yule (2009) highlighted that there are significant differences between the national perception of management commitment to safety and risk-taking behaviour. Authors illustrated that at multiple worksites across UK and USA workers perceived management to be less committed than their Filipino counterparts. In addition, researchers also found that a nation's masculinity and power distance significantly predict employee risk-taking behaviour. Workers in the UK and Philippines was observed to have significantly lesser risk-taking behaviours, while workers from Malaysia were found to engage in substantially more risk-taking behaviour than other national cultures. For instance, the masculine nation will value achievement, and personal gains, while feminine nation value more on a relationship with surrounding people which includes their concern for their safety and health. As for power distance, national cultural with low power distance employee may be more comfortable in engaging in a conflicting discussion regarding safety-related issues with supervisors as compared with those nations high in power distance.

2.3 Background of Singapore

Singapore is multiracial with 74.3% Chinese, 13.4% Malays, 9.0% Indians and 2% Others and altogether, it brings along great diversity (Singstat, 2017). Despite being a multiracial country, English is the official language used for education and the workplace. Additionally, three other official languages (e.g., Mandarin, Malay and Tamil) are also taught in school as a form of preserving the mother tongue of the respective races. Therefore, the majority of Singaporeans are proficient in at least two languages (Singapore Economic Development Board, 2018).

Hofstede Insights (2010) benchmark Singapore against other world culture and reported that Singapore is relatively higher regarding power distance due to the influence of a Confucian background. Furthermore, people in Singapore are conditioned to having structure due to influence from observing numerous government regulations. Singapore is recognised to have a syncretic approach to personal life and pragmatic approach to professional life. Singapore is rated as a collective society where people associate themselves to in-groups whom they stay loyal to such as families, clans or organisations who keep a look out for one another. People in Singapore give priority to maintain harmony in their private, social and professional life. For example, to maintain harmony at the workplace, communication is diplomatic and open disagreements are avoided even at the expense of task fulfilment (Hofstede Insights, 2010).

The workforce data of a country can provide insights into the productivity and well-being of employees. According to Ministry of Manpower (2018a), the sector-wide average working hours per week have reduced from 46.4 hours in 2007 to 43.2 hours in 2017, which suggests that the workforce in Singapore is conscious of work-life balance. Despite the reduction trend, the construction sector still tops the chart for highest working hours at 50.8 hours, followed by the manufacturing sector which clocks 48.5 hours in the year 2017 (Singstat, 2018a). Although Singapore is working more hours as compared to other Asian countries such as Hong Kong, Korea, Taiwan and Japan, employee productivity does not correspond proportionally (Gallup, 2014). Based on a national survey (Singstat, 2018a) the participation of workforce aged 25 to 49 have increased from 85.3% in 2007 to 89.3% in 2017, and those aged 65 and above have also increased from 22.6% in 2007 to 26.8% in 2017. The data indicates the presences of multiple generations are on the rise in Singapore's labour market, and employees are working past their retirement age. These data allow employers to trigger necessary interventions in organisation policies and human resource management, HRM practices to accommodate the changing needs of employees better.

2.3.1 Well-being research in Singapore.

Well-being research in Singapore is scarce and only a handful done by government, insurance and human resource consultancy firm. Ho (1997) found that Singapore employees in organisations that provide wellness programs have better well-being

regarding positive attitudes towards the organisation, higher satisfaction for their job and fringe benefits as compared to organisations that do not offer employee wellness programs. Kathirasan (2015) found that 88% of the Singapore workforce is between 21 to 50 years old, which is similar to the data of the national survey. The author developed an integrated well-being scale in the context of the workplace which comprises of meaningfulness, intellectual well-being, emotional well-being, physical well-being and spatial well-being. This new scale included concepts of psychological well-being, subjective well-being, emotional and objective well-being. The average well-being score industry-wide indicates that people working in Singapore has relatively high levels of well-being, and only 5% reported low levels of happiness at work. However, despite the high well-being score, almost half of the respondents indicating that stress, lack of safety, ill health, and fatigue considerably impaired their well-being. Results also illustrate that people working in manufacturing had relatively lower well-being score as compared to other industries, which may be attributed to the environment and safety of the workplace.

Another research from MOM shows that almost 75% of Singapore workforce lacks motivation and less than 10% has the commitment and zest to their job (Ministry of Manpower, 2012). In Singapore, employees having a job that comprises of relatively high pay, wholesome company benefits, and regular work hours may sound perfect, but these employees are experiencing declining work productivity. In addition, they are not necessarily happy at work due to the poor working relationships and unpleasant work environment where concerns still revolve around workplace stress, coping strategies, work-life balance and physical well-being (Cigna Corporation, 2018). These findings on the well-being of employee in Singapore resonates with some of the concerns identified, such as individual wealth and needs, long working hours and lack of PERMA. It is also clear that EWB is an increasingly important issue in Singapore with wide-ranging consequences for productivity and therefore deserving further study.

2.3.2 Safety climate research in Singapore.

Ministry of Manpower (MOM), is a ministry of the Government of Singapore which is responsible for the formulation and implementation of labour policies related to the workforce in Singapore. Currently, the WSH Act which is the critical legislation for industry safety operations with three principles underlying the WSH framework.

Firstly, risks should be eradicated or mitigated even before they are created, which requires stakeholders to implement a system for risk assessments that identifies risk and recommend countermeasures before work commencement. Secondly, a safety culture should be adopted at all levels from managers, safety personnel, and all employees to shift from a reactive to a proactive approach by fostering safety ownership. Thirdly, to consider imposing financial disincentives and penalties with unsafe practice and the system even in the absence of accidents can help to achieve cost-effectiveness of WSH management system. This WSH Act is based on a performance-based regime that places responsibilities on stakeholders to ensure reasonably practical measures to ensure the safety and health of employees. Apart from stakeholders, accountabilities also fall on those assigned to manage and control WSH hazard (Navaratnam, 2011).

WSH is also the source for certified WSH professionals and safety and health training providers to register themselves as government-approved institutions to carry out safety-related work. WSH also conducts periodic monitoring and surveillance of organisations safety and health system, promotes workplace safety through campaigns, best practice sharing, innovation challenges, and keeps employers updated with annual reports and statistics on the safety scene in Singapore (Navaratnam, 2011; Workplace Safety and Health, 2010). Additionally, WSH also advocates safety-related research in various areas which anticipates future needs (WSH, 2011, 2018). Recently, Singapore mentioned that the top three priorities are injury prevention, solutions for ill-health arising from and impacting work, and other emerging concerns such as ageing workforce and work stress. WSH will examine the execution of psychosocial antecedents and new technology for interventions, and they also urge employers to do likewise (WSH, 2018).

According to Singapore annual injury statistics, there were 12, 498 fatal and non-fatal workplace injuries reported for the year 2017. Fortunately, the non-fatal injury rate has decreased by approximately 21% from the year 2008 to 2017. Non-fatal injury can be classified into major and minor injuries. The definition is adopted from OSHA standards, where major injuries include amputation, paralysis, fractures and burns or other significant injuries that require more than 20 days of medical leave. While minor injuries include all other injuries such as slips, trips, falls, cuts, bruises, scalds, strains, sprains or other injuries that require basic first aid. The top

three industries for injuries are manufacturing, construction, and marine. The manufacturing industry has the highest workplace injury rate since the year 2011, and the fatal injury rate increased from 9% in 2015 to 17% in 2017 (Ministry of Manpower, 2017).

Besides the loss of life, both employees and employers have to bear financial expenses for work-related injuries. Ill health and community expenses amounted to 10.45 billion Singapore dollars which is equivalent to 3.2% of nation's GDP in 2011. Despite the statistics, various organisations' perspective on WSH is to fulfil the minimum requirements of government legislation and less than half the organisations in Singapore allocate an annual budget for safety-related activities. Furthermore, only 30% of managers in Singapore associate good safety performance with better organisation returns (Loke et al., 2013). In the face of government-led WSH to promote workplace safety, efforts will be in vain if there is inadequate organisation budget to cultivate these initiatives in the long run. Hence, there is an urgency to improve the safety perception of the workforce.

According to the MOM (2017), the Singapore construction industry has been ranked top regarding workplace injuries from the very beginning up until the year 2010. One of the earliest safety climate-relevant studies conducted in Singapore was explicitly for the construction industry. Teo, Ling, and Chong (2005) identified the top three most significant human factors for construction safety in Singapore and they are the adoption of safe work behaviours by workers and supervisors; management's roles and responsibilities towards safety and health promotion; and attitudes of workers and supervisors towards safe work practices. This study proposes that interventions from a psychological approach may be useful for driving safety issues in Singapore, apart from engineering and administrative control. Subsequently Teo and Fang (2006) found nine safety climate dimensions namely management commitment, communication and feedback, supervisory and supportive environment, safety rules and procedures, safety investment, training program and competency level, personal risk appreciation and appraisal of work hazards, workers' involvement, and work pressure for the construction industry in Singapore. Six out of nine dimensions resonated with those dimensions in NOSACQ-50 (Kines et al., 2011) which suggests that NOSACQ-50 will be suitable as a safety climate instrument for the workforce in Singapore. Research further

examines what it means by having a favourable safety climate in the Singapore construction industry with a unique culture that is different from the western countries. Results portray three features of a healthy safety climate namely management commitment to accident prevention activities, the effectiveness of risk management on site, and employees readily comply with safety regulations despite work pressure. Overall, a healthy safety climate reflects authentic safety management system and contributes to the morale and job satisfaction of employee (Teo & Feng, 2009). From the 47 completed building construction projects in Singapore, the study shows that safety climate negatively correlates with workplace accident rates. Besides, safety investment also displays a direct negative relationship with accident rates and an indirect positive relation through safety climate.

From 2011 onwards, manufacturing industries took over the number one position for workplace injuries in Singapore (Ministry of Manpower, 2017). For the manufacturing industry in Singapore, Leng (2013) found that all three predictors of group-level safety climate namely proactive practices, active practices and declarative practices accounts for 64.7% of the variation in employee safety motivation. Furthermore, results show that active practices which include controlling and monitoring has the highest correlation with employee safety motivation as compared to proactive and declarative practices such as guiding and declaring information. The observation is plausible due to the inherent culture of Singapore which requires a need for structure from adhering to numerous government regulations and low uncertainty avoidance culture (Hofstede Insights, 2010). This implies that when an employee receives clear expectations and safety procedures, it reduces the conflict between work and safety which in return gives the employee a sense of safety control and as a result increases safety motivation. Correspondingly, in a steel fabrication yard in Singapore Wong and Lee (2016) discovered that perceived behavioural control, attitude and subjective norms within safety climate is correlated to the intention of behaving safely at work which includes complying to safety regulations. This suggests that an employees' internal locus of control has more considerable influence than the external locus of control.

For multi-sectors MNC in Singapore, the study shows that the purpose of WSH is to comply with government legislation rather than recognising the benefits. For example, results for these MNC from manufacturing, construction, marine,

service, pest control illustrated less than average health status among employees and displayed a substantial gap between organisational goals and management commitments (Chia et al., 2015). In addition, data also shows that 22.8% of the small-medium enterprise (SME) businesses have no motivation for WSH leadership. On the other hand, barriers to SME leadership include lack of expertise, financial resources, time, and difficulties in encouraging employees' compliance (Chen & Tan, 2015). Fortunately, these barriers can be eradicated with appropriate leadership training and emphasis on management-related capitals (Brooks, 2017), tangible justification of safety budget (Madsen, 2013), and increasing personal resources for employees (Dierynck et al., 2016; Eid et al., 2012). Furthermore, research shows that the perception of dangerous conditions was one of the main concerns that hinder younger generation from entering the industry (Ling & Ho, 2013). Thus, improving safety climate perception in "dangerous" sectors can also help to attract new and talented workforce into the industry (Chia et al., 2015).

Generally, the review indicates that the manufacturing sector in Singapore appears to have more impact on the surrounding community due to the high density of the country on top of individual and organisational losses. Jurong Island aggregates the most hazardous manufacturing industries as compared to mainland Singapore (Carpenter & Ng, 2013). Therefore, this study of EWB and safety climate for Singapore workforce in the manufacturing sector can contribute to the limited database for the industry and enrich the understanding of key constructs pertaining to working in a hazardous environment.

2.3.3 Injuries and accidents in Singapore.

One of the worst industrial accidents in Singapore history is in the marine industry in 1978, where the massive explosion of a crude oil tanker resulted in 76 deaths and 69 injured (Koh, 2004). Followed by a flammable compound storage tanker in the petrochemical industry in 1988, where the fire burned up to five days resulting in 25 injured (Rodante, 2005).

Table 3

Summary of industrial accidents in Singapore

Reference	Year	Industry	Fatality	Injuries	Remarks	Main findings
Koh, 2004, 28th Oct 2016	1978	marine	76	69	work pressure due to incentives	<ol style="list-style-type: none"> 1) lax workplace safety legislation 2) poor safety system 3) violation of safety rules 4) non-compliance of safety procedures 5) lack emergency response, arrangements and procedures 6) poor implementation and enacting of safety system
Rodante, 2005	1988	petrochemical	-	25	fire lasted for 5days	<ol style="list-style-type: none"> 1) equipment design inherently inadequate 2) poor equipment maintenance problems 3) lack precision in operator procedures 4) time and information gap between shift change over 5) delayed emergency response 6) ineffective safety system 7) inadequate safety training and emergency response
Chia, B. K. (2014)	2000	petrochemical	2	1	6 months stop work	<ol style="list-style-type: none"> 1) violating standard operation procedures 2) ineffective implementation of safety management system 3) insufficient technical and safety training 4) non-compliance to safety requirements 5) lack proper documentation of operation procedures
Ahmad, N. (2004, 2016)	2004	construction	4	3	utilities disruption to 15,000 people and 700 businesses	<ol style="list-style-type: none"> 1) portion of highway construction collapse 2) critical design errors 3) risk management effectiveness 4) lack system of managing uncertainties and quality 5) absences of independent design reviews and checks

Table 3 (cont'd)

Summary of industrial accidents in Singapore

Reference	Year	Industry	Fatality	Injuries	Remarks	Main findings
Ministry of Manpower. (2012, 15th April 2015)	2011	petrochemical	-	6	-	<ul style="list-style-type: none"> 1) violation of safety procedures 2) insufficient technical and safety training 3) no measures of risk assessment 4) poor safety management
Chong, E., & Williams, A. (2018, 10th Nov 2017)	2012	marine	2	1000	-	<ul style="list-style-type: none"> 1) inadequate safety design in operating system 2) lack safety measures for non-routine operation 3) not undertaking risk assessment 4) no implementation of control measures in safe work procedures 5) lack emergency response, arrangements and procedures.
Ho, O. (2018, 9th Oct 2016)	2016	construction	55	many	cummulative of fatality within 9 months at separate construction site	<ul style="list-style-type: none"> 1) lack safety training 2) non-compliance of safety procedures 3) violating safety regulations
Channel News Asia. (2018, 7th Nov 2017)	2017	Logistics	1	-	-	<ul style="list-style-type: none"> 1) inadequate workplace management to minimise risk and hazards

Fortunately, with the constant revision of the WSH Act, accident severity rates have reduced drastically across industries especially the top three most hazardous sectors (Foo, Wu, & Yuan, 2016). However, despite the positive progression, industrial workplace accidents continue to occur, and the findings revolve around similar concerns as shown in Table 3. These concerns are reflected in dimensions of safety climate such as management, risk, competence, and safety behaviour. Therefore, through this study on EWB and safety, climate measures can be developed to mitigate injury occurrences for the manufacturing sector in Singapore.

Overall, chapter two shows that culture does influence the perception of EWB due to the different values present in the western and Asian context. On the whole, safety climate perception is univocal across different cultural settings, but sub-dimensions of safety climate may still be subjected to cultural influence. Hence, one should consider cultural influence when interpreting research results as this study will investigate EWB, safety climate and injuries within the Singapore context.

Chapter Three: Method

3.1 Procedure and Participants

As discussed in chapter one, most of the work on EWB and safety climate has been skewed towards western culture. There has been insufficient research on EWB, safety climate and associated outcomes in the Asian context. In this study, the targeted research respondents were employees working in Singapore in the manufacturing sector. The study was cross-sectional and involved the use of a self-report questionnaire (Appendix D), which was distributed electronically via the survey software *Qualtrics*. Ethical approval for this research was granted by the School of Psychology Research and Ethics Committee of the Faculty of Arts and Social Sciences, University of Waikato. Participants for the study were recruited through two methods.

The first method of recruitment was approaching organisations in Singapore under the Singapore Manufacturing Federation, SMF (2018), and from the member's directory of 1420 organisations, only 112 organisations with production facilities were shortlisted, of which 32 organisations were located on Jurong Island and the remaining were located on mainland Singapore. The direct email address was obtained through personal contacts, and where direct email was not available, the general email address was obtained from the company's website. The content of email contained an invitation message (Appendix A) including the information sheet (Appendix B) were sent to invite the organisation to participate in this research. The information sheet outlined the research aims, what would be required of them if they wished to participate, explained the anonymity and confidentiality of the participation process for the organisations, and that response will not be traced back to any individual for appraisal or HR decisions. Organisations were offered a summary of the results after the research as a way of encouraging their participation. Additional liaising was necessary with organisations included further emails and phone calls to address other questions and concerns. Subsequently, organisations who permitted to participate were then sent research poster (Appendix C) with the online questionnaire link and QR code for ease of accessibility.

The second method of data collection was through approaching individuals who were identified as potentially valuable participants due to their connection with the manufacturing sector. Potential individuals were then directly emailed with the research information (Appendix B and C), and this group of participants further suggested other individuals who may wish to participate. These participants were then provided permission to forward on the research details. Signed consent from the participating organisation was obtained, and informed consent was implied upon submission of the survey by individuals.

A total of 192 individuals participated in this study, out of which 86 participants were recruited via Method one from one organisation on Jurong Island with a response rate of 19.11%, while the remaining 106 participants recruited via Method two were either working on Jurong Island or mainland Singapore's manufacturing sector. Nineteen participants had invalid inputs for the screening questions and were removed as they were deemed ineligible for this study. Subsequently, 26 participants completed less than 50% of the entire questionnaire or individual scales, so they were removed from the final analysis according to NOSACQ-50 scoring guide; leaving 147 participants for this study.

3.2 Measures

The questionnaire (Appendix D) examined participants' well-being, safety climate and injuries in their workplace. The questionnaire comprised of 123 items, which included a mix of text input, four-point and five-point Likert-type scales. Additionally, screening questions and questions related to gathering demographic data were also included.

3.2.1 Recoding of variables.

Two variables within the study required recoding for a more meaningful analysis to occur. Firstly, question 5 which asked participants for the age was recoded into age groups according to Singstat (2018b) standardised from age 20 to 69 with each group having a four years range - group 1 indicating age 20 to 24, group 2 indicating age 25 to 29, so on and so forth and there are a total of 10 age groups. Secondly, question 20 which asked participants for their tenure within their organisation was recoded to seniority groups with reference from Cooper and Phillips (2004). With group 1 indicating 6mths to 5 years, group 2 indicating 6 to 15 years, group 3 indicating 16

to 25 years, and group 4 indicating participants with more than 26 years of working experience.

3.2.2 Screening questions.

Screening questions were developed and placed at the start of the questionnaire to determine whether the eligible participants were filling out the questionnaire. The first question was ‘Is English your first language?’, and the second question was ‘If English is not your first language, are you certified under Workplace Literacy Assessment (WPL)?’. If a participant answered *yes* to either one of the two questions, the data would be used. Again, if a participant answered *no* to both questions, the data was excluded. The third question was “How long have you been working in the manufacturing sector?”. Participants that have been in the industry for less than six months would have their responses excluded.

3.2.3 Employee well-being.

Ágota et al. (2017) 35-items Workplace Well-Being Questionnaire based on Seligman’s PERMA model was used to assess participants’ everyday work-related well-being. The scale measures six factors and breakdown for the 35 items is as follows: 5 items for the *positive emotions* (e.g., “I feel positive at work.”), 6 items for *engagement* (e.g., “my job inspires me.”), 5 items for *positive relationships* (e.g., “I can turn to my colleagues with confidence.”), 6 items for *meaning* (e.g., “I perform my tasks in full swing.”) 5 items for *accomplishment* (e.g., “I turn plans into actions.”) and 8 items for *negative aspects of work* (e.g., “I have unpleasant feelings about my work.”). All items were rated on a 5-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). The score was calculated for each factor as well as an overall mean for each participant. The Cronbach’s alpha for EWB ranged from .73 to .86 in the previous study which illustrates high internal consistency (Ágota et al., 2017). This measure was selected as this six-factor model accounted for more variance for work-related EWB as compared to other measures reviewed within positive psychology literature.

3.2.4 Safety climate.

Kines et al. (2011) 50-items Nordic Safety Climate Questionnaire (NOSACQ-50) was used to assess participant perception of their workplace safety climate. The scale measures seven dimensions and breakdown for the 50 items are as follows: 9

items for *management safety priority, commitment and competence* (e.g., “Management places safety before production.”), 7 items for *management safety empowerment* (e.g., “Management involves employees in decisions regarding safety.”), 6 items for *management safety justice* (e.g., “Management treats employees involved in an accident fairly.”), 6 items for *workers’ safety commitment* (e.g., “we who work here help each other to work safely.”), 7 items for *workers’ safety priority and risk non-acceptance* (e.g., “we who work here regard risks as unavoidable.”), 8 items for *safety communication, learning, and trust in co-workers’ safety competence* (e.g., “we who work here feel safe when working together.”), and 7 items for *workers’ trust in the efficacy of safety systems* (e.g., “we who work here consider it important to have clear-cut goals.”). All items were rated on a 4-point Likert-type scale from 1 (strongly disagree) to 4 (strongly agree). Scores were calculated for each dimension as well as an overall mean for each participant. The Cronbach’s alpha for NOSACQ-50 ranged from .71 to .87 in the previous study which illustrates high internal consistency. This measure was selected due to the replicability across both western (Bergh et al., 2013) and eastern (Sutalaksana et al., 2016) countries and multiple industries (Ajslev et al., 2017).

3.2.5 Workplace injuries.

The Occupational Safety and Health Administration (2018b) standard definition of minor and major non-fatal injuries was used to assess the number of workplace injuries that participants encountered both reportable and non-reportable for the last six months. Minor injury classifications included slips, trips, falls and other minor occurrences; cuts or lacerations; bruises or contusions; surface burns/ scalds; strains and sprains of body parts; injuries that required basic first aid. The classifications of injuries were converted into questions to minimise the overlooking of participants’ injury encounters. There were a total of 13 items under injuries covering both minor and major injuries. For example, we asked participants “how many times have you encountered *slips, trips, falls and other minor occurrences* at your workplace in the last six months?”. The injury count was computed for both severity categories as well as the total number of injuries.

3.3 Data Analysis

Multiple data analyses were conducted on the results collected for purposes of assessing support for the hypotheses. The data collected and stored via the survey

software Qualtrics was exported to the IBM Statistical Package for the Social Sciences (SPSS 25). Results will be further elaborated in the following chapter (Chapter four).

3.3.1 Missing data.

Less than 30 percent of the entire sample (39 participants) had missing data for more than 50% of each scale dimension, hence excluded from the analysis. According to the NOSACQ-50 scoring guide, data will only be included in the calculation of mean when a participant answers more than 50% of items in a dimension. Similarly, the total mean will only be calculated when a participant has more than 50% of dimensions scored. This method of treating missing data is used for both the EWB and safety climate scale.

For questions 58 to 63 and questions 65 to 70 on injury count declaration missing data will be assumed as zero, mean value will be taken for responses given in a range (e.g. 3 to 4 injuries), and when response states “a few” or “unsure” it will be replaced by the grand mean of all participants injury count. Similarly, for question 21 and 22 on working hours, the mean value will be taken when the response was given in a range (e.g. 40 to 42 hours).

3.3.2 Descriptive statistics and statistical analysis.

Descriptive statistical analyses were conducted to provide information on frequencies, means, standard deviations, skew and kurtosis values for the data. The current results did not show any data within extreme ranges and therefore did not require any transformation. A range of analyses was carried out and reported in the following chapter. Reliability analysis was conducted to determine the internal reliability of each scale. Correlations were conducted to evaluate the associations between key variables and test hypotheses. One-way analyses of variance (ANOVAs) and t-tests were carried out to test differences between demographic variable categories, and finally, mediation analysis tested the main model.

This chapter describes the method used for data collection and analysis in this study. The following chapter illustrates and describes the results of the analyses.

Chapter Four: Results

This chapter presents the findings of this study and includes descriptive statistics, reliability analysis, correlations, ANOVAs, T-test, and mediation analyses.

4.1 Demographics

Demographic variables were also gathered for describing the general characteristics of the sample. They were gender, age, job location, job type, hierarchy classification, tenure at the current organisation, and working hours. Demographic variables of the 147 participants who completed the questionnaire are shown in Table 4. The participants for this study mostly work at Jurong Island (67.3%) which holds the majority of chemical manufacturing, and the remaining on the mainland, Singapore. There are more males (74.8%) as compared to females, as is common in the manufacturing sector with the majority being middle age ($M = 42.23$, $SD = 11.95$). They are mostly management (66.7%) and non-shift (84.4%) employees with work experience ranging from 6 months to 37 years ($M = 12.83$, $SD = 11.57$) and worked between 39 to 132 hours per week ($M = 56.50$, $SD = 17.90$). The mean working hours captured in this study is 16.5% more than the national average reported by Singstat (2018a) for the manufacturing sector in Singapore. This implies that manufacturing sector comprises of wide-ranging industries and the work duration demands varies.

Table 4

Descriptive statistics for demographic variables

	N	Percent
Gender		
Male	110	74.8
Female	37	25.2
Age Group		
20 - 24	7	4.8
25 - 29	15	10.2
30 - 34	25	17
35 - 39	26	17.7
40 - 44	16	10.9
45 - 49	11	7.5
50 - 54	11	7.5
55 - 59	25	17

Table 4 (cont'd)

Descriptive statistics for demographic variables

	N	Percent		
Age Group				
60 - 64	7	4.8		
65 - 69	4	2.7		
Tenure Groups				
0.5 - 5	53	36.1		
6 - 15	43	29.3		
16 - 25	23	15.6		
> 26	27	18.4		
Hierarchy Classification				
Management	98	66.7		
Non-Management	49	33.3		
Location				
Jurong Island	99	67.3		
Mainland	48	32.7		
Job Classification				
Shift Work	23	15.6		
Non-Shift Work	124	84.4		
Severity of Injury				
Minor	271	77.9		
Major	77	22.1		
	<i>N</i>	<i>Range</i>	<i>Mean</i>	<i>SD</i>
Age (years)	147	21 - 67	42.23	11.95
Tenure (Years)	146	.5 - 37	12.83	11.57
Working Hours (per week)	147	39 - 132	56.50	17.90

4.2 Descriptive Statistics

Descriptive statistics, including the mean, standard deviation, skew, and kurtosis for all key variables are displayed in Table 5 (pg. 66). The mean for EWB was measured on a scale of one to five (1 = strongly disagree and 5 = strongly agree). The mean for safety climate scale was measured on a scale of one to four (1 = strongly disagree and 4 = strongly agree). On average, respondents reported relatively moderate levels of well-being and safety climate at the workplace. The mean for injuries is the number of injury count. The skew and kurtosis scores for predictor and mediator variables were acceptable; only the outcome variable is positively skewed possibly due to the low injury count. Results show that EWB and safety climate ratings were above average which implies that employees are relatively happy at the workplace

and the workplace also display relatively coherent safety behaviour and safety policies.

Table 5.

Descriptive statistics for key variables

	N	Mean	SD	Skew.	Kurtosis
EWB	147	3.64	0.43	-.18	-.03
Safety Climate	132	3.11	0.37	.64	-.42
Injuries	134	2.59	4.87	4.68	32.21

4.3 Scale Reliability

Reliability analysis was carried out on the EWB scale and the safety climate scale. Using Cronbach's alpha (α), each measure was tested for internal reliability with the level of reliability being determined by the cut-off values of .7 (Field, 2013). The reliabilities of the EWB scale is .92 and safety climate scale is .97 which were regarded as reliable and sensitive. The individual dimension reliabilities of each scale and their inter-item correlation matrix are reported in Table 6 (pg. 69).

4.4 Correlations

Pearson's product-moment correlation was conducted to examine the significance of the association between key variables in this study (Table 6, pg. 69), and to determine whether there was support for the hypotheses. This correlation method was also used to examine the demographic variable on a continuous scale (working hours with overtime) and the relationships with the outcome variable, individual workplace injuries. This step is essential to determine if this demographic variable needed to be controlled during the mediation analysis.

4.4.1 Key variables.

Hypothesis 1a. It was hypothesised that EWB would be positively associated with safety climate for the Singapore sample in the manufacturing sector. EWB correlated significantly in a positive direction with safety climate ($r = .55, p < .001$), thus hypothesis 1a was supported. In addition, within the safety climate dimensions EWB was most highly associated with D2, management safety empowerment ($r = .54, p < .001$), D1, management safety priority, commitment and competence ($r = .48, p < .001$), and D3, management safety justice ($r = .47, p < .001$) respectively.

This suggests that as EWB at workplace increases, the perception of safety climate at the workplace also improves especially in those top three dimensions.

Hypothesis 1c. It was hypothesised that EWB would be negatively associated with individual workplace injuries for the Singapore sample in the manufacturing sector. EWB correlated significantly in a negative direction with workplace injuries ($r = -.24, p = .005$), thus hypothesis 1c was supported. However, within the severity of workplace injuries, EWB was negatively correlated with minor injuries ($r = -.34, p < .001$) but not major injuries ($r = -.13, p = .13$). This implies that as EWB at the workplace increases, the number of injuries at the workplace reduces and more so for minor injuries.

Hypothesis 2b. It was hypothesised that safety climate would be negatively associated with individual workplace injuries for the Singapore sample in the manufacturing sector. Safety climate correlated significantly in a negative direction with injuries ($r = -.33, p < .001$), thus hypothesis 2b was supported. Furthermore, within the severity of workplace injuries safety climate was negatively correlated with both minor injuries ($r = -.33, p < .001$) and major injuries ($r = -.19, p = .03$). This indicates that as employee perception of safety climate at the workplace improves, the overall number of individual workplace injuries will decrease.

Hypothesis 3b. It was hypothesised that minor individual workplace injuries would be positively associated with major individual workplace injuries for the Singapore sample in the manufacturing sector. Minor injuries correlated significantly in a positive direction with major injuries ($r = .37, p < .001$), thus hypothesis 3b was supported. This suggests that as the number of minor injuries an employee encounter increases so does the number of major injuries.

4.4.2 Working hours.

Hypothesis 1e. It was hypothesised that the working hours would be negatively associated with EWB for the Singapore sample in the manufacturing sector. The results of the correlation analysis indicated a negative relationship between the two variables, but the relationship was not significant ($r = -.11, p = .38$), hence providing only partial support for the hypothesis.

Hypothesis 2e. It was hypothesised that working hours would be negatively associated with safety climate for the Singapore sample in the manufacturing sector.

Working hours correlated significantly in a negative direction with safety climate ($r = -.28, p = .001$), thus hypothesis 2e was supported. Additionally, within the safety climate dimensions working hours was most highly associated with D3, management safety justice ($r = -.32, p < .001$), D5, workers' safety priority and risk non-acceptance ($r = -.30, p = .001$), and D7, workers' trust in the efficacy of safety systems ($r = -.27, p = .002$) respectively. This suggests that as the working hours of an employee increases, the perception of safety climate at the workplace reduces particularly in the top three dimensions.

Hypothesis 3d. It was hypothesised that the working hours would be positively associated with individual workplace injuries for the Singapore sample in the manufacturing sector. Working hours correlated significantly in a positive direction with workplace injuries ($r = .31, p < .001$), thus hypothesis 3d was supported. Nevertheless, within the severity of workplace injuries, working hours were only correlated with minor injuries ($r = .34, p < .001$) and not with major injuries ($r = .13, p = .13$). This implies that as the working hours of an employee increases, the number of minor individual injuries at the workplace also increases and more so for minor injuries.

Table 6:

Pearson's product-moment correlations for predictor, mediator, outcome, their sub-dimensions, and continuous variable.

	Mean	SD	EWB	P	E	R	M	A	-veAW	Safety Climate	D1	D2	D3	D4	D5	D6	D7	Injuries	Minor	Major	Working Hours	
EWB	3.64	0.43	(.92)																			
P	3.56	0.57	.89**	(.77)																		
E	3.51	0.59	.86**	.78**	(.83)																	
R	3.56	0.53	.81**	.66**	.67**	(.78)																
M	3.89	0.44	.80**	.64**	.61**	.54**	(.72)															
A	3.8	0.46	.74**	.57**	.52**	.41**	.67**	(.73)														
-veAW	3.38	0.51	.69**	.51**	.45**	.52**	.43**	.34**	(.75)													
Safety Climate	3.11	0.37	.55**	.52**	.48**	.39**	.50**	.31**	.42**	(.97)												
D1	3.11	0.48	.48**	.47**	.44**	.34**	.47**	.19*	.38**	.79**	(.84)											
D2	3.09	0.45	.54**	.50**	.47**	.41**	.48**	.29**	.42**	.89**	.68**	(.86)										
D3	3.06	0.43	.47**	.46**	.41**	.32**	.43**	.32**	.31**	.87**	.62**	.80**	(.84)									
D4	3.13	0.41	.45**	.42**	.38**	.31**	.39**	.32**	.37**	.83**	.55**	.69**	.63**	(.78)								
D5	3.03	0.48	.44**	.41**	.37**	.35**	.35**	.19*	.41**	.83**	.60**	.70**	.71**	.62**	(.82)							
D6	3.21	0.41	.46**	.44**	.45**	.32**	.39**	.28**	.31**	.89**	.65**	.75**	.74**	.70**	.68**	(.93)						
D7	3.17	0.4	.35**	.33**	.27**	.19*	.42**	.26**	.22*	.79**	.48**	.60**	.65**	.71**	.56**	.72**	(.85)					
Injuries	2.59	4.87	-.24**	-.27**	-.12	-.19*	-.28**	-.09	-.20*	-.33**	-.33**	-.30**	-.37**	-.24**	-.30**	-.20*	-.21*	-				
Minor	1.96	3.68	-.26**	-.29**	-.12	-.19*	-.29**	-.10	-.24**	-.33**	-.33**	-.32**	-.32**	-.24**	-.31**	-.20*	-.19*	.92**	-			
Major	0.58	2.06	-.10	.12	-.04	-.10	-.13	-.04	-.05	-.19*	-.19*	-.14	-.29**	-.13	-.15	-.11	-.14	.71**	.37**	-		
Working Hours	56.5	17.9	-.11	-.15	.00	-.10	.01	-.05	-.14	-.28**	-.24**	-.22**	-.32**	-.12	-.30**	-.15	-.27	.31**	.34**	.13	-	

Note. P = Positive emotions, E = Engagement, R = Relationships, M = Meaning, A = Accomplishment, -veAW = Negative aspect of work. D1 = Management safety priority, commitment and competence, D2 = Management safety empowerment, D3 = Management safety justice, D4 = Workers' safety commitment, D5 = Workers' safety priority and risk non-acceptance, D6 = Safety communication, learning, and trust in co-workers' safety competence, D7 = Workers' trust in the efficacy of safety systems. Cronbach's alpha reliabilities are given in brackets where relevant. ** $r < .01$, * $r < .05$, 2-tailed.

4.5 ANOVAs

ANOVAs were conducted to examine if there were any differences among multiple category demographic variables (age, tenure and injury severity reporting pattern) with the key variables. This step is also used to determine if the demographic variables needed to be controlled during the mediation analysis. Additionally, omega squared (ω^2) will be used as recommended by Field (2013). This study adopts the interpretation by Kirk (1996) where generally .01, .06 and .14 represents small, medium and large effect size respectively and will be reported for significant results only.

4.5.1 Tenure.

Participants were divided into four groups according to their work experiences (Group 1: 6mths to 5yrs; Group 2: 6 to 15yrs; Group 3: 16 to 25yrs; Group 4: 26yrs and above).

Hypothesis 1f. It was hypothesised that EWB would be poorer for short tenure group than long tenure group for the Singapore sample in the manufacturing sector. There was no statistical difference in the EWB score for the four tenure groups, $F(3, 142) = 1.74$, $p = .16$, thus hypothesis 1f was not supported. This suggests that an employee's well-being at the workplace is no different for various levels of work experience.

Hypothesis 2f. It was hypothesised that safety climate would be poorer for short tenure group than long tenure group for the Singapore sample in the manufacturing sector. There was no statistical difference in the safety climate score for the four tenure groups, $F(3, 127) = 1.94$, $p = .13$, hence hypothesis 2f was not supported. This implies that the perception of safety climate at the workplace is no different for various levels of work experience.

Hypothesis 3e. It was hypothesised that individual workplace injuries would be more for short tenure group than long tenure group for the Singapore sample in the manufacturing sector. There was a statistical significant difference in injuries for the four tenure groups, $F(3, 129) = 3.26$, $p = .02$, $\omega^2 = .05$. This indicates that workplace injuries are different for various level of work experience. The actual difference in mean injury count between groups was approaching medium effect size calculated using omega squared, was .05. Post-hoc comparisons using the Tukey

HSD test indicated that the mean injury count for Group 3 ($M = 5.45$, $SD = 9.43$) was significantly higher than Group 2 ($M = 1.98$, $SD = 3.08$) and Group 4 ($M = 1.42$, $SD = 2.11$), while Group 1 ($M = 2.45$, $SD = 3.85$) did not differ significantly from either of Group 2, 3 or 4. However, results did not illustrate that short tenure group reported more injuries comparing with long tenure group; thus, hypothesis 3e was not supported.

4.5.2 Age.

Participants were divided into ten groups according to their age (Group 1: 20 to 24yrs; Group 2: 25 to 29yrs; Group 3: 30 to 34yrs; Group 4: 35 to 39yrs; Group 5: 40 to 44yrs; Group 6: 45 to 49yrs; Group 7: 50 to 54yrs; Group 8: 55 to 59yrs; Group 9: 60 to 64yrs; Group 10: 65 to 69yrs).

Hypothesis 1g. It was hypothesised that EWB would be poorer for young age group than old age group for the Singapore sample in the manufacturing sector. There was no statistical difference in EWB score for the ten age groups, $F(9, 137) = 1.74$, $p = .09$, thus, hypothesis 1g was not supported. This suggests that there are no differences in an employee's well-being at the workplace for various age groups.

Hypothesis 2g. It was hypothesised that safety climate would be poorer for young age group than old age group for the Singapore sample in the manufacturing sector. There was no statistical difference in safety climate score for the ten age groups, $F(9, 122) = .83$, $p = .59$, hence hypothesis 2g was not supported. This implies that the perception of safety climate at the workplace is no different for various age groups.

Hypothesis 3f. It was hypothesised that individual workplace injuries would be more for young age group than old age group for the Singapore sample in the manufacturing sector. There was a statistical significant difference in injuries for the ten age groups, $F(9, 124) = 2.10$, $p = .03$, $\omega^2 = .07$. This indicates that workplace injuries are different for various age groups. The actual difference in mean injury count between groups has a medium effect size, calculated using omega squared, was .07. Post-hoc comparisons using the Tukey HSD test indicated that the mean injury count for Group 6 ($M = 8.5$, $SD = 12.77$) was significantly higher than Group 3 ($M = 2.26$, $SD = 4.28$), Group 4 ($M = 1.92$, $SD = 2.86$), Group 5 ($M = 1.64$, $SD = 2.06$), Group 7 ($M = 1.36$, $SD = 1.57$), and Group 8 ($M = 1.78$, $SD = 2.90$); while

Group 1 ($M = 2.86, SD = 2.97$), Group 2 ($M = 3.27, SD = 5.08$), Group 9 ($M = 2.42, SD = 3.77$), and Group 10 ($M = 3.67, SD = 3.06$) did not differ significantly from other age groups. However, results did not illustrate that young age group reported more injuries comparing with old age group; thus, hypothesis 3f was not supported.

4.5.3 Injury reporting pattern.

Participants injury reporting pattern were divided into 3 groups (Group 1: yes, verbally; Group 2: yes, through near-miss; Group 3: no) for minor injury and 4 groups (Group 1a: yes, verbally; Group 2a: yes, through near-miss; Group 3a: yes, through incident report; Group 4a: no) for major injury. Descriptive statistics in Table 7 illustrates that 52.9% of minor injuries and 49.3% of major injuries at the workplace was not reported.

Table 7.

Severity of injury and corresponding reporting pattern

	N	Percent
Minor injury reporting pattern		
Group 1	31	22.8
Group 2	33	24.3
Group 3	72	52.9
Major injury reporting pattern		
Group 1a	13	9.7
Group 2a	13	9.7
Group 3a	42	31.3
Group 4a	66	49.3

Note. Group 1 = yes verbally, Group 2 = yes through near-miss, Group 3 = no, Group 1a = yes verbally, Group 2a = yes through near-miss, Group 3a = yes through incident report, Group 4a = no.

Hypothesis 1d. It was hypothesised that EWB would be better for employees who report injuries than not reporting injuries for the Singapore sample in the manufacturing sector. There was a statistical significant difference in EWB score for reporting patterns of minor injuries, $F(2, 133) = 4.64, p = .01, \omega^2 = .05$. This suggests that employee's perception of well-being at the workplace is different for their reporting pattern for minor injuries. The actual difference in mean EWB score between groups was approaching medium effect size, calculated using omega

squared, was .05. Post-hoc comparisons using the Tukey HSD test indicated that the mean EWB for Group 2 ($M = 3.80$, $SD = 0.34$) was significantly higher than Group 3 ($M = 3.54$, $SD = 0.44$), while Group 1 ($M = 3.63$, $SD = 0.38$) did not differ significantly from other reporting patterns. Furthermore, there was also statistical significant difference in EWB score for reporting patterns of major injuries, $F(3, 130) = 3.10$, $p = .03$, $\omega^2 = .05$. This suggests that employee's perception of well-being at the workplace is different for their reporting pattern for major injuries. Similarly, the actual difference in mean EWB score between groups was also approaching medium effect size, calculated using omega squared, was .05. Post-hoc comparisons using the Tukey HSD test indicated that the mean EWB for Group 1a ($M = 3.42$, $SD = 0.45$) was significantly lower than Group 3a ($M = 3.76$, $SD = 0.37$), while Group 2a ($M = 3.67$, $SD = 0.33$) and Group 4a ($M = 3.58$, $SD = 0.43$) did not differ significantly from other reporting patterns; therefore, hypothesis 1d was supported.

Hypothesis 2d. It was hypothesised that safety climate would be better for employees who report injuries than not reporting injuries for the Singapore sample in the manufacturing sector. There was a statistical significant difference in safety climate score for reporting patterns of minor injuries, $F(2, 128) = 4.70$, $p = .01$, $\omega^2 = .05$. This suggests that employee perception of safety climate at the workplace is different for their reporting pattern for minor injuries. The actual difference in mean safety climate score between groups was approaching medium effect size, calculated using omega squared, was .05. Post-hoc comparisons using the Tukey HSD test indicated that the mean safety climate score for Group 2 ($M = 3.28$, $SD = 0.41$) was significantly higher than Group 3 ($M = 3.04$, $SD = 0.35$), while Group 1 ($M = 3.11$, $SD = 0.33$) did not differ significantly from other reporting patterns. Additionally, there was also statistical significant difference in safety climate score for reporting patterns of major injuries, $F(3, 127) = 4.62$, $p < .001$, $\omega^2 = .08$. This suggests that employee perception of safety climate at the workplace is different for their reporting pattern for major injury. Moreover, the actual difference in mean safety climate score between groups indicates medium effect size, calculated using omega squared, was .08. Post-hoc comparisons using the Tukey HSD test indicated that the mean safety climate score for Group 3a ($M = 3.28$, $SD = 0.38$) was significantly higher from Group 1a ($M = 2.96$, $SD = 0.30$) and Group 4a ($M = 3.05$, $SD = 0.36$), while

Group 2a ($M = 3.06$, $SD = 0.24$) did not differ significantly from other reporting patterns; therefore, hypothesis 2d was supported.

Hypothesis 3c. It was hypothesised that individual workplace injuries would be lesser for employees who report injuries than not reporting injuries for the Singapore sample in the manufacturing sector. There was no statistical difference in the number of injuries for reporting patterns of minor injuries, $F(3, 130) = .41$, $p = .75$ and major injuries, $F(2, 133) = 1.08$, $p = .34$; thus, hypothesis 3c was not supported. This indicates that the number of injuries regardless of severity is no different among employee's reporting pattern for both minor and major injuries.

4.6 T-test

Independent *t*-tests were conducted to test for differences among binary demographic variables (work location, hierarchy and job classification) with the individual workplace injuries. Similarly, these tests helped to determine demographic variables that needed to be controlled during the mediation analysis.

4.6.1 Location.

Hypothesis 1h. It was hypothesised that EWB would be poorer for employees working on Jurong Island than on mainland Singapore sample in the manufacturing sector. The EWB score between employees working on Jurong Island ($M = 3.67$, $SD = 0.44$) and mainland Singapore ($M = 3.58$, $SD = 0.39$) was not statistically significant, $t(145) = 1.23$, $p = .22$, thus hypothesis 1h was not supported. This suggests that the employee perception of well-being at the workplace is no different among working locations.

Hypothesis 2h. It was hypothesised that safety climate would be poorer for employees working on Jurong Island than on mainland Singapore sample in the manufacturing sector. The safety climate score between employees working on Jurong Island ($M = 3.09$, $SD = 0.38$) and mainland Singapore ($M = 3.16$, $SD = 0.33$) was not statistically significant, $t(130) = -1.09$, $p = .28$, hence hypothesis 2h was not supported. This implies that employee's perception of safety at the workplace is no different among working locations.

Hypothesis 3g. It was hypothesised that individual workplace injuries would be more for employees working on Jurong Island than on mainland Singapore sample in the manufacturing sector. The number of injuries for employees working on Jurong

Island ($M = 2.73$, $SD = 5.43$) and mainland Singapore ($M = 2.30$, $SD = 3.49$) was not statistically significant, $t(132) = 0.48$, $p = .63$, thus hypothesis 3g was not supported. This indicates that employee injury count at the workplace is no different among working locations.

4.6.2 Hierarchy classification.

Hypothesis 1b. It was hypothesised that EWB would be better for management employees than non-management employees for the Singapore sample in the manufacturing sector. The EWB score for management ($M = 3.72$, $SD = 0.41$) and non-management ($M = 3.49$, $SD = 0.42$) was statistically significant, $t(145) = -3.05$, $p = .003$, hence hypothesis 1b was supported. This suggests that management staff rated higher EWB at the workplace as compared to non-management and it did represent a small to medium effect size, $r = .25$.

Hypothesis 2c. It was hypothesised that safety climate would be better for management employees than non-management employees for the Singapore sample in the manufacturing sector. The safety climate score for management ($M = 3.15$, $SD = 0.37$) and non-management ($M = 3.02$, $SD = 0.36$) was approaching significant, $t(130) = -1.91$, $p = .058$, thus hypothesis was not supported. However, this indicates that the employee perception of safety climate at the workplace is no difference between management and non-management staff.

Hypothesis 3a. It was hypothesised that individual workplace injuries would be lesser for management employees than non-management employees for the Singapore sample in the manufacturing sector. The number of workplace injuries for management ($M = 1.83$, $SD = 3.16$) and non-management ($M = 4.09$, $SD = 6.95$) was statistically significant, $t(53.38) = 2.07$, $p = .04$ despite equal variances not assumed, hence hypothesis 3a was supported. This suggests that management reported lesser workplace injuries as compared to non-management staff and it did represent a small to medium effect size, $r = .27$.

4.6.3 Job classification.

Hypothesis 1i. It was hypothesised EWB would be poorer for shift workers than non-shift workers for the Singapore sample in the manufacturing sector. The EWB score for shift workers ($M = 3.52$, $SD = 0.53$) and non-shift workers ($M = 3.66$, $SD = 0.41$) was not statistically significant, $t(27.08) = -1.2$, $p = .23$ and homogeneity of variance

was also not assumed, thus hypothesis 1i was not supported. This implies that employee perception of well-being at the workplace is no different between shift and non-shift workers.

Hypothesis 2i. It was hypothesised that safety climate would be poorer for shift workers than non-shift workers for the Singapore sample in the manufacturing sector. The safety climate score for shift workers ($M = 2.74$, $SD = 0.21$) and non-shift workers ($M = 3.17$, $SD = 0.35$) was statistically significant, $t(34.37) = -7.32$, $p < .001$ despite equal variances not assumed, hence hypothesis 2i was supported. This suggests that the shift workers rated lower safety climate at the workplace as compared to non-shift workers and it did represent a medium to large effect size, $r = .54$.

Hypothesis 3h. It was hypothesised that individual workplace injuries would be more for shift workers than non-shift workers for the Singapore sample in the manufacturing sector. The number of workplace injuries for shift workers ($M = 6.28$, $SD = 9.37$) and non-shift workers ($M = 1.94$, $SD = 3.22$) was approaching significant, $t(19.79) = 2.05$, $p = .054$ and homogeneity of variance was also not assumed, thus hypothesis 3h was not supported. This indicates that the number of workplace injuries is no difference between shift and non-shift workers.

4.7 Mediation Analysis

Mediation analysis was used to test for mediation effect between the predictor variable, EWB and the outcome variable, injuries, with the mediator variable, safety climate. Mediation analysis was conducted using the *PROCESS* command developed by Preacher and Hayes (2004), as recommended by Field (2013). Figure 2 shows a diagram of a basic mediation model.

Simple Relationship



Mediated Relationship

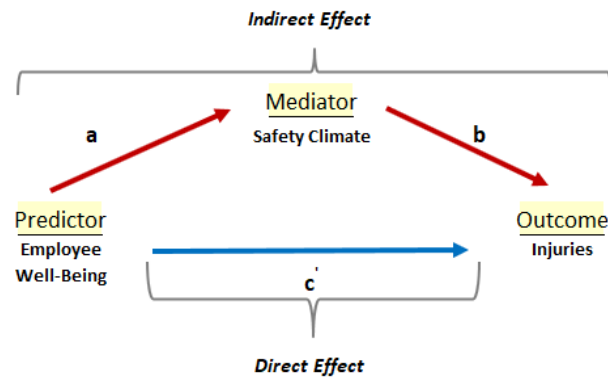


Figure 2. Diagram of a basic mediation model.

The mediation hypothesis was assessed by estimating the indirect effect between the predictor and the mediator variable. This indirect effect combines the effects of path *a* and path *b* and is illustrated in Figure 2. The size of the indirect effect was reported using bootstrap confidence intervals, and R^2 which express the contribution of variance to the outcome variable (Field, 2013). The kappa-squared (κ^2) measure, which expresses the indirect effect as a ratio to the largest possible indirect effect is no longer available in the 2019 *PROCESS* v3.3; hence, this will not be reported.

From the correlation, t-test and ANOVA, four demographical control variables were identified, and they are age, tenure, working hours and hierarchy classification. If the indirect effect was significant, then mediation was said to have occurred. Bootstrapping was performed to generate confidence intervals around the indirect effect. The confidence interval (CI) for the indirect effect was a BCa bootstrapped CI (bias-corrected and accelerated confidence interval) based on 1000 samples, at a 95% interval.

Hypothesis 2a proposed that safety climate would act as a mediator between EWB and individual workplace injuries for the Singapore sample in the manufacturing industry. It was predicted that EWB would be associated with higher safety climate, which in turn be associated with reduced injuries. EWB significantly predicted safety climate, $\beta = .53$, $t = 6.87$, $p < .001$. Among the control variables, working hours has the most effect based on the standardised coefficient as displayed in Table 8. In this model, EWB explains 35.3% of the variance in safety climate when age, tenure, working hours and hierarchy were included as control variables. This relationship was positive which implies that as EWB increases, safety climate also increases.

Table 8.

Model coefficients for mediation analysis path a with four covariates

			β	t	p
Predictor	EWB	a	.53	6.87	.00
Controls	Age	c ₁	-.12	-.99	.33
	Tenure	c ₂	.06	.46	.65
	Hierarchy	c ₃	.06	0.81	.42
	Work Hours	c ₄	-.22	-2.93	.00

$$R^2 = 0.35$$

$$F(5,124) = 13.56, p < .001$$

EWB did not significantly predict for individual workplace injuries when safety climate was included in the model, $\beta = -.08$, $t = -.83$, $p = .41$; safety climate was approaching significant when predicting individual workplace injuries, $\beta = -.19$, $t = -1.94$, $p = .055$. However, among the control variables, working hours and hierarchy classification had a significant effect on the model as displayed in Table 9 (pg. 79). This model explained that 20.1% of the variance in individual workplace injuries when age, tenure, working hours and hierarchy were included as control variables. This relationship was negative which suggests that as EWB and safety climate increases, individual workplace injuries decreases.

Table 9.

Model coefficients for mediation analysis path b and c' with four covariates

			β	t	p
Predictor	EWB	c'	-.08	-.83	.41
	Safety Climate	b	-.19	-1.94	.06
Controls	Age	c ₁	.06	.48	.63
	Tenure	c ₂	-.03	-.25	.81
	Hierarchy	c ₃	-.18	-2.08	.04
	Work Hours	c ₄	.25	2.85	.01

$R^2 = 0.20$
 $F(6,123) = 5.17, p < .001$

When safety climate was not in the model, EWB did significantly predict individual workplace injuries, $\beta = -.19, t = -2.14, p = .03$. Among the control variables, working hours and hierarchy classification also had a significant effect on the model as illustrated in Table 10. This model explained that 17.7% of the variance in individual workplace injuries when age, tenure, working hours and hierarchy were included as control variables. This relationship indicates that as EWB increases, individual workplace injuries decreases.

Table 10.

Model coefficients for mediation analysis total effect with four covariates

			β	t	p
Predictor	EWB	c	-.19	-2.14	.03
Controls	Age	c ₁	.09	.65	.52
	Tenure	c ₂	-.04	-.32	.75
	Hierarchy	c ₃	-.19	-2.2	.03
	Work Hours	c ₄	.29	3.42	.00

$R^2 = 0.18$
 $F(5,124) = 5.33, p < .001$

The indirect effect of EWB on individual workplace injuries through safety climate was significant, $b = -.10, BCa\ CI [-.20, -.02]$. Therefore, hypothesis 2a was supported. These results are present in Figure 3 and 4 (pg. 80).

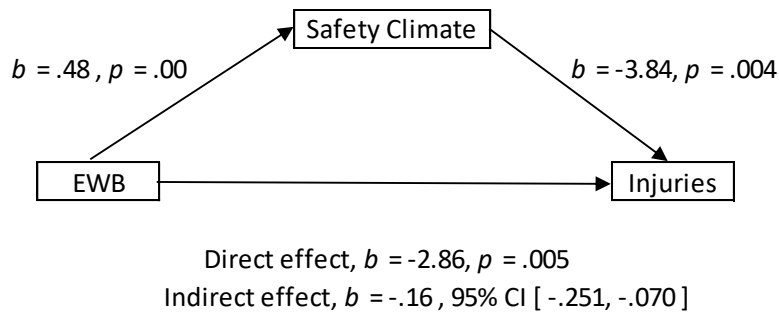


Figure 3. Model of EWB as a predictor of injuries, mediated by safety climate without covariates.

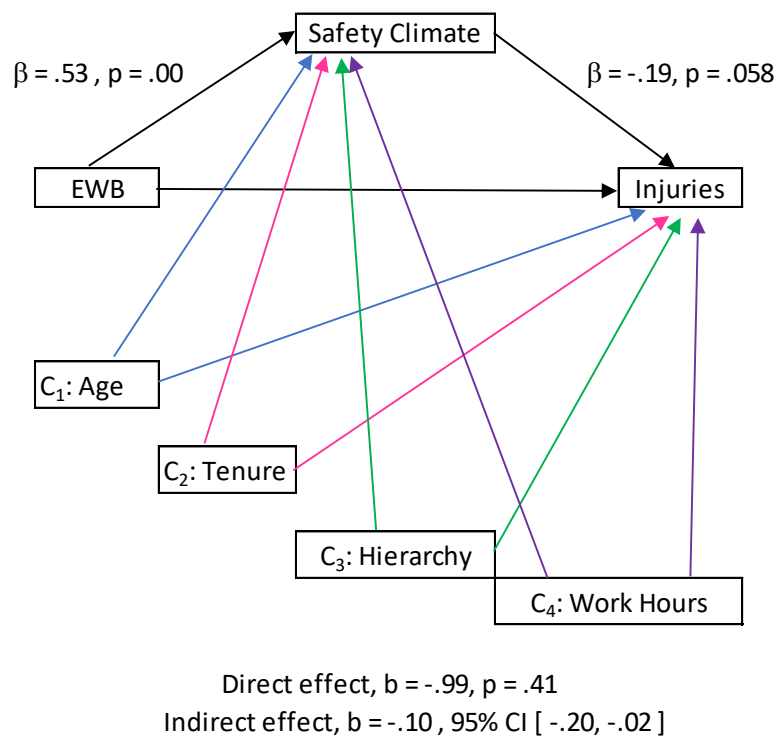


Figure 4. Model of EWB as a predictor of injuries, mediated by safety climate with four covariates.

Summary

This chapter reports the findings from the data analyses for this study. Overall, the results indicated that most of the direct hypotheses were supported, and several non-significant but interesting relationships found between key variables and covariables as illustrated in Figure 5 (pg. 81). These results will be discussed in chapter 5 together with findings from previous research. Additionally, the strengths and limitations of this study will also be discussed, including directions for future research.

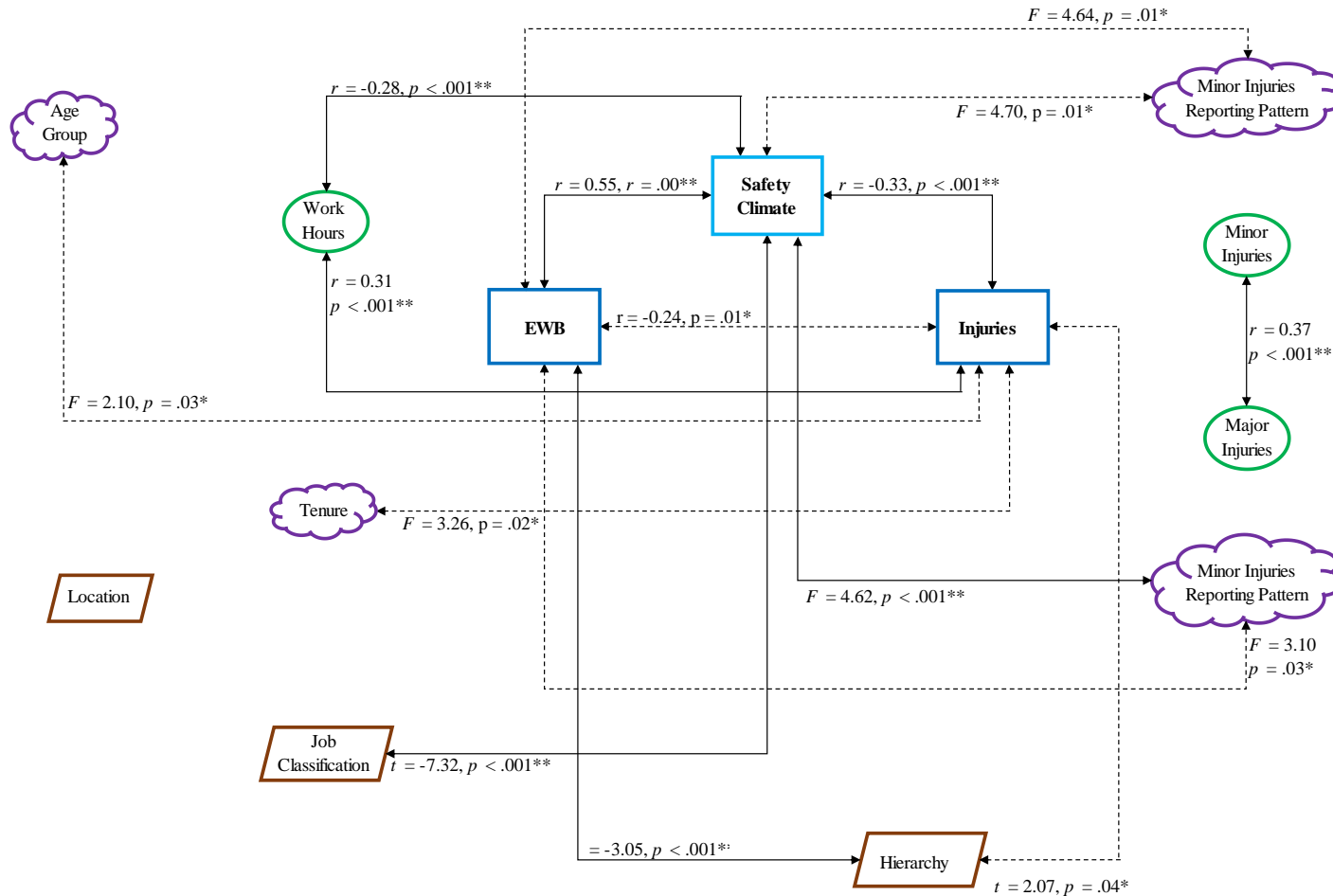


Figure 5. Framework showing association between variables

* $p < .05$, ** $p < .001$

Chapter Five: Discussion

The current study was designed to explore gaps in positive psychology literature on EWB, safety climate research and workplace injuries in an Asian context. In exploring the current gap among the three domains, the study was designed to make two main contributions. Firstly, it examines the role of EWB from a positive psychology perspective using the PERMA model and the association with workplace injuries, via safety climate. Secondly, to assess the presence of EWB, safety climate and injuries in the Asian context, Singapore.

It is essential to investigate EWB as past research indicated mixed reviews on the EWB of Singapore's workforce, with the majority reflecting non-optimistic results (Cigna Corporation, 2018; Kathirasan, 2015). Furthermore, Singapore's manufacturing sector had the highest overall injury rate from 2011 onwards (Ministry of Manpower, 2018b). Besides, Singapore has a strong focus and comprehensive legislation regarding workplace safety and health, and how the safety climate mediates the relationship between EWB and workplace injuries will be valuable to employers. Apart from the three main variables, certain demographical variables were also examined due to the relevance highlighted during the literature review. Participants were employees working in Singapore's manufacturing sector which includes industries such as energy and chemicals, life sciences, food and beverage, medical technology, metal, machinery and engineering, and smart automation (SMF, 2018).

The results of this study supported most of the proposed hypotheses. This chapter discusses the main findings from this research including possible reasons why some of the hypothesised relations which were not supported are also discussed. This chapter is structured into several sub-sections following the ensuing format: examination and discussion of direct relationships between EWB, safety climate and injuries; examination and discussion of demographics and key variables; discussion and interpretation of the mediation analysis and results; discussion of practical, theoretical implications, strengths and limitation of current study; suggestions for future research and concluding remarks.

5.1 Key Variables

From the correlational analysis conducted on the key variables EWB, safety climate and individual workplace injuries in the manufacturing sector of Singapore, it is found that hypotheses 1a, 1b, 2a and 3g were all supported. These hypotheses discussed below are about relevant literature including the implications for organisations.

5.1.1 EWB and safety climate.

Hypothesis 1a was supported: EWB was positively correlated with employee perception of safety climate at the workplace, indicating that as EWB improves, so does safety climate. Higher EWB allows the employee to expand their cognitive processing to incorporate the safety aspects of work in the hazardous environment of the manufacturing sector (Neal & Griffin, 2006). Table 6 (pg. 69) shows that within the EWB construct, positive emotions, meaning and engagement are the top three dimensions that are positively associated with the safety climate perception of an employee at the workplace. This finding is essential as EWB can be a precursor for safety perception at the workplace. Hence, employers in Singapore manufacturing sector can target interventions concerning the top three dimensions to improve safety climate at the workplace.

5.1.2 EWB and individual workplace injuries.

Hypothesis 1c was supported: EWB was negatively correlated with individual workplace injuries, demonstrating that when EWB improves, injury rate at the workplace reduces. Table 6 (pg. 69) illustrates that within the EWB construct, having meaning in one's job and possessing positive emotions at work have more influence on workplace injuries followed by the negative aspects of work and positive relationships with co-workers. This finding is important as EWB can also be a precursor for mitigating personal workplace injuries. Although previous research also mentioned in the reverse association, where employees that have been injured will have reduced well-being at the workplace (McEvoy, 2016). Nevertheless, when human life is at stake employers will want to err on the safe side and take a proactive approach.

Since both EWB significantly correlate with safety climate and injuries, organisations can look into interventions that can improve employee's EWB at the

workplace such as constructive leadership training (Arnold et al., 2007; Li et al., 2014; Roche, 2010), character strengths building (Niemic, 2013), Psy. Cap (Yongduk & Dongseop, 2014), self-awareness training (Sutton, Williams, & Allinson, 2015) and other areas of well-being programs targeted at physical health, psychological health, or energy level just to name a few (Fenton, Pinilla Roncancio, Sing, Sadhra, & Carmichael, 2014; Sutton, Evans, Davies, & Lawson, 2016).

5.1.3 Safety climate and injuries.

Hypothesis 2b was supported: Safety climate was negatively correlated with individual workplace injuries, indicating that as ratings for safety climate increases, the injuries at the workplace decreases. Table 6 (pg. 69) displays that within the safety climate construct, the top three dimensions associated with workplace injuries are management safety justice (D3), management safety priority, commitment and competence (D1), and workers' safety priority and risk non-acceptance (D5). This finding has implications for organisations, particularly for those that have low safety climate scores or has high workplace injuries reported. Thus, employers in Singapore manufacturing sector can target interventions concerning the top three dimensions to reduce workplace injuries. The top two dimensions revolve around management behaviours and actions, and safety-enhancing leadership training for management employees have been proven to be beneficial (Brooks, 2017; Clarke, 2013; Shen et al., 2017). Overall, organisations should be striving to create a workplace where the safety policies and guidelines are coherent with safety behaviour and actions of employees.

5.1.4 Severity of individual workplace injuries.

Hypothesis 3b was supported: Minor injury count was positively correlated with major injury count, demonstrating that as the number of minor workplace injury increases, so do the number of major injuries. Even though previous studies within literature review have not explored this relationship, this finding has implications for organisations; especially when there is an increase in minor injuries reported, it might be an indication to intervene on safety before situations deteriorate leading to major injuries. Table 4 (pg. 65) shows that 22.1% of the reported injuries are major injuries, and they could be mitigated if measures were taken on 77.9% of minor injuries reported.

5.2 Demographics and Key Variables

From the statistical analyses conducted for the demographic variables and key variables in the manufacturing sector of Singapore, supported and non-supported hypotheses were discussed below about relevant literature including the implications for organisations.

5.2.1 Working hours.

Exploring hypotheses 1e, 2e and 3d, current research that examines working hours suggest that employees who worked long hours are more likely to have poorer EWB, lower safety climate perception and more workplace injuries.

Hypothesis 1e was partially supported: Working hours will be negatively correlated with EWB for employees. Despite the correlation indicating the number of work hours increases, the EWB rating reduces. However, the correlation was not statistically significant. There were several potential influences of external factors as to why this hypothesis was not fully supported. Firstly, among the participants there are 15.6% of shift workers (Table 4, pg. 65) and their total working hours are based on a shift schedule arrangement which is unlike typical office hours. Secondly, although the participants were all from the manufacturing sector, the job scope disparity in different industries (e.g., petrochemical vs food and beverage manufacturing) between shift workers and non-shift workers may impact the significance of the correlation as previous research shows that shift workers have inherently lower well-being due to the atypical working hours and conditions (Caza & Wrzesniewski, 2012).

Hypothesis 2e was supported: Working hours will be negatively correlated with safety climate, indicating that as the number of working hours increases, the perception of safety climate at the workplace reduces. This finding is in line with Lu and Chou (2017) and Grosch et al. (2006) on how presentism or extended work hours will lead to adverse behaviours and compromise safety perception of the work environment.

Hypothesis 3d was supported: Working hours will be positively correlated with injuries, demonstrating that as the number of working hours increases, so do the number of individual workplace injuries. This result aligns with previous research on how extended working hours affect sleep and vitality, work-home

conflicts which make employees more susceptible to injuries due to cognitive malfunction and inability to concentrate at work (Grosch et al., 2006; Jeffrey et al., 2014).

These findings from hypotheses 2e and 3d have implications for organisations, particularly those employees that have records of high overtime. Hence, organisations may want to intervene and review the competency of the employee or the reasonability of employee's workload to combat safety climate and workplace injuries.

5.2.2 Tenure.

Examining hypotheses 1f, 2f and 3e, current research that explores tenure suggests that EWB and safety climate perception will be poorer, and workplace injuries will be more for short tenure group than long tenure group in an organisation. There are four categories of job experience which consist of 6 months to 5 years, 6-15 years, 16-25 years, and above 26 years.

Hypothesis 1f was not supported: EWB was not statistically different among the four tenure groups. This suggests that EWB at the workplace is no different when one joins the organisation for six months or when one has worked there for more than 26 years.

Hypothesis 2f was not supported: Safety climate perception was not statistically different among the four tenure groups, which indicates that employee perception of safety climate of the workplace is not different regardless an employee has worked six months or 26 years for that organisation. The result is not in line with prior research, and one potential reason might be because Singapore's WSH is governed by strict legislation and hefty penalties for safety non-compliance, hence employers might have performed their due diligence in ensuring the physical safety of the working environment in conforming to safety standards.

Hypothesis 3e was not supported: Shorter tenure groups did not report more workplace injuries than long tenure group. However, workplace injuries were significantly different for three out of four tenure groups, and result illustrates that employees with work experience between 16-25 years have the highest injury count as compared with employees with work experience between 6-15 years and those above 26 years with the least injury count. This finding is not aligned with previous

studies but still has implications for organisations particularly for those who have a substantial number of long-serving employees or employees that are approaching that seniority range (Castillo-Rosa et al., 2017; Cooper & Phillips, 2004). Thus, organisations might intervene with the safety awareness training program as a refresher at intervals to mitigate complacency or other personal resource-related training such as PsyCap (Bergheim et al., 2013) or mindfulness (Dierynck et al., 2016; Zhang & Wu, 2014) to reinstate the importance of safety at the workplace.

5.2.3 Age.

Exploring hypotheses 1g, 2g and 3f, current research that explores age suggests that EWB and safety climate perception will be poorer, and workplace injuries will be more for young age group than old age group. Ten age groups were referenced according to Singstat (2017) with a four years range starting from 20-24 years, 25-29 years, 30-34 years, 35-39 years, 40-44 years, 45-49 years, 50-54 years, 55-59 years, 60-64 years, and 65-69 years.

Hypothesis 1g was not supported: EWB was not statistically different among various age groups despite older employees did report higher EWB as compared to their younger co-workers. One of the possible reasons for non-significances might be due to the overall smaller sample size as compared to previous studies.

Hypothesis 2g was not supported: Safety climate perception was not statistically different among various age groups meaning regardless of an employee's age, their safety climate score is not significantly different. The result is not aligned with previous studies, and one potential explanation in the context of the manufacturing sector in Singapore might be due to the legislation implications for safety non-compliance. Hence, the organisation ensures that workplace safety is addressed across all employees.

Hypothesis 3f was not supported: Younger age groups did not report more workplace injuries than older age groups. However, workplace injuries were significantly different for six (age 30 to 59) out of ten age groups. Results illustrate that employees aged between 45 to 49 years old reported the most injuries and age 50 to 54 years old reported the least injuries. This finding is not in line with literature but still has implications for employers, where the extra emphasis is necessary for

injury prevention for the workforce that falls into the injury-prone age group (Castillo-Rosa et al., 2017).

5.2.4 Injury reporting pattern.

Exploring hypotheses 1d, 2d and 3c, current research that explores injury reporting patterns suggest that EWB and safety climate perception will be better, and workplace injuries will be lesser for employees who report injuries than not reporting injuries. Injury reporting pattern was referenced based on researcher's work experience in the manufacturing sector where minor injury reporting were divided into 3 groups (Group 1: yes, verbally; Group 2: yes, through near-miss; Group 3: no), and major injury reporting were divided into 4 groups (Group 1a: yes, verbally; Group 2a: yes, through near-miss; Group 3a: yes, through incident report; Group 4a: no).

Hypothesis 1d was supported: EWB was significantly better for employees who reported minor and major injuries than those that did not report. An employee who reported minor injury via near-miss which is the proper channel rated higher EWB as compared to an employee who did not report minor injuries. Similarly, employees who reported major injury via incident report which is the proper channel rated higher EWB as compared to employees who only verbally report to the supervisor. This finding is in line with literature which illustrates that employees with a positive attitude are more likely to report an injury when an incident occurs (Probst & Graso, 2013). Positive thinking and feelings are relevant to EWB, where previous studies associate with productive behaviour and performance (Ágota et al., 2017; Jeffrey et al., 2014). Practical implications for organisations especially those that have poor EWB and low reported injuries, as findings might not be that injury count is low, but the underreporting pattern is high. When an injury goes unreported, no investigation will be conducted, and no appropriate measures will be implemented to prevent similar occurrence which may lead to more severe injury which is reflected in Hypothesis 3b.

Hypothesis 2d was supported: Safety climate was significantly better for employees who reported minor and major injuries than those that did not report. An employee who reported minor injury via near miss rated higher safety climate perception as compared to employees who did not report minor injuries. Similarly,

employees who reported major injury via incident report rated higher safety climate perception as compared to employees who did not report or only verbally report to the supervisor. This finding resonates with prior literature which found that when employees in the organisation have high safety climate perception, they are more likely to comply with appropriate safety behaviour (Jiang & Probst, 2015). In this study, reporting minor injuries through near-miss and major injuries through an incident report are appropriate behaviours. Considering the medium effect size of these analyses, this has substantial implications for organisations especially those that have inadequate safety climate and low reported injuries. This trend amplifies the need to unveil the unreported injuries which may eventually accumulate and lead to a snowball effect if left unattended.

Hypothesis 3c was not supported: Workplace injuries were not statistically different for various minor and major injury reporting patterns. This suggests that the severity of injuries is not affected by the injury reporting pattern, which contradicts the inferential linkage between injury reporting pattern and workplace injuries. Nevertheless, one potential explanation is that the injury count is positively skewed which may impact the ability to achieve significance.

Overall, findings illustrated that the reporting pattern of injury does impact the EWB and safety climate of an employee. This means that when an employee gets injured at the workplace and abide safety protocols by reporting injuries through proper channel, the appropriate behaviour significantly influenced their well-being and safety perception of the workplace. Approximately 50% of the respondents in the Singapore's manufacturing sector did not report injuries regardless of severity, and this corresponds with data from the USA which is between 33% to 69% (Leigh et al., 2004). This finding warrants attention from employers in the manufacturing sector in Singapore to investigate the underlying issues for discrepancies in injury reporting.

5.2.5 Location.

Exploring hypotheses 1h, 2h and 3g, current research that explores location suggest that EWB and safety climate perception will be poorer, and workplace injuries will be more for employees working on Jurong Island than on mainland Singapore. Jurong Island houses hazardous heavy-duty manufacturing sites and is purely an

industrial area whereas mainland Singapore is a combination of light-duty manufacturing sites, commercial and residential areas.

Hypothesis 1h, 2h and 3g were not supported: EWB ratings, safety climate perception and injury count for Jurong Island and the mainland, Singapore was not significantly different between both work locations. The results converse from previous studies which might be attributed to the size of the country in which the sample is studied as Singapore is a relatively small country in terms of land mass. Alternatively, this finding may also suggest that national legislation on caring for employee's well-being and safety or the sharing of best practices within the manufacturing sector is well established. Therefore, no significant difference regardless of geographical work location.

5.2.6 Hierarchy classification.

Exploring hypotheses 1b, 2c and 3a, current research that explores hierarchy suggest that EWB and safety climate perception will be better, and workplace injuries will be lesser for management employees than non-management employees.

Hypothesis 1b was supported: EWB ratings were significantly better for management employees than non-management employees, which imply that management staff rated higher EWB as compared to non-management staff. Although previous studies within the literature review have not explored this relationship, this finding has implications for organisations, especially when implementing EWB guidelines and programs. Employers will want to take into consideration the specific needs of employees from different hierarchy classification, especially the non-management employees instead of using the one-size fits all approach.

Hypothesis 2c was not supported: Safety climate score perception was not significantly different between management and non-management employees. The results were not aligned with previous studies, and possible explanation apart from the legislative context about the country may be attributed to the small sample size as non-management employees only account for 33.3% (Table 4, pg. 65).

Hypothesis 3a was supported: Workplace injuries were significantly lesser for management employees than non-management employees, where management staff reported two times lesser injuries as compared to non-management staff. The

result is consistent with Beus et al. (2010) which has practical implications on employers, especially when developing and implementing injury prevention programs to emphasise on non-management employees.

Overall, results indicate that management staff reported higher EWB and lower workplace injuries as compared to non-management staff. This might be because management employees might have more organisational resources at their disposal or better personal resources such as coping techniques, mindfulness and psy. Cap. Hence, apart from considering the hierarchy classification when implementing EWB or injury prevention interventions, the organisation will also want to increase resources available for non-management employees through human resource management or training and development.

5.2.7 Job classification.

Exploring hypotheses 1i, 2i and 3h, current research that explores job type suggest that EWB and safety climate perception will be poorer, and workplace injuries will be more for shift workers than non-shift workers.

Hypothesis 1i was not supported: EWB ratings were not significantly different between shift and non-shift workers. This result is contrary to previous findings, one of the potential explanations might be because in Singapore, there is specific legislation to protect the welfare of employees and despite being a developing country (United Nation, 2014), Singapore has a strong union presence.

Hypothesis 2i was supported: Safety climate perception was significantly poorer for shift workers than non-shift workers, where shift workers rated safety climate lower as compared to non-shift workers. The result corresponds to literature as shift workers are at the frontline of production and face more safety-related conflicts as compared to non-shift workers (Nielsen et al., 2016). This finding has practical implications on employers, especially when designing safety awareness programs or when management disseminate safety-related information with greater emphasis to the shift workers as they are susceptible to poorer safety climate perception.

Hypothesis 3h was not supported: Workplace injuries were not significantly different between shift and non-shift workers, despite shift workers reporting three times more injuries compared to non-shift workers. This finding is conflicting with

previous findings, and one of the potential explanations may be attributed to the insufficient representation of shift workers which is less than 20% of the sample (Table 4, pg. 65) and the overall skewed injury count (Table 5, pg. 66).

5.3 Mediation Analysis

Exploring hypotheses 2a, current research that examines safety climate as a mediator suggests that the relationship between EWB and individual workplace injuries will be mediated by safety climate.

Hypothesis 2a was supported: Safety climate did act as a mediator variable between EWB (predictor variable) and individual workplace injuries (outcome variable) without and with four control variables as illustrated in Figure 3 and Figure 4 (pg. 80). The control variables involved in the mediating relationship are age, tenure, hierarchy and work hours. This suggests that the individual and contextual variables influence the extent to which safety climate act as a mediator, possibly due to the overlapping constructs between safety climate dimensions and control variables.

Caza and Wrzesniewski (2012) mentioned that duration and pattern of work schedules profoundly impact where and how one lives and their association with work goals, social bonds and health. This explains why work hours have the most impact on the mediation relationship for both direct and indirect pathway. Furthermore, Griffin and Curcuruto (2016) explained that management employees have additional responsibilities as compared to non-management employees. For example, management employees need to be involved in safety-related activities and display certain behaviours so that they can be role models for their subordinates and also display a commitment to their superiors. Some management employees want to because of the congruence with organisational goals, while other management employees need to because it is part of the job scope. This clarifies why hierarchy classification impacts the mediation relationship.

Within the literature review studies with safety climate as a mediator did not explicitly control for age and tenure. However, some question in the EWB and safety climate appears to resonate with the two control variables. For instance, in the relationship dimension of EWB, questions such as “I am satisfied with my workplace relationships” or “In most cases, I can count on my colleagues” can be

responded with a higher affirmation for a long tenure employee as compared to someone who joins the company for six months. Likewise, for safety communication, learning, and trust in co-workers safety competence (D7) dimension of safety climate, questions such as “we who work here feel safe when working together” or “we who work here have great trust in each other’s ability to ensure safety” may potentially reflect the length of service in the organization. This is because to feel safe and to establish trust among co-workers requires time, and with time it also comes with age.

These findings indicate that employers in the manufacturing sector in Singapore should also pay attention to age, tenure, hierarchy classification and work hours when interpreting EWB and safety climate ratings of employees. This can help the organisation to devise customised interventions for more effective results.

5.4 Implications of Current Study

5.4.1 Practical implications.

This research explored the influence of EWB on individual workplace injuries and how this relationship is mediated by the safety climate perception of the work environment. Firstly, findings illustrated that EWB could be a precursor for improving safety climate and mitigating injuries at the workplace. There are a range of interventions in the market to improve EWB from an organisation level (e.g. employee assistance programme for psychological health, managing stress, anxiety, anger; discounted gym membership, in-house exercise programmes or team sports to promote healthy lifestyle, provide health-related information and employee bonding), and at an individual development level (e.g. leadership and self-awareness training, character strengths building).

Secondly, for safety climate especially in terms of management behaviours and actions, has shown to impact workplace injuries negatively. Hence, providing safety-enhancing leadership training for management employees may be a plausible remedy. While doing so, the organisation should not neglect the non-management employees as they tend to rate themselves lower in EWB and reported more workplace injuries. Since non-management employees tend to have less organisational resources at their disposal compared to management employees, the employer may want to look into human resource training and development for non-

management employees to increase their personal resources such as work-based coping mechanisms, mindfulness and PsyCap.

Thirdly, the organisation's health and safety personnel need to intervene when minor injury count is on an increasing trend as minor injuries are positively associated with major injuries. However, the employer needs to primarily foster desirable safety behaviour for reporting injury via the appropriate channel as EWB and safety climate perception will suffer when employees fail to report workplace injuries through the proper platform. Especially if an organisation has poor EWB and low injury counts, this observation warrants further investigation as it may suggest that underreporting is high.

Fourthly, organisations involving shift work will want to give greater emphasis to shift workers when designing and implementing safety-related information as they are susceptible to poorer safety climate perception of the workplace. Furthermore, paying attention to common demographics can also be a source of intervention for the organisation in terms of mitigating workplace injuries. One area to observe would be on prolonged working hours negatively impacting EWB, safety climate and injuries at the workplace. Hence, frontline managerial personnel may have to look at employee's work hours, especially those with high overtime records or exhibit presentism behaviours and review their workload. The other two essential demographics that are associated with workplace injuries are tenure and age. The organisation will want to pay extra emphasis on long-serving employees particularly those with 16 to 25 years of work experience and employees that fall between 45 to 49 years old as they reported more individual workplace injuries. Thus, an employer might conduct safety awareness training as a form of a refresher to mitigate complacency or develop employee's personal resources (e.g. PsyCap and mindfulness) to reinstate the importance of workplace safety for the susceptible age and tenure group of employees.

Additionally, approximately 50% of workplace injuries go unreported (Table 7, pg. 72), and this raises a red flag at an organisational and national level. The fact that the participation of non-management and shift employees are less than half the sample may suggest their indifferent attitude towards the area of EWB, safety climate and workplace injuries. Having an indifferent attitude towards such

essential employee topics also raises concern to organisations, which might be due to the barriers of organisation leadership (Chen & Tan, 2015). In conclusion, to reduce injuries at workplace, the organisation needs to work on various aspects of EWB and safety climate of the work environment, while paying close attention to specific demographics which can influence the association. Since the major and minor injuries statistics of Singapore have been relatively stagnant for the past eight years (Ministry of Manpower, 2018b), organisations may want to combat safety-related outcomes by first taking care of their employee's well-being at workplace.

5.4.2 Theoretical implications.

This study made two theoretical contributions. Firstly, this research has examined how the collaboration of two major constructs, EWB and safety climate and their association with workplace injuries. The hypotheses in this study were formulated using the positive psychology perspective PERMA model of EWB developed by Hungarian researchers and safety climate dimensions developed by Norwegian researchers. Besides, both the EWB and safety climate instrument were exposed for the first time to Singapore's manufacturing context, which expands the database on cross-cultural and cross-sector application. Although the inter-correlation matrix among dimensions is acceptable, the compatibility of both instruments with Singapore sample will require further analysis for future research. Almost half of the proposed hypotheses were supported, and these findings from the Singapore population contribute to the literature in EWB and safety climate for the Asian sample. This proposes that both EWB and safety climate models and understandings developed in the western culture are partially supported in eastern context.

Secondly, for the remaining hypotheses that were not empirically supported illustrates that instruments of western origins are still inadequate in capturing the difference and therefore, requires adaptation to encompass the Asian culture. For instance, EWB, safety climate and workplace injuries were not poorer for short tenure and young age groups for participants in Singapore comparing to western countries. The association between EWB and tenure may potentially have cultural influence as studies reviewed in section 1.4.2 have a western origin (e.g. USA and Spain) which is more individualistic comparing to Singapore which is of a collective nature. Thus, an employee's approach towards long-term establishment within an organisation may be culturally dependent as highlight in chapter 2. Additionally,

the researcher may want to consider national employment legislation when interpreting results, especially when reviewing studies conducted in the USA as it may also affect the length of service within an organisation. This is because the USA has at-will employment act which allows the employer to dismiss an employee for any reason without warning (National Conference of State Legislatures, 2008) which does not exist in Singapore (Ministry of Manpower, 2019). As for the association of EWB and age, other potential influences may be country's economic performance as it affects the labour market movement, employment rate and employment condition (López Ulloa et al., 2013). Hence, a country's employment legislation and economic status may very well impact employee's perception of job security, which in return influences EWB and other safety-related outcomes (Probst, 2004).

5.4.3 Strengths of current study.

One of the strengths of this study was that it surveyed participants from specifically the manufacturing sector, which reduces the confound due to industry differences. Furthermore, the study was conducted using the Singapore population where such research is required but lacking. While previous research examined the key variables of EWB and safety climate, this research also incorporated a variety of common demographic variables that can potentially influence EWB, safety climate and injuries, thus controlling for their effects. This allows the employer to effectively utilise the information that is readily available when contemplating interventions on EWB and safety climate. This study used already validated measures for analysing EWB and safety climate, which adds to the validity of the study. Lastly, this research adds to the current literature which suggests EWB and safety climate are precursors for preventing individual workplace injuries which prove to be present in the non-western sample.

5.4.4 Limitations of current study.

The current study is limited in sample size and lacks a representative portion of non-management employees and those working on rotating shift, which may have contributed to the approaching significant and non-significant findings for relevant hypotheses (De Vaus, 2002). Regression analysis could have been conducted if twice the sample size was available for more in-depth analysis in EWB and safety climate dimensions, which may lead to increasing the ability to predict the outcome

variable. Another limitation of this study was its cross-sectional design, which does not imply causation (Field, 2013) and measures gathered were all self-report scales which produces variances in responses such as halo effect and socially desirable responding leading to common method bias (Donaldson & Grant-Vallone, 2002), hence it is important to take note when interpreting results. This study targeted the manufacturing sector. Thus, the generalizability to other sectors such as healthcare, finance or marine, to name a few will be limited. The overall survey is quite lengthy with 123 questions which may have contributed to approximately 20% of incomplete data from participants. From the free-text segment, participants with complete data also feedback that survey comprised of too many questions and was time-consuming.

5.5 Future Research

The current study for the manufacturing sector in Singapore not only confirms the association of EWB and safety climate with injuries but also highlights the top dimensions of EWB and safety climate, demographic variables and their association with workplace injuries. Hence, future studies can explore the highly recommended interventions (e.g. mindfulness, Psy. Cap, leadership training) proposed by previous researchers on improving EWB and safety climate based on relevant dimensions where employees can display discretionary efforts towards improving safety-related outcomes. For instance, using a longitudinal research design with pre- and post-test for participants from an organisation in the manufacturing sector in Singapore and implement well-being program(s) for employees in specific age and tenure group, hierarchy and job classification. Research can examine the effectiveness of interventions on EWB, safety climate and workplace injuries. Given the gap in positive psychology perspective on EWB and safety climate literature in Asia context, this lays a foundation for continuous examination and improvement of organisational life in Singapore and other non-western countries.

5.6 Conclusion

This study examined how work-related employee well-being potentially influences the safety climate perception of employees in the work environment, that may lead to individual workplace injuries for the workforce from the manufacturing sector in Singapore. The findings show that work-related employee well-being correlated significantly with safety climate and workplace injuries, and safety climate act as a

mediator between work-related employee well-being and workplace injuries. The findings also show that some demographical variables impact the relationship among work-related employee well-being, safety climate and workplace injuries. Overall, the results indicate that there is a likelihood that the EWB and safety climate instrument may have overlapping variance with the demographical control variables. The results have implications for the organisations within the Singapore manufacturing sector that have relatively good EWB, and safety climate score and low injuries count may suggest some degree of under-reporting of workplace injuries. Singapore organisations should strive to create working environments that foster positive emotions and meaning at the workplace and develop management employees to walk the talk as these are highly correlated to safety-related outcomes. Employers need to focus on the needs of employees who have long working hours, within certain age groups and seniority as they are more prone to workplace injuries. Organisations could also give further consideration to non-management employees and shift workers when designing well-being programs and safety-related campaigns as they are susceptible to lower EWB and safety climate perception. Overall, effectively investing in the well-being of employees may significantly impact safety climate perception and safety-related outcomes.

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Appendix A

Invitation Letter to Organisation

To: Human Resource Manager

I am Mabelene Sim, currently a postgraduate student doing my Master of Applied Psychology (Organisational) at the University of Waikato, New Zealand.

Purpose

I would like to invite your organisation to take part in a research study I am conducting that examines how employee's well-being at work affects workplace injuries in the petrochemical industry (Jurong Island) in Singapore. Information regarding these associations are well-established in the western culture and have become a popular area of research in the eastern culture, but there is still a noticeable lack of research in Singapore.

The reason we want to know more about the relationship between well-being and workplace injuries is that globally, there are 2.78 million fatal work-related injuries and illnesses each year, and the economic impact of these injuries is estimated to amount to 3.94 percent of the global Gross Domestic Product, GDP¹. In Singapore, the manufacturing sector has the highest overall injury rate and is the second contributing sector to workplace fatal injuries at a rate of 1.2 per 100,000 employed persons². Additionally, a national wide survey shows that 43 percent of workers experience at least one dimension of work-related stress which potentially account for productivity loss of 51.3 days annually³. Therefore, it is critical for employers to be aware of aspects of employee well-being that may reduce injuries at the workplace.

Benefits to your organisation

Participating in this research is beneficial for the organisation as it provides a view of employee's well-being and their safety perceptions at work. At the end of the research study, your organisation will be given a report which indicates an overall employee's well-being status and their safety perceptions with respect to the workplace injury for those working in petrochemical industry, on Jurong Island in Singapore. Although the findings generated will be industry-level and not specifically for one particular organisation, it will still be of considerable value to the organisation. The industry-specific results from research can be used by organisation to elevate employees' perception on safety and well-being via interventions that are relevant for the organisation.

The information your employees give us will be used to help researcher to examine the relationship between well-being and workplace safety in Singapore and to give other people in the same position as yourself guidance on how to improve employee well-being and safety.

Eligibility of Participation

There are no right or wrong answers to the survey, and I am keen to gain a wide variety of opinions. Apart from being employees of a petrochemical company working on Jurong Island, I am looking for people who want to take part in this research study and who are:

- Permanent staff with English as their first language or has completed a workplace literacy (WPL) assessment. This is to ensure adequate English literacy as all survey will be only be available in English language.

If your organisation decides to take part in the study, I will ask for your assistance as follows:

- I will send an email including a link to survey portal, which will explain the objectives and relevance of the study, assure the respondents of anonymity and give them the option of not participating in the study if they wish.
- I would ask that you disseminate this email with the link to all eligible employees.
- I will also ask that two reminders be sent: after one week and after two weeks.

If any of this is not by usual procedures, please send me guideline and forms or contact me to discuss your requirements.

Conclusion

I have included an information sheet which explains the research in detail and a consent form. I am happy to review any of this with you and answer any questions you may have.

Thank you for your consideration of this request.

Yours sincerely,

Mabelene Sim

Appendix B

Information Sheet

Research Title

The Effects of Employee Well-Being on Injuries at the Workplace with Safety Climate as Potential Mediator

Researcher

I am Mabelene Sim, currently a postgraduate student doing my Master of Applied Psychology (Organisational) at the University of Waikato, New Zealand.

Thank you for showing interest in being a part of my research study. Your contribution is much appreciated.

Purpose of Research

The purpose of the research is to investigate the impact of work-related well-being on workplace injuries and the effect of safety climate in the petrochemical industry in Singapore.

This study is under the supervision of Dr Anna Sutton (anna.sutton@waikato.ac.nz) and Dr Maree Roche (maree.roche@waikato.ac.nz).

This research project has been approved by the School of Psychology Research and Ethics Committee of the Faculty of Arts and Social Sciences, University of Waikato. Any questions about the ethical conduct of this research may be sent to the convenor of the Research and Ethics Committee (e-mail ethics@waikato.ac.nz).

What Will Happen

In this research study, you will be asked to complete an online survey. It consists of a demographic section and three different questionnaires namely a safety climate questionnaire, work-related well-being questionnaire and an injuries questionnaire. It will take approximately 15 to 20 minutes to complete, and you can stop at any time by closing the browser.

This is a survey on how you feel when performing your duties at work and the number of injuries personally encountered while at work. This is not a test, so there are no right or wrong answers. Questions are aimed at discovering your true views, feelings and encounters at the workplace. These questions provide information that could be beneficial for improving how you feel at the workplace. Be as honest as you can and not answer how you might like it to be.

At the end of the questionnaire, please remember to click “DONE”, to certify that you have completed the study.

Confidentiality/ Anonymity

The data we collect does not contain any personal information about you. You do not need to provide your name. All your responses go directly to the researcher via

licensed software survey platform provided by the University of Waikato and will not go through your organisation. Therefore, you can be assured that your responses cannot be traced back to an individual for any appraisal or other human resource decisions. Results collected are solely for research purposes.

The researcher will keep all study records, and only the researcher and supervisor will have access to the records. At the conclusion of this study, the researcher may publish the findings. Information will be presented in a summary format, and you will not be identified in any publication or presentations.

Potential Psychological Risk

The questionnaire participation process is unsupervised, and there may be minimum psychological discomfort when trying to recall an accident or injury that happened at work. If you experience distress while doing the survey, you are welcome to discontinue the study at any point. If any aspects of the study triggered distress after you have completed the survey, please seek your organisation's "Employee Assistance Program" if available or you can call Samaritans of Singapore 24 hours hotline at 1800-221 4444.

Participants' Rights

The online survey will include a "Done" button at the end which you must click to indicate that you are finished. You may decide to stop being part of the study at any time before clicking this final button.

Funding

This research is done through the University of Waikato and has received no sponsorship or funds.

For Further Information

I will be glad to answer your questions about this study at any time. Feel free to contact me or my supervisors at:

Researcher

Mabelene Sim

Mobile: +64 021 1777634

Email: ms465@students.waikato.ac.nz

Supervisors

Dr Anna Sutton

Email: anna.sutton@waikato.ac.nz

Dr Maree Roche

Email: maree.roche@waikato.ac.nz

Findings Of Research Study

A summary of the research findings base on all participants working in petrochemical industry, on Jurong Island (not organisation-specific) will be communicated to participating organisations via email for dissemination to employees. All findings will be anonymous and cannot be traced to any individual.

Summary

By proceeding with the online survey, you are agreeing that: (1) you have read and understood the Information Sheet, (2) questions about your participation in this study have been answered satisfactorily, (3) you are aware of the potential risks, (4) you are taking part in this research study voluntarily, and (5) anonymised data only may be shared in public research repositories.

Appendix C



THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Research Participants Wanted

The purpose of the research is to examine the impact of *employee well-being* on *workplace injuries* and the effect of *safety climate* in the petrochemical industry on Jurong Island, Singapore.

The survey will take approximately 15-20 minutes. Responses will be strictly anonymous and confidential.

(All your responses go directly to the researcher, rest assured that your responses cannot be traced back to any individual for any appraisal or HR decisions)

If you would be interested in taking part, please follow the link below.

https://waikato.qualtrics.com/jfe/form/SV_1SP735vMkYGT88Z



Reference: <https://www.ethics.trade.org/events/ethical-insights-worker-well-being-right-or-privilege>



This research project has been approved by the School of Psychology Research and Ethics Committee of the Faculty of Arts and Social Sciences, University of Waikato. Any questions about the ethical conduct of this research may be sent to the convenor of the Research and Ethics Committee (e-mail ethics@waikato.ac.nz)

Appendix D
Questionnaire

Demographics

<u>S/N</u>	<u>Questions</u>	<u>Response</u>
1	Is English your first language?	Yes/ No
2	If English is not your first language, are you certified under Workplace Literacy Assessment (WPL)?	Yes/ No/ NA
3	Does your English ability allows you to attempt a full English Survey?	Yes/ No/ Maybe
4	Which gender do you identify most with?	Female/ Male/ Others
5	Please input your age?	Participants to input number
6	Please select your marital status.	single/ long-term partner/ married/ divorced/ others
7	Please indicate the number of children you have.	Participants to input number
8	Please input your Job Title.	Participants to input text
9	Do you work on Jurong Island?	Yes/ No
10	Please select you Job Hierarchy.	Management/ Non-Management
11	Please select your Job Classification part 1.	Shift worker/ Non-shift worker
12	Please select your Job Classification part 2.	Permenant Staff/ Contract Staff
13	How many members are there in your shift team?	Participants to input number
14	How many management members are there in your shift team?	Participants to input number

15	How many non-management members are there in your shift team?	Participants to input number
16	Please select a Job Role.	Production work/ maintenance work, warehouse operations, computer or office work/ laboratory work/ others
17	Please select the workspace where you spent most of your working hours. (you can select more than one option)	office environment/ production site/ laboratory/warehouse/ maintenance workshop
18	Which industry are you in?	Petrochemical/ oil & gas/ energy/ manufacturing/ others
19	How long have you been working in this petrochemical/oil & gas/ manufacturing sector?	Participants to input number
20	How long have you been working in this current organisation?	Participants to input number
21	How many hours do you work in a week from Monday to Sunday (on an average over the last 6months excluding overtime)?	Participants to input number
22	How many hours of overtime do you work in a week from Monday to Sunday (on an average over the last 6months)?	Participants to input number

Employee well-being

Please answer the following questions about your everyday work by indicating the extent of your agreement with the following sentences. Items marked with an asterisk were reverse scored.

1	2	3	4	5
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Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
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<u>S/N</u>	<u>Questions</u>	<u>Response</u>				
23	My job inspires me	1	2	3	4	5
24	I have unpleasant feelings about my work*	1	2	3	4	5
25	My job allows me to become completely absorbed in what I am doing	1	2	3	4	5
26	I turn plans into actions	1	2	3	4	5
27	I feel positive at work	1	2	3	4	5
28	I perform my tasks in full swing	1	2	3	4	5
29	My job performance is outstanding	1	2	3	4	5
30	I can turn to my colleagues with confidence	1	2	3	4	5
31	It is important to me that the work I do is useful	1	2	3	4	5
32	I am determined to achieve my goals	1	2	3	4	5
33	I try to find the positive in every situation	1	2	3	4	5
34	I am usually distracted during work*	1	2	3	4	5
35	I am satisfied with my workplace relationships	1	2	3	4	5
36	It is important to me that my work gives me a sense of purpose in my life	1	2	3	4	5
37	I am aware of my strengths required for the good performance	1	2	3	4	5
38	At work, I more frequently have positive emotions than negative ones	1	2	3	4	5
39	It is hard to be enthusiastic about my work*	1	2	3	4	5
40	I can be at my best at work	1	2	3	4	5
41	I will achieve what I want against all odds	1	2	3	4	5
42	I am optimistic about the future	1	2	3	4	5
43	I like to be absorbed in my tasks	1	2	3	4	5
44	I feel joyful at work	1	2	3	4	5
45	I think my colleagues like me	1	2	3	4	5

46	I think I am using my knowledge and skills to accomplish an important goal	1	2	3	4	5
47	In most cases I can count on my colleagues	1	2	3	4	5
48	My job is one of the most important things in my life	1	2	3	4	5
49	My job makes me happy	1	2	3	4	5
50	Job demands exceed my abilities*	1	2	3	4	5
51	When hard times hit I can't count on my colleagues*	1	2	3	4	5
52	If I fail at something I lose my perseverance*	1	2	3	4	5
53	We have many common themes with colleagues	1	2	3	4	5
54	My work tasks have significance	1	2	3	4	5
55	I put minimal effort into my work*	1	2	3	4	5
56	I seldom feel blue	1	2	3	4	5
57	I feel like I don't fit in with my colleagues*	1	2	3	4	5

Injuries at workplace

For the following questions, your organisation will not know any of your responses to the injuries you are about to report. Hence results cannot be traced back to participants, therefore you can be as truthful as possible.

<u>S/N</u>	<u>Questions</u>	<u>Response</u>
58	how many times have you encounter "slip, trip, fall and other minor occurrences" at your workplace in the last 6 months?	Participants to input number
59	how many times have you encounter "cuts or lacerations (flesh/ tissue tear)" at your workplace in the last 6 months?	Participants to input number
60	how many times have you encounter "bruises or contusions (a region of injured tissue)" at your workplace in the last 6 months?	Participants to input number
61	how many times have you encounter "surface burns/ scalds" at your workplace in the last 6 months?	Participants to input number

62	how many times have you encounter "strains and sprains of body parts" at your workplace in the last 6 months?	Participants to input number
63	how many times have you encounter "injuries that required basic first aid" at your workplace in the last 6 months?	Participants to input number
64	Did you report your minor injuries (as mentioned above) to your immediate superior?	Yes: verbally/ Yes: through near-miss submission/ No
65	how many times have you taken "time off work/ medical certificate" due to injuries at your workplace in the last 6 months?	Participants to input number
66	how many times have do you require "restricted work or transfer to another job" due to injuries at your workplace in the last 6 months?	Participants to input number
67	how many times have you encounter "medical treatment beyond first aid" at your workplace in the last 6 months?	Participants to input number
68	how many times have you encounter "amputation of limb or body part(s)" at your workplace in the last 6 months?	Participants to input number
69	how many times have you encounter "loss of consciousness" at your workplace in the last 6 months?	Participants to input number
70	how many times have you been told "a significant injury diagnosed by a physician or other licensed health care professional" at your workplace in the last 6 months?	Participants to input number
71	how many "illness diagnosed by a physician or other licensed health care professional" at your workplace in the last 6 months?	Participants to input number

72	Please indicate what is the " illness diagnosed by a physician or other licensed health care professional " due to your workplace in the last 6 months?	Participants to input text
73	Did you report your major injuries (as mentioned above) to your immediate superior?	Yes: verbally/ Yes: through near-miss submission/ Yes: through incident report/ No

Safety climate

In the following section please describe how you perceive that the managers and supervisors at this workplace deal with safety. Although some questions may appear very similar, please answer each one of them. Items marked with an asterisk were reverse scored.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

<u>S/N</u>	<u>Questions</u>	<u>Response</u>			
74	Management encourages employees here to work in accordance with safety rules - even when the work schedule is tight.	1	2	3	4
75	Management ensures that everyone receives the necessary information on safety	1	2	3	4
76	Management looks the other way when someone is careless with safety*	1	2	3	4
77	Management places safety before production	1	2	3	4
78	Management accepts employees here taking risks when the work schedule is tight*	1	2	3	4
79	We who work here have confidence in the management's ability to deal with safety	1	2	3	4

80	Management ensures that safety problems discovered during safety rounds/ evaluations are corrected immediately	1	2	3	4
81	When a risk is detected, management ignores it without action*	1	2	3	4
82	Management lacks the ability to deal with safety properly*	1	2	3	4
83	Management strives to design safety routines that are meaningful and actually work	1	2	3	4
84	Management makes sure that everyone can influence safety in their work environment	1	2	3	4
85	Management encourages employees here to participate in decisions which affect their safety	1	2	3	4
86	Management never considers employees' suggestions regarding safety*	1	2	3	4
87	Management strives for everybody at the worksite to have high competence concerning safety risks	1	2	3	4
88	Management never asks employees for their opinions before making decisions regarding safety*	1	2	3	4
89	Management involves employees in decisions regarding safety	1	2	3	4
90	Management collects accurate information in accident investigations	1	2	3	4
91	Fear of sanctions (negative consequences) from management discourages employees here from reporting near-miss accidents*	1	2	3	4
92	Management listens carefully to all who have been involved in an accident	1	2	3	4
93	Management looks for causes, not guilty persons, when an accident occurs	1	2	3	4
94	Management always blames employees for accidents*	1	2	3	4
95	Management treats employees involved in an accident fairly	1	2	3	4

96	We who work here try hard together to achieve a high level of safety	1	2	3	4
97	we who work here take joint responsibility to ensure that the workplace is always kept tidy	1	2	3	4
98	we who work here do not care about each others' safety*	1	2	3	4
99	we who work here avoid tackling risks that are discovered*	1	2	3	4
100	we who work here help each other to work safely	1	2	3	4
101	we who work here take no responsibility for each others' safety*	1	2	3	4
102	we who work here regard risks as unavoidable*	1	2	3	4
103	we who work here consider minor accidents to be normal part of our daily work*	1	2	3	4
104	we who work here accept dangerous behaviour as long as there are no accidents*	1	2	3	4
105	we who work here break safety rules in order to complete work on time*	1	2	3	4
106	we who work here never accept risk-taking even if the work schedule is tight	1	2	3	4
107	we who work here consider that our work is unsuitable for cowards*	1	2	3	4
108	we who work here accept risk-taking at work*	1	2	3	4
109	we who work here try to find a solution if someone points out a safety problem	1	2	3	4
110	we who work here feel safe when working together	1	2	3	4
111	we who work here have great trust in each others' ability to ensure safety	1	2	3	4
112	we who work here learn from our experiences to prevent accidents	1	2	3	4
113	we who work here take each others' opinions and suggestions concerning safety seriously	1	2	3	4
114	we who work here seldom talk about safety*	1	2	3	4

115	we who work here always discuss safety issues when such issues come up	1	2	3	4
116	we who work here can talk freely and openly about safety	1	2	3	4
117	we who work here consider that a good safety representatives plays an important role in preventing accidents	1	2	3	4
118	we who work here consider that safety rounds/ evaluations have no effect on safety*	1	2	3	4
119	we who work here consider that safety training to be good for preventing accidents	1	2	3	4
120	we who work here consider early planning for safety as meaningless*	1	2	3	4
121	we who work here consider that safety rounds/ evaluations help find serious hazards	1	2	3	4
122	we who work here consider safety training to be meaningless*	1	2	3	4
123	we who work here consider it important to have clear-cut goals for safety	1	2	3	4

Appendix E



CONSENT FORM

A completed copy of this form should be retained by both the researcher and the participant. Participant can do a "print screen" on their mobile device to retain a copy of the consent form.

Research Project: The Effects of Employee Well-being on Injuries at the workplace with Safety Climate as potential mediator

Please complete the following checklist. Tick (✓) the appropriate box for each point.	YES	NO
1. I have read the Participant Information Sheet and I understand it.	✓	
2. I have been given sufficient time to consider whether or not to participate in this study	✓	
3. I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet	✓	
4. I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without penalty	✓	
5. I have the right to decline to participate in any part of the research activity	✓	
6. I know who to contact if I have any questions about the study in general.	✓	
7. I understand that the information supplied by me could be used in future academic publications.	✓	
8. I understand that my participation in this study is confidential and that no material, which could identify me personally, will be used in any reports on this study.	✓	

Declaration by participant:

I agree to participate in this research project and I understand that I may withdraw at any time. If I have any concerns about this project, I may contact the convenor of the Psychology Research and Ethics Committee (Dr Rebecca Sargisson, phone 07 837 9580, email: rebecca.sargisson@waikato.ac.nz)

Please note that when you complete the survey, you are giving your consent for the researcher to use the information you have provided.

- I understand and agree
- I don't agree and no longer wish to participate in this study

WONG CHIN FEE
 Manager, Human Resource & Administration
 THE POLYOLEFIN COMPANY (SINGAPORE) PTE LTD
 28 January 2019

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