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The Constructing Health Study:

Factors Influencing the Dietary Behaviours of Men Working in New Zealand Construction

A thesis presented in partial fulfilment of the requirements for the degree of

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Abstract

Background: The construction industry is a male dominated career group consisting largely of low to medium socioeconomic status (SES) workers. This population is known to be significantly impacted by non-communicable disease which shortens their life expectancy and negatively impacts their work ability. Currently in the sector a majority of health research has focused on musculoskeletal disorders with lifestyle behaviours such as diet and exercise being secondary considerations. Qualitative investigations surrounding dietary behaviours in this group have demonstrated that there are many factors that are perceived to influence behaviour which could be targeted to improve their long-term health outcomes. At this time there is no research in New Zealand surrounding this subject, resulting in a gap in knowledge.

Aim: Using an ecological model this research seeks to identify barriers, motivators and demographic characteristics influencing the dietary behaviours of full-time male construction workers within New Zealand and present pathways to improve dietary profiles.

Methods: Men who had worked in the construction sector for 2+ years and were currently working in the Manawatu – Whanganui regions were invited to participate. The investigation was broken down into 3 phases. Phase 1 was a brief dietary questionnaire administered as a hard copy or online via Qualtrics®. Phase 2 consisted of individual or group interviews of a purposive sample of participants from phase 1 with thematic analysis being carried out on transcripts using NVIVO 12 Pro. Emphasis was placed on carrying out and analysing interviews using the ecological framework, to ensure individual, organisational and societal variables were discussed by workers. Phase 3 provided a health screening available to all phase 1 participants. Participants were also given questions from phase 1 surrounding health belief model (HBM) constructs to assess changes in perceptions.

Results: *Phase 1 (n=20):* Compared to the *2008/09 NZ Adult Nutrition Survey* and *Annual NZ health survey*, this cohort had low fruit and vegetable intakes with 40% and 30% respectively meeting recommended daily intakes (RDI's) while the majority exceeded RDI's for meat. 7 were classified as hazardous drinkers according to New Zealand Ministry of Health (NZMoH) guidelines. Sweetened beverage and fast-food intakes were high while a majority of men in their 20's did not eat breakfast or pack lunches regularly, resulting in poor eating behaviours at work.

Phase 2 (n=13): The evidence supports previous investigations showing that men are interested in their long-term health. Prevalent themes discussed as impacting dietary behaviours included female partners, nutritional knowledge, body weight, cost, time, healthcare providers, work environment and mentalities of other staff and managers. Unlike previous investigations, these themes could not be

labelled as predominantly motivators/facilitators or barriers to healthy eating with the exception of female partners, who had an overwhelmingly positive influence.

Phase 3 (n=12): Body mass index (BMI) and body composition measures classified 8 and 7 participants respectively as overweight or obese. 5 participants had high TC/HDL ratios with a 6th unable to be recorded due to readings exceeding equipment capabilities. For the questionnaire, more participants perceived cardiovascular disease (CVD) and type 2 diabetes (T2D) as serious concerns. 5 participants were now happy with the way they were eating with another 5 believing their diet did not increase their risk of these diseases at the end of the study.

Conclusions: This research presents multiple themes which are perceived by men to support or prevent healthy dietary behaviours. Many of these could be targeted to improve the health and wellbeing of men in the industry. There is evidence that the health of this group is being negatively being affected by dietary behaviours. However, there is a need for broad scale surveys of dietary behaviours and testing of health status within the sector to understand the breadth of the issue. Lifestyle interventions must also be trialled in this population in order to identify effective long-term strategies which involve all primary stakeholders.

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List of Abbreviations:

BMI – Body mass index

CVD – Cardiovascular disease

GI – Glycaemic index

HBC – Heartbeat challenge

HBM – Health belief model

HDL – High density lipoprotein

HUC – Health under construction

T2D – Type 2 diabetes

MetS – Metabolic Syndrome

NCD – Non-communicable disease

NZDep – New Zealand Deprivation Index

NZMoH – New Zealand Ministry of Health

NZSEI – New Zealand Socioeconomic Index

RCT – Randomised control trial

ROI – Return on investment

RUFIT – Rugby union fans in training

SES – Socioeconomic status

SSB – Sugar sweetened beverage

TC – Total cholesterol

WHR – Waist hip ratio

WHO – World health organisation

1 Chapter 1: Background, Aims, Objectives, and Thesis Structure

1.1 Background

International research surrounding the health status of construction workers has demonstrated that they are an at-risk group for a range of non-communicable diseases (Dong, Wang, Daw, & Ringen, 2011; Hwang, Hong, & Kim, 2012; Loudoun & Townsend, 2017). The most prevalent of these disorders have been identified as hypertension, cardiovascular disease, diabetes, cancer and musculoskeletal disorders in multiple developed nations including Germany, the United States and South Korea (Claessen, Arndt, Drath, & Brenner, 2009; Dong et al., 2011; Hwang et al., 2012; Kolmet, Marino, & Plummer, 2006). These conditions, as well as all-cause mortality, are known to be exacerbated by diets high in processed sugar, trans fats and total calories (Moodie et al., 2013; Rauber et al., 2018) and low in fibre, fruits and vegetables (Alissa & Ferns, 2017; Bellavia, Larsson, Bottai, Wolk, & Orsini, 2013; Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014; Yahia, 2017). Despite this, there is limited research surrounding dietary patterns of this population with research and innovation primarily focused on limiting musculoskeletal pain and workplace injuries (Biswas, Bhattacharya, & Bhattacharya, 2017; Hengel, Blatter, Geuskens, Koppes, & Bongers, 2012).

Obesity is another factor seen to negatively impact the construction sector. In the United States, construction workers who are classified obesity class 3 have the highest levels of worker impairment of any career group at 37.21%, with a high proportion of this stemming from musculoskeletal pain (Kudel, Huang, & Ganguly, 2018). This figure was based an individual's absenteeism and presenteeism in the past seven days. While there is evidence that being overweight, 25-30kg/m^2, has a protective effect for workers in this industry (Arndt, Rothenbacher, Zschenderlein, Schuberth, & Brenner, 2007; Claessen et al., 2009; Dong et al., 2011), it is unclear whether this is related to the methods inability to differentiate between lean mass and body fat (Elagizi et al., 2018; Walsh et al., 2018). There is a need to investigate the body composition of this population further in order to set recommendations that are specific to this population.

The construction industry is a largely blue-collar sector which employed an estimated 350 million people globally as of 2016 (Biswas et al., 2017). Income and socioeconomic status (SES) is variable in the sector depending on nation with workers in Australia being the 6th highest earning group in the nation (Australian Bureau of Statistics, 2019) while workers in the United States are seen to earn approximately 65% of their white-collar counterparts, ranking them as a collectively low SES population (Dong et al., 2011). This population is also known to work significantly longer hours than the national average in developed nations (Hengel et al., 2012; Lingard & Turner, 2014). Within New

Zealand, national figures reflect these trends with this population collectively ranked as having a low to medium SES dependent on skillset (Fahy, Lee, & Milne, 2017) while working approximately 10% longer than the national average (StatsNZ, 2020).

Despite findings demonstrating that blue collar men are an at risk group, there is a noticeable lack of research surrounding causal factors influencing their dietary behaviors (Biswas et al., 2017) with none being carried out in New Zealand (Novak, Bullen, Howden-Chapman, & Thornley, 2007). The qualitative research which exists has identified factors such as time, food cost and availability, workplace culture and knowledge of dietary recommendations as factors influencing lifestyle behaviors (Du Plessis, 2011; Hengel et al., 2012; Loudoun & Townsend, 2017; Okoro, Musonda, & Agumba, 2016). Employers and senior worksite staff are also seen to strongly influence dietary behaviors both due to their administrative role to provide quality, accessible eating facilities, and due to their status as team leaders and mentors (Du Plessis, 2011; Townsend, Loudoun, & Markwell, 2016). However, the significance of these factors appears to vary depending on the nation being investigated and given no investigations have been undertaken in New Zealand, it is unknown whether these factors hold significance in this population.

To date there is no data within New Zealand surrounding health status and dietary behaviors of construction workers. However, national dietary surveys have demonstrated that a minority of the population meet both the daily fruit and vegetable recommendations while a majority exceed recommended caloric, trans fat and processed sugar intakes (New Zealand Ministry of Health, 2019c; University of Otago & Ministry of Health, 2011). These trends are known to be more common in men, male Māori and Pacifika populations and low socioeconomic groups all of which are strongly represented in blue-collar industries and the construction sector (Fahy et al., 2017; Novak et al., 2007; StatsNZ, 2020; University of Otago & Ministry of Health, 2011). Similarly, these population subsets are known to have elevated rates of obesity (New Zealand Ministry of Health, 2019b). There is also evidence that lifestyle diseases such as cardiovascular disease (CVD) are elevated in blue collar industries in New Zealand which includes the construction sector (Novak et al., 2007). Due to this data, it is fair to assume that these global trends are also reflected within New Zealand and thus should be a concern in the public health sector.

In the past there have been many research-based interventions and national programs surrounding improving the health status of construction workers. These programs have included educational and empowerment courses for staff (Cook, Swinburn, & Stewart, 2001; De Boer, Burdorf, Van Duivenbooden, & Frings-Dresen, 2007; Hengel, Blatter, van der Molen, Bongers, & van der Beek, 2013), programs offering support to staff and companies (Price, Mackay, & Swinburn, 2000; Viester,

Verhagen, Bongers, & van der Beek, 2018) and national programs involving industry, government agencies and other key stakeholders (Stenlund, 2005; Tonnon, Proper, van der Ploeg, Anema, & van der Beek, 2016). These have yielded variable outcomes with large scale programs targeting lifestyle factors at an individual and industry level commonly having greater success in influencing dietary behaviors and other metrics such as BMI, biochemical markers, and absenteeism. Smaller studies cited the need for more research surrounding factors influencing dietary behaviors of this population (Hengel et al., 2013) as well as the need to target men before they are already deemed "at risk" of disease or exit from the industry (De Boer et al., 2007; Groeneveld, Proper, Van der Beek, & Van Mechelen, 2010). If programs were to be developed for New Zealand construction workers, a base of information surrounding causal factors, health status and dietary behaviors could help improve their efficacy.

1.2 Aims

Using an ecological model this research seeks to identify barriers, motivators and demographic characteristics influencing the dietary behaviours of full-time male construction workers within New Zealand and present pathways to improve dietary profiles.

1.3 Objectives

1. Identify prevailing barriers and motivators perceived by male construction workers to be influencing their dietary behaviours and the dietary behaviours of their peers.

2. Undertake a pilot study to investigate the dietary behaviours of male construction works.

3. Carry out a pilot study investigating the body composition and health status of men in the construction sector and how this information impacts their perceptions of disease risk and dietary quality.

1.4 Thesis structure

The following thesis has been broken down into five chapters with additional appendices included to present raw data from the phase 1 dietary questionnaire and phase 3 health screening. Objective 1 is covered in Chapter 3. Objectives 2 and 3 are covered in Chapter 4.

Chapter 1 includes the background research used to determine the scope of the current investigation. The chapter concludes with the aims and objectives. Chapter 2 is a literature review which is commenced by investigating lifestyle factors such as alcohol consumption, dietary behaviours, and body composition, which can be detrimental to health. Based on population data and data from other nations, it was determined whether the population subset of interest, male construction workers, may be heavily impacted by these factors. The scope is then refined to current qualitative research on the lifestyle behaviours of male construction workers in other nations as well as lifestyle interventions carried out both in New Zealand and abroad. Chapter 3 is a manuscript structured for submission to the American Journal of Men’s Health. It focuses on the qualitative data gained in phase 2 of the research and consists of an abstract, introduction, methods, results, discussion, and conclusions. Chapter 4 is a brief chapter covering the methods, findings and discussion of phase 1 and 3 data. Chapter 5 is the conclusion of the thesis, including study limitations and recommendations for future research.

2 Chapter 2: Literature review

2.1 Introduction

Men working in blue collar industries are commonly identified as an at-risk group for preventable lifestyle diseases and shortened life expectancies (Dong et al., 2011; Hwang et al., 2012; Kolmet et al., 2006; Loudoun & Townsend, 2017). The most prevalent of these disorders have been identified as hypertension, cardiovascular disease, diabetes, cancer and musculoskeletal disorders in multiple western nations (Claessen et al., 2009; Dong et al., 2011; Hwang et al., 2012; Kolmet et al., 2006). These conditions, as well as all-cause mortality, are known to be exacerbated by diets high in processed sugar, trans fats and total calories (Moodie et al., 2013; Rauber et al., 2018) and low in fibre, fruits and vegetables (Alissa & Ferns, 2017; Bellavia, Larsson, Bottai, Wolk, & Orsini, 2013; Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014; Yahia, 2017). Despite this, an overwhelming majority of health research surrounding blue collar workers has focused exclusively on musculoskeletal disorders as these conditions can be directly related to their career and subsequent workplace injuries (Biswas et al., 2017). Workers in the construction sector are also the most significantly impacted by obesity with worker productivity negatively correlating with weight as individuals become overweight or obese (Kudel et al., 2018).

Within New Zealand, a minority of the population meet both the daily fruit and vegetable recommendations while a majority exceed recommended caloric, trans fat and processed sugar intakes (New Zealand Ministry of Health, 2019c; University of Otago & Ministry of Health, 2011). These trends are known to be more common in men, male Māori and Pacifika populations and low socioeconomic groups all of which are strongly represented in blue-collar industries and construction (Fahy et al., 2017; Novak et al., 2007; StatsNZ, 2020; University of Otago & Ministry of Health, 2011).

Despite findings demonstrating that blue collar men are an at risk group, minimal research has been undertaken to understand the causal factors influencing their dietary behaviors (Biswas et al., 2017) with none identified within New Zealand. This shortage of investigative interest may stem from men, specifically young and middle aged men, being a difficult to reach subset of the population especially in relation to health and lifestyle investigations (Caperchione et al., 2012). The qualitative research which exists has identified factors such as time, food cost and availability, workplace culture and knowledge of dietary recommendations as factors influencing lifestyle behaviors (Du Plessis, 2011; Hengel et al., 2012; Loudoun & Townsend, 2017; Okoro et al., 2016). Employers and senior worksite staff are also seen to strongly influence dietary behaviors (Du Plessis, 2011; Townsend et al., 2016). However, the significance of these factors appears to vary depending on the population. Given no

investigations have been undertaken in New Zealand, it is unknown whether these factors are impacting behavior.

A majority of the literature surrounding unhealthy eating habits has been female dominated which is difficult to translate to male populations (Caperchione et al., 2012). Furthermore, men who identify with a more traditionally masculine set of behaviors, traits more commonly reflected in blue collar industries (Ogden, 2011), commonly place self-care as a lower priority than other aspects of life such as work (Mahalik, Burns, & Syzdek, 2007). Considering this, further research is needed on this population subset to understand their perceptions of health especially in nations with no current qualitative data such as New Zealand. The current research seeks to identify barriers, motivators and demographic characteristics influencing the dietary behaviors of this population and present pathways to improve dietary profiles. By developing our understanding of these factors within the New Zealand context, future programs and investigations can be tailored towards improving the long-term health and wellbeing of these men.

2.2 Dietary Patterns for Long-Term Health

It is well established that a western diet, high in heavily processed, high GI foods and alcohol and lacking in fruits, vegetables and sources of monounsaturated and polyunsaturated fats such as nuts, 'healthy' oils and fish is detrimental to the long-term health and wellbeing of a population (Aune et al., 2017; Bellavia, Larsson, Bottai, Wolk, & Orsini, 2013; Eleftheriou, Benetou, Trichopoulou, La Vecchia, & Bamia, 2018; Keys et al., 1986; Moodie et al., 2013; Rauber et al., 2018). The EAT-Lancet Commission developed a healthy and sustainable reference diet in 2019 which largely consists of vegetables, fruits, whole grains, legumes, nuts, and unsaturated oils, low to moderate amounts of seafood and poultry, and no or a low amounts of red meat, processed meat, added sugar, refined grains, and starchy vegetables (Willett et al., 2019).

2.2.1 Fruits and Vegetables

Fruit and vegetable consumption is a significant factor influencing an individual's health and wellbeing with elevated intakes linked to reduced incidence of conditions such as cardiovascular disease (CVD) (Alissa & Ferns, 2017), cancer (Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014) and all-cause mortality (Bellavia et al., 2013; Schwingshackl et al., 2017). Meta-analysis by Aune et al (2017) concluded that intakes of fruits and vegetables up to 400g/d, approximately 5 servings, had the most significant effects on reducing cancer, CVD and all-cause mortality risk with benefits extending up to 800g/d, approximately 10 servings. While the mechanisms behind these effects are not fully understood, relationships between dietary components and health outcomes have been heavily

investigated (Aune et al., 2017; Bellavia et al., 2013; Yahia). Table 1 outlines some of the prominent theorized protective mechanisms of fruit and vegetables.

Factor	Theorized effects on health and wellbeing
Antioxidants	A comprehensive systematic review and meta-analysis by Aune et al (2018) concluded that an array of antioxidants found in fruits and vegetables likely have protective effects against CVD, atherosclerotic development, and cancer in a synergistic nature along with an array of other bioactive compounds. This was done using both dietary intake and biomarker data from 69 prospective studies. This would explain why randomized control trials (RCTs) focusing on a single or small group of antioxidants regularly fail to elicit significant changes in outcomes (Aune et al., 2018). Both this and a prior review concluded that individual antioxidant supplements are not supported as a primary or secondary treatment/preventative for conditions such as CVD or cancer. Instead recommendations should focus on increasing total fruit and vegetable intake (Asplund, 2002; Aune et al., 2018).
Fibre content.	A meta-analysis published in the Lancet by Reynolds et al (2019) used the data of 185 prospective studies and 58 RCTs with a focus on carbohydrate quality and disease. The team demonstrated that fibre intake reduced the risk of non-communicable diseases (NCD's) in a logarithmic nature with 25-29g of fibre per day being deemed optimal for health (Reynolds et al., 2019). Higher intakes offered further health benefits but to a less significant extent (Reynolds et al., 2019). The health benefits of a high fibre diet included increased satiety, reduced insulin response and increased lipid absorption. Observational data showed a 15-30% reduction in all-cause mortality when comparing high and low fibre intake brackets and clinical trials showed a reduction in body weight, blood pressure and total cholesterol (Reynolds et al., 2019).
Low energy, high nutrient dense foods	A review by Drenowski (2017) outlines the current issue with global food markets, with high energy, low nutrient dense foods such as fats, sweets and dry grains becoming more readily available due to being relatively inexpensive. Consumption of high nutrient, high water content foods such as fruits and vegetables are commonly more satiating, generally resulting in a lower caloric intake and reduced instances of obesity (Drewnowski, 2018). Meta-analysis also suggests that consumption of nutrient rich foods high in protein, fiber, vitamins and minerals is directly associated with lower rates of CVD events and all-cause mortality (Streppel et al., 2014).

Table 1: Dietary Benefits of Fruit and Vegetables. An overview of literature surrounding key nutritional benefits of fruits and vegetables.

According to the *2008/09 New Zealand Adult Nutrition Survey* approximately 55% of males and 66% of females meet the recommended daily intake (RDI) of 2+ servings of fruit while 59% of males and 72% of females meet the RDI of 3+ serving of vegetables (University of Otago & Ministry of Health, 2011). Similarly, the annual *NZ Health survey* found that between 2016 and 2019 <40% of the total population achieved 2+ serves of fruit and 3+ serves of vegetables daily. These figures are significantly lower for Māori and Pacifika populations of which approximately 30% achieve fruit and vegetable recommendations between 2016 and 2019 (New Zealand Ministry of Health, 2019c). Similarly, males and females in the highest quintile of deprivation are seen to have considerably lower intakes of fruits and vegetables compared to the least deprived quintile (University of Otago & Ministry of Health, 2011).

2.2.2 Processed Foods

Dietary profiles consisting of energy dense foods high in salt, processed sugars and trans fats, which commonly correlates with reduced intakes of unprocessed foods, have repeatedly been associated with increases in NCDs such as T2D, hypertension and CVD as well as elevated all-cause mortality (Moodie et al., 2013; Rauber et al., 2018). A key component seen within processed foods is the use of trans fats sourced from hydrogenated plant oils such as palm oils. High consumption of processed foods containing these compounds such as fried foods and bakery goods is associated with elevated rates of all-cause mortality and CVD (De Souza et al., 2015; Heileson, 2020). Multiple reviews have demonstrated that processed and ultra-processed foods have, on average, a higher caloric density than unprocessed or minimally processed foods resulting in higher energy intakes (Drewnowski, 2018; Fardet, 2016). There is also research indicating that consumption of liquid carbohydrates, such as sugar sweetened beverages (SSB’s), promotes a positive energy balance which can lead to long term weight gain (Malik, Pan, Willett, & Hu, 2013; Malik, Schulze, & Hu, 2006). These dietary patterns are known to be exacerbated within construction and blue-collar industries in other nations, which has been theorized to be a leading cause of elevated NCD rates in this group compared to the general populous (Arndt et al., 2007; Claessen et al., 2009; Dong et al., 2011; Du Plessis, 2011; Kolmet et al., 2006; Townsend et al., 2016). Within New Zealand, men and Maori and Pacifika populations are all seen to have higher SSB intakes than the general populous however, records of processed and ultra-processed food consumption is not readily available (University of Otago & Ministry of Health, 2011).

2.2.3 Animal Products (Red and processed meats, dairy and fish)

It has long been believed that a diet high in saturated fats sourced from animal products is a source of elevated rates of numerous NCD's in western society (Heileson, 2020). This is reflected globally with governing bodies such as the American Heart Association and EAT-Lancet Commission recommending a diet low in animal products, especially processed meats (Heileson, 2020; Willett et al., 2019). However, in the past decade, the narrative has appeared to curtail with observational and intervention research alike presenting an unclear picture of the long-term health effects of these food groups. Multiple recent meta-analysis have found neutral or inverse associations between CVD and all-cause mortality and consumption of food groups such as red meat (Astrup et al., 2020; De Souza et al., 2015; Dena Zeraatkar, 2019; Heileson, 2020; Rohrmann et al., 2013) and either high fat or low fat dairy (Astrup et al., 2020; Guo et al., 2017; Schwingshackl et al., 2017). A key issue surrounding this research is confounding variables. Rohrmann et al (2013) who worked with data from the European Prospective Investigation into Cancer and Nutrition (EPIC), noted in their analysis that men and women who had high red and processed meat intakes commonly had lower intakes of fruits and vegetables, were more likely to smoke and, as a collective, were less educated. These variables, especially other dietary components, make it difficult to distinguish the impact of high saturated fat intakes from low intakes of other key nutrients.

In comparison to the inconclusive research surrounding red meat and dairy, meta-analysis surrounding processed meats and fish demonstrate significant negative and positive health effects respectively. High intakes of processed meats, above roughly 20g/d, are positively correlated with elevated rates of all-cause mortality and many cardiometabolic conditions (Astrup et al., 2020; Dena Zeraatkar, 2019; Schwingshackl et al., 2017). This has, in part, been associated with the processing procedures used in production, causing elevated intakes of carcinogens such as nitrites and heterocyclic amines (Dena Zeraatkar, 2019). In contrast, fish consumption has been shown to negatively correlate with all-cause mortality (Schwingshackl et al., 2017; Zhao et al., 2016). Zhao et al (2016) concluded that the protective effects of fish is likely a source of three factors; the high concentrations of n-3 PUFA's, fish acting as a valuable source of key vitamins and trace minerals, and the fact that fish consumption is highly correlated with the SES of the consumer due to its generally high cost.

Given the current state of the data, it would be fair to conclude that a diet containing a moderate quantity of meat and dairy is not a significant risk factor, granted the individual meets other dietary recommendations. Fish consumption should also be endorsed while processed meats should be minimized. Table 2 tabulates data from the *08/09 Adult Nutrition survey* and outlines how intakes of

these animal products fluctuate based on gender, ethnicity and deprivation level based on the New Zealand Deprivation Index (NZDep). As can be seen, men are similar to the general populous in most metrics other than meat consumption (University of Otago & Ministry of Health, 2011). Contradictory to the notes taken by Zhao et al (2016), fish consumption is elevated in the most deprived quintile. However, according to the survey the least deprived cohort have higher intakes of fresh, frozen and canned fish while the most deprived have elevated intakes of battered or fried fish (University of Otago & Ministry of Health, 2011) which commonly contains high amounts of trans fats. Dairy intake is also considerably lower in the Māori and Pacifika population while processed meats are elevated for these groups. All these factors have the potential to lead to long term health complications according to the research discussed above.

	General Populous	Men	Māori Men	Pacifika Men	Low NZDep Men	High NZDep Men
Red Meat (beef, veal, lamb, mutton & pork)	6.1	6.6	8.5	8.2	4.8	7.5
Processed meats	2.3 (2 - 2.5)	2.4 (2 - 2.8)	3.1 (2.1 - 4.2)	3.3 (2.2 - 4.4)	1.8 (1 - 2.6)	2.4 (1.6 - 3.2)
Seafood	2.8 (2.4 - 3.1)	2.7 (2.2 - 3.1)	3.7 (2.5 - 4.8)	4.4 (3.2 -5.6)	1.7 (0.9 -2.4)	3.7 (2.5 - 4.8)
Dairy	2.5 (2.2 - 2.7)	2.2 (1.9 - 2.6)	1.6 (1.1 - 2.2)	1.2 (0.7 - 1.8)	2.7 (1.9 - 3.5)	1.7 (1.1 - 2.3)

Table 2: Weekly Servings of Animal Products Consumed by New Zealand Men Sourced from 2008/09 New Zealand Adult Nutrition Survey (University of Otago & Ministry of Health, 2011)

2.2.4 Alcohol

According to a review by WHO, alcohol abuse is associated with over 200 deleterious health effects ranging from liver disease, CVD and cancer to elevated rates of suicide, motor vehicle accidents and violence (WHO, 2019). It was estimated that in 2016, 2.3 million deaths were directly associated with alcohol abuse globally and 237 million men and 46 million women suffered from alcohol related disorders (WHO, 2019).

Despite this, the proportion of the global population consuming alcohol decreased marginally between 2000 and 2016, with the exception of Western Pacific nations, including New Zealand, which have marginally increased (WHO, 2019). This matches with 2019 data from the NZMoH which suggest that 80% of the adult population consumes alcohol, with 20% being classified as hazardous drinkers

according to a 10-item questionnaire (New Zealand Ministry of Health, 2019a). Men are more than twice as likely to be classified as hazardous drinkers compared to women while Māori individuals are 1.6 times more likely to fall into this category compared to the general population. The most at-risk group identified were men between the ages of 18-24, with regions of high deprivation having significantly elevated rates (New Zealand Ministry of Health, 2019a). High stress work environments which are physically or psychologically demanding and offer the individual little decision authority, such as blue collar careers, are also seen to have significantly higher rates of hazardous drinking (Marchand, 2008). When classified as a hazardous drinker, an individual is described as being at greater risk of physical, social or mental harm (New Zealand Ministry of Health, 2019a). Estimates suggest that in 2007, 537 men and 236 women died as a result of alcohol abuse, accounting for 6.1% and 4.3% of all premature deaths in New Zealand respectively. A review in the early 90s estimated that the cost of alcohol abuse on the national economy was $57m after including absenteeism (Jones, Casswell, & ZHANG, 1995). Adjusted for inflation that value increases to approximately $105m in 2020. Given the percentage of the population consuming alcohol has risen in the past 2 decades (New Zealand Ministry of Health, 2019a; WHO, 2019) and the population has risen from 3.4 million in 1995 to 4.8 million in 2020, this cost is likely even higher in the present day.

Despite there being no data in New Zealand on the topic, global research suggests that blue collar industries are among the most prevalent career groups affected by alcohol abuse (Marchand, 2008). Given the reported statistics on the prevalence of men, Māori and Pacifika, and the low SES individuals working in construction it is likely that this trend is reflected in New Zealand.

2.2.5 Cooking Ability

There is evidence to suggest that cooking ability and the confidence individuals have in their cooking abilities are positively correlated with diet quality (Utter, Larson, Laska, Winkler, & Neumark-Sztainer, 2018; Wolfson & Bleich, 2015). Individuals with greater confidence in their cooking ability during adolescence and early adulthood were identified as using more vegetables when cooking and eating less fast food (Utter et al., 2018). It is evident from the literature that subsets of men perceive cooking as a skill and something to be expressed on occasion, while women are more likely to discuss cooking as a care giving task (Szabo, 2014; Utter et al., 2018). In order to increase the number of men cooking and thus eating healthier, there needs to be research on how to change the way men perceive this task.

2.3 Biochemical Markers Associated with Health

Given that diabetes, hypertension and CVD are some of the most prevalent NCDs affecting society it is understandable that early diagnosis through screening has been shown to improve long term health outcomes (Ferket et al., 2010; Lee et al., 2015). Traditional biochemical and physiological markers and their cut-off ranges are seen below in Table 3. These markers can be used in conjunction with factors such as age, smoking status and family history to determine an individual's risk of developing CVD and other NCDs (Kuller, 2006; Upadhyay, 2015). Once identified as at risk, interventions can be implemented to prevent cardiovascular events from occurring. This commonly includes lifestyle changes such as diet and exercise and may include medication such as statins or blood pressure medication (New Zealand Ministry of Health, 2018). Once a cardiovascular event has occurred, inflammatory, immunohistochemical and oxidative stress-related biomarkers may need to be investigated along with physical measures such as aortic and atrial hypertrophy to determine the appropriate treatment measures moving forward (Upadhyay, 2015). However once a cardiovascular event has occurred the risk of future events increases significantly (New Zealand Ministry of Health, 2009).

Biochemical Markers	**Optimal Ranges**	**Physiological Biomarkers**	**Optimal Ranges**
Blood glucose: HBA1c	40mmol/mol	Blood pressure	<130/80mm/Hg
Lipids: Total cholesterol	<4.0mmol/L	Body mass index (BMI)	<25kg/m^2
HDL	>1.0mmol/L	Waist Circumference	<100cm for men
LDL	<2.0mmol/L		
Triglycerides	<1.7mmol/L		
TC/HDLC ratio	<4.0mmol/L		

Table 3: Biochemical and Physiological Health Markers. Ranges outlined in the 2009 New Zealand Ministry of Health Cardiovascular Guidelines Handbook (New Zealand Ministry of Health, 2009)

In most developed nations guidelines have been put in place recommending that low risk individuals be tested every 5 years for CV risk and dyslipidemia, 2 years for hypertension and 3 years for disglycemia (Ferket et al., 2010). Figure 1 illustrates how cardiovascular disease risk is determined within New Zealand as outlined by the *2009 New Zealand Ministry of Health Cardiovascular Guidelines Handbook* (New Zealand Ministry of Health, 2009). The percentage risk is in regard to the likelihood of experiencing a cardiovascular event in the next five years. An individual's risk will determine whether they need lifestyle or pharmaceutical intervention and how long it should be between follow-ups with their healthcare provider.

New Zealand was the first nation to develop a national testing plan for CVD with the goal of testing 90% of men aged 45-74 and women aged 55-74 (Hooper et al., 2016). Māori, Pacifika and Indian populations were to be tested from the age of 35 as they were deemed to be at an elevated risk of early onset. The program has been largely successful to date however, low SES individuals and males are less likely to get tested regularly leaving them at an elevated risk of long term health repercussions (Hooper et al., 2016). The future goal of the program is to test low SES individuals and those with dyslipidemia and hypertensive individuals more frequently. It is well documented that men, especially those in blue collar industries and even more so Māori and Pacifika individuals are less likely to have regular check-ups with a physician (Caperchione et al., 2012; Dong et al., 2011; Rodriguez, George, & McDonald, 2017) an issue which must be addressed in order to reduce cardiovascular disease risk in these populations.

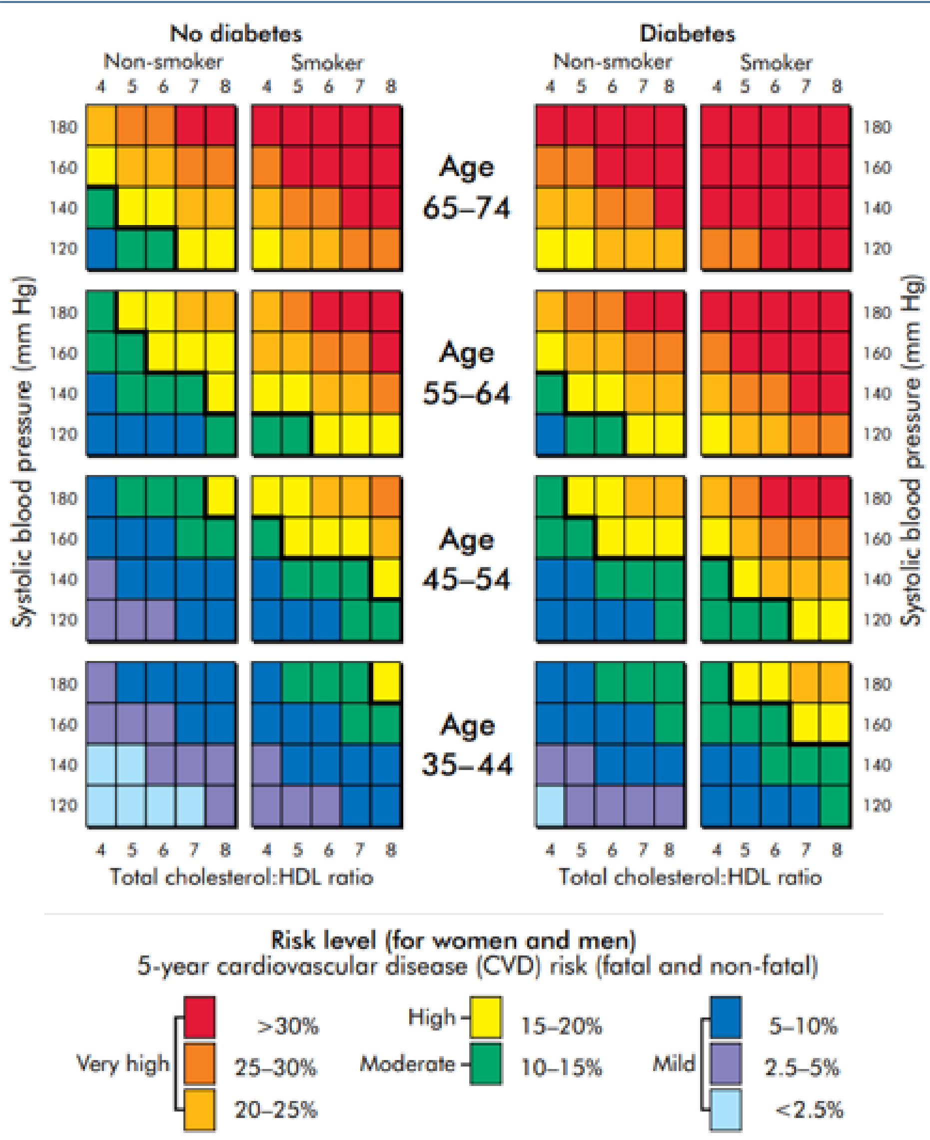

Figure 1: Heat Map of 5 Year Cardiovascular Risk Factors for Men. A graphic developed for use in the 2009 New Zealand Ministry of Health Cardiovascular Guidelines Handbook (New Zealand Ministry of Health, 2009)

2.4 Weight and Body Composition

Obesity has been linked to an elevated risk of developing metabolic syndrome (MetS) (Eckel, Alberti, Grundy, & Zimmet, 2010), cancer, immobility and musculoskeletal disorders among other conditions (Claessen et al., 2009). Research is conflicting over the association between BMI and all-cause mortality with evidence demonstrating a positive, linear relationship (Gelber, Kurth, Manson, Buring, & Gaziano, 2007), positive association only in young populations (Kuk & Ardern, 2009) or that outside a weight range of 20-25kg/m^2, there is elevated mortality rates across entire populations (Di

Angelantonio et al., 2016). Figure 2 outlines the BMI classification system. The largest of these investigations, a meta-analysis undertaken by The Global BMI Mortality Collaboration, analyzed data from 239 prospective studies spanning 4 continents and determined that populations with a BMI of 20-25kg/m^2 had the lowest rates of all-cause mortality after removing smoking cohorts and adjusting for age and sex. These results have been heavily disputed within the scientific community with data demonstrating that overweight and obese class 1 individuals have an improved prognosis once diagnosed with heart failure (HF) and CVD (Bastien, Poirier, Lemieux, & Després, 2014; Elagizi et al., 2018; Myint, Kwok, Luben, Wareham, & Khaw, 2014; Piché, Poirier, Lemieux, & Després, 2018). This phenomenon was termed the obesity paradox in the late 1990's. Evidence suggests that once CVD or HF has developed, an excess of fat, excluding obesity class 2 individuals or higher, can offer some protective effects such as the production of adipokine hormones and prevention of sarcopenia, the unintended loss of lean mass or skeletal muscle mass (Elagizi et al., 2018). Overweight and obese individuals are however at greater risk of developing CVD and HF than 'healthy weight' individuals at a population level (Elagizi et al., 2018). Once a cardiovascular event has occurred, factors such as total lean mass and cardiorespiratory fitness must be consider as these offer significant protective effects for the individual (Elagizi et al., 2018).

Weight class	BMI (kg/m^2)
Underweight	<18.5
Normal weight	18.5–24.9
Overweight	25.0–29.9
Obesity	
Class I	30.0–34.9
Class II	35.0–39.9
Class III	40.0–49.9
Class IV	50.0–59.9
Class V	≥60

Figure 2: Body Mass Index Ranges. Sourced from (Elagizi et al., 2018)

The primary argument against the use of BMI as a risk factor tool is that it does not account for lean body mass and fat distribution (Ortega, Sui, Lavie, & Blair, 2016; Piché et al., 2018). Due to this, 'healthy weight' individuals can have a high body fat percentage and low lean body mass, elevating their risk, while overweight individuals may have a higher than average level of muscle mass which can be protective long term (Elagizi et al., 2018; Piché et al., 2018). Despite this inaccuracy, at a population level BMI, along with waist circumference (WC) and waist to hip ratio (WHR) measurements continue to more accurately estimate clinical outcomes than tools calculating body composition such as bioelectrical impedance, DEXA or air displacement techniques (Elagizi et al., 2018; Myint et al., 2014; Piché et al., 2018). WC and WHR measurements are useful additions as they allow clinicians to identify where an individual stores fat. Those with high visceral and ectopic fat stores are at an elevated risk of CVD, diabetes and other conditions categorized by MetS through the promotion of dyslipidemia, hypertension, glucose intolerance and inflammation (Bastien et al., 2014).

Within the construction industry men are seen to have elevated rates of worker disability and all-cause mortality when outside a BMI range of 25-35kg/m^2 with primary causes being cardiovascular disease, cancer, diabetes and osteoarthritis according US and German investigations (Arndt et al., 2007; Claessen et al., 2009; Dong et al., 2011). These prospective studies identified variables which elevate mortality in low BMI individuals such as significantly higher rates of smoking and increased risk of injury which are clinical manifestations relating to low BMI identified by the obesity paradox (Arndt et al., 2007; Elagizi et al., 2018).

Data from the US has also demonstrated that morbid obesity, >40kg/m^2, is correlated with significantly greater rates of worker impairment, defined as absenteeism and presenteeism, in all industries with the construction/installation industry being the most severely impacted by high BMI outcomes (Kudel et al., 2018). A considerable proportion of worker impairment stems from musculoskeletal disorders especially within blue collar industries (Kudel et al., 2018). Weight bearing and impact on these joints is believed to be the primary cause of these disorders prevalence in obese populations however this does not account for the rates of osteoarthritis in non-weight bearing joints such as the wrists which are seen in this population subset (Walsh et al., 2018). There is growing evidence that elevated adipokine and inflammatory proteins such as C-reactive protein can place individuals in an atherogenic state, with long term weight loss currently being used as a treatment and preventative measure for musculoskeletal disorders (Walsh et al., 2018).

According to the most recent national data, the 2018/19 National Health Survey, 34.3% of the New Zealand population is overweight with an additional 30.9% categorized as obese class 1, 2 or 3 according to BMI classifications (New Zealand Ministry of Health, 2019b). Research from other

developed nations shows that obesity rates are commonly elevated in the construction industry (Alwan, 2011; Loudoun & Townsend, 2017). It is likely that this is also the case in New Zealand given Māori and Pacifika populations have higher rates of overweight and obesity (New Zealand Ministry of Health, 2019b) while being heavily represented in the industry (Novak et al., 2007; Rodriguez et al., 2017).

The evidence surrounding obesities effects on long term health, wellbeing and workability within blue collar industries should be taken seriously. However, within the New Zealand context Māori and Pacifika populations are known to have greater lean body mass on average than European and Asian cohorts of the same BMI (Duncan, Schofield, Duncan, Kolt, & Rush, 2004). This could also be the case for construction workers as a collective due to the physical nature of their work, however body composition has never been investigated in this cohort. Elevated lean body mass could also account for the variability seen between the perceived healthy range for the general populous of 20-25kg/m^2 (Di Angelantonio et al., 2016; Gelber et al., 2007) and that of construction workers of 25-35kg/m^2 (Arndt et al., 2007). Research is needed to understand the body composition of this population of men both in terms of body fat percentage, lean body mass and fat distribution. If it is demonstrated that the lean body mass of workers varies significantly from the general populous, weight recommendations may need to be altered to ensure the wellbeing of this workforce is being supported.

2.5 Research Surrounding Construction Worker Health and Nutrition

A majority of the research surrounding the health of male construction workers focuses on musculoskeletal disorders which commonly cause early exiting from the industry (Biswas et al., 2017). Minimal research has been undertaken in other fields of health and wellbeing for blue collar men with personal health and lifestyle often being perceived as part of the individuals responsibility as opposed to the industry's (Hengel et al., 2012). There have already been many factors identified as having the potential to influence the dietary patterns of men within blue collar industry such as food availability, organoleptic properties, nutritional knowledge, time, social support, cost, workplace environment and current health status (Alavinia, van Duivenhooden, & Burdorf, 2007; Du Plessis, Cronin, Corney, & Green, 2013; Gough & Conner, 2006; Townsend et al., 2016; Viester et al., 2012). Du Plessis et al (2011) developed a framework which broke these factors down into two distinct themes; barriers/inhibiting factors and motivators/facilitating factors which was adopted by later qualitative investigations within Australia including Lingard and Turner (2014), Loudon et al (2016) as well as abroad by Tonnon et al (2014).

2.5.1 Barriers/Inhibiting Factors

2.5.1.1 Australian Research

A number of studies have been carried out in Australia surrounding worker nutrition. Repeated findings suggest that time constraints stemming from 6-day work weeks or 12 day fortnights, access to/availability of healthy foods and the workplace environment are acting as barriers preventing workers from adhering to government dietary guidelines (Lingard & Turner, 2014; Loudoun & Townsend, 2017; Townsend et al., 2016). Workers and site managers have discussed the construction industries tight timeframes and limited resources, which results in staff working extensive, often irregular hours to meet deadlines which places strain on their ability to properly structure their personal lives (Alavinia et al., 2007; Lingard & Turner, 2014; Townsend et al., 2016). Longer working hours are also reflected in the New Zealand construction industry with the average worker completing 42.3 hours/week compared to the national average of 38.1 hours/week (StatsNZ, 2020). However, evidence suggests that men in the industry tend to eat worse during days off and holiday periods (Lingard & Turner, 2014). Lingard and Turner (2014) suggested that poor dietary behaviors during these periods stemmed from blue collar men associating fast food with relaxation, acting as an escape from the high stress weekly work environment.

Research by Du Plessis et al (2011) used focus groups to investigate factors influencing dietary patterns of apprentices entering the workforce, a cohort primarily consisting of teenage males. The dietary patterns of this cohort were significantly impacted by moving away from home and/or in with a significant other. Many young males demonstrated a lack of basic dietary knowledge with many believing that unhealthy foods can be quickly metabolized without negative health implications (Du Plessis, 2011; Du Plessis et al., 2013). Many also heavily relied on a female companion/caregiver to prepare meals and purchase groceries with those leaving home often losing that support structure (Du Plessis, 2011). Cost, accessibility and the influence of peers were the primary barriers to healthy eating discussed during focus groups (Du Plessis, 2011). Older workers have been found to face far more multifaceted barriers with investigations suggesting that time constraints, family priorities and limited access to quality food all impacted dietary behavior (Lingard & Turner, 2014; Townsend et al., 2016).

The culture within the work environment has also been identified as relevant, with many discussing certain foods as “manly” or “feminine” (Lingard & Turner, 2014), a pattern seen in a broad range of men that appears perpetuated within blue collar industry (Dumbrell & Mathai, 2008; Mahalik et al., 2007). Masculine populations have been shown to have a lower perceived risk of lifestyle disease

while also being less likely to seek medical advice and have regular health checkups (Dong et al., 2011; Hwang et al., 2012; Mahalik et al., 2007). Supervisor's and senior workers attitudes towards eating and dietary behaviors have also been seen to influence team behaviors such as going off site to buy food as opposed to packing lunches (Du Plessis, 2011; Lingard & Turner, 2014; Townsend et al., 2016). However, when questioned on the topic workers and management staff have said that supervisors and senior staff have little to no influence over their eating habits and that it is not their job to police eat behaviors (Townsend et al., 2016).

2.5.1.2 Research from other Nations

Research in South Africa by Okoro et al (2016) quantitatively assessed factors relating to a construction worker's identity and lifestyle and how this influenced the consumption of certain food groups. The team developed a questionnaire comprising of 2 sections with a 5-point Likert-scale ranging from "never" to "always" for section 1 and "strongly disagree" to "strongly agree" for section 2. Section 1 consisted of 14 food item questions previously validated for collecting nutritional information in South African populations. Section 2 consisted of 42 questions relating to economic, environmental, social, psychological, and physiological factors outlined as the determinants of food choices by South African researchers (Nie & Zepeda, 2011). After running a principle components analysis, foods were grouped into four categories and nutritional determinants were grouped into 7 categories accounting for 61.45% of the total variance (Okoro et al., 2016). The statistically notable relationships identified between these food groups and food choice categories can be seen in Table 4.

Food group	**Factors which significantly influenced intake**
Secondary core foods (fruits and vegetables etc.)	Culture, available resources, and cost
Core foods (meat, corn meal etc.)	Nutritional knowledge
Traditional core foods (heavily salted, added sugar, fried foods, or grains such as rice)	Cultural background
alternative foods (dairy, eggs, nuts, seeds etc.)	Cost and nutritional knowledge

Table 4: Factors Impacting Food Groups in South African Construction Workers. A summary of research findings from (Okoro et al., 2016)

Variation between populations may mean that some of these factors may impact construction workers in New Zealand differently than that of South African, American, or Australian cohorts. Major food groups would likely vary due to cultural differences as would the impact of certain intrapersonal, interpersonal, and organizational factors seen to influence dietary behaviors.

Stress and poor work stability, have also been discussed as having a significantly negative impact on the dietary behaviors and overall health outcomes both in the general public and blue collar industries (Alavinia et al., 2007). In a 28 year prospective study in Finland, low job stability was seen to have the greatest negative impact on male blue collar workers, significantly greater than their white-collar counterparts (von Bonsdorff et al., 2012). Unlike previous investigations, job strain only increased all-cause mortality in blue collar workers for younger workers, however this was cited as being a result of their measuring technique and the healthy worker effect (J. V. Johnson, Hall, & Theorell, 1989; von Bonsdorff et al., 2012). While these studies did not investigate dietary behaviors, the outcomes of elevated lifestyle disorders suggest these factors may impact worker longevity and should be considered during prospective research.

2.5.2 Motivating/Facilitating Factors

As well as barriers to a healthy diet confronting construction workers, much of the research also identified motivators for improving dietary behaviors. Of these, recommendations from healthcare professionals were a prevailing factor instigating dietary improvement with many stating they have made or would make changes if their health began to deteriorate (Du Plessis, 2011; Gough & Conner, 2006; Lingard & Turner, 2014; Townsend et al., 2016). The role of partners, caregivers and family members in motivating and facilitating dietary changes is also well documented. The primary sources of support included food preparation, food purchases/selection and sourcing of information relating to health (Du Plessis, 2011; Gough & Conner, 2006; Viester et al., 2012).

Body image was also discussed, primarily by younger males, as a motivator to adhere to a specific dietary protocol or limit the consumption of “unhealthy” foods such as fast food and sweetened drinks (Du Plessis, 2011). Young males as well as a proportion of older workers often believed that sport and exercise, including the physical nature of their career, would overcome any shortcomings in their dietary patterns in relation to health and wellbeing, a sign of lacking knowledge in the area of health (Du Plessis, 2011; Gough & Conner, 2006). Dutch research also reported on this perception with a majority of blue collar workers believing they had healthy lifestyles due to their physical careers (Alavinia et al., 2007). Despite these views, 33% of the workforce were not meeting the minimum

exercise recommendations and 80% were not meeting exercise recommendations for optimal health (Alavinia et al., 2007).

To date there is no qualitative data in New Zealand surrounding the barriers and motivators men face in the construction sector. Given it has been demonstrated that these vary depending on the population, it would be valuable to investigate these themes within New Zealand before attempting to develop programs to target lifestyle change. This may include but is not limited to; the role of families and partners, workers interactions with healthcare professionals, how the workplace environment impacts eating patterns and the knowledge base of men relating to healthy eating practices. It may also include programs and support structures which workers have already been exposed too and programs they would be supportive of or against taking part in.

2.6 Demographic Characteristics of New Zealand Construction Workers which could Impact Dietary Behaviours

Currently in New Zealand men make up approximately 92% of administrative positions, 98% of skilled trades and 95% of unskilled laborers in the construction sector according to 2013 census data (Fahy et al., 2017). Within this population a majority are classified as having a low to moderate SES with Māori and Pasifika groups having a disproportionately high representation within the industry (Fahy et al., 2017; Novak et al., 2007). Given the disproportionate number of individuals in the industry that fall into one or more of these categories, it is important to take these factors into consideration when investigating this population.

2.6.1 Socioeconomic Status

Within New Zealand, workers such as laborers are classed as a low SES group, with average weekly earnings of NZ$750 in 2019 (StatsNZ, 2020). Skilled trade and technician workers collectively fall into the category of intermediate SES with average weekly earnings of $1110NZD (StatsNZ, 2020). However, according to the *2013 New Zealand Socioeconomic Index (NZSEI)* laborer's have an NZSEI score of 28, placing them in a similar position to skilled workers like plasterers, tilers, and painters. Other skilled trades such as carpenters, plumbers and electricians received scores of 36, 40 and 46 respectively which ranks them in the same range as most clerical and administrative based positions (Fahy et al., 2017). This demonstrates that when investigating a population group like construction workers, it would be invalid to class skilled trades as collectively having a moderate SES as there is a

significant difference in income based on skillset. Instead, professions should be individually grouped if such an analysis is needed.

NZSEI scores are calculated using census data on income, education and age using multiple regression analysis with correction for variables such as part-time workers, self-employment, and rurality. The formula produces scores ranging from 10-90 evenly distributed around a mean of 50, with low scores indicating that individuals within the career group have a lower socioeconomic status on average (Fahy et al., 2017). It has been repeatedly demonstrated both in New Zealand and abroad that populations with a low SES are easily influenced by food marketing and are limited in their ability to purchase 'health foods' as they are often perceived as being more expensive (Rodriguez et al., 2017; Townshend & Lake, 2017). Research in the United States also shows that low SES is associated with never/rarely cooking at home or always cooking at home while those with a higher SES are seen to regularly or sometimes cook at home, suggesting high SES groups have more freedom to choose between cooking meals or purchasing pre-cooked meals (Wolfson & Bleich, 2015). This was suggested to be caused by individuals in lower SES positions being time poor, resulting in them having to purchase pre-cooked food regularly, or struggling financially, resulting in the need to buy and cook meals on a budget (Wolfson & Bleich, 2015).

Unlike New Zealand, the Australian construction industry is one of the highest paying sectors in the nation currently ranking 6th according to the Australian Bureau of Statistics (Australian Bureau of Statistics, 2019). Despite this, health outcomes commonly seen in higher income subsets are not reflected in the construction industry with the group commonly having high levels of chronic disease and poor levels of overall health (Kolmet et al., 2006; Townsend et al., 2016). Australian research has also demonstrated that individuals who perceive fruits and vegetables to be more accessible and affordable are more likely to have a diet rich in both, regardless of SES (Williams, Ball, & Crawford, 2010). This research suggests that financial stability is not the only determinant of health outcomes and that other factors are impacting the behaviors of workers in this career group.

It has been demonstrated that a 'healthy' diet can cost less than the average diet in New Zealand, however this is only true if individuals meet the recommended caloric intake (Mackay et al., 2018). Compared to the average New Zealand diet, this healthy, affordable diet was higher in fruits, vegetables, grains, dairy and protein and contained no takeaways, alcohol, SSB's or discretionary foods high in fat, salt, or sugar. However, in New Zealand the average caloric intake for men is 2,481 kcal/day, while Māori and Pacifika men eat 2,736 and 2,560 kcal/day on average (University of Otago & Ministry of Health, 2011). This far exceeds the 2,000 kcal/day allowance outlined in this dietary protocol and as caloric intake increases beyond 2,000 kcal, so too does the cost of the diet (Mackay et al., 2018).

Many investigations in the construction sector have shown that workers regularly have high caloric intakes to meet the physically demanding workload (Du Plessis, 2011; Loudoun & Townsend, 2017; Okoro et al., 2016). It would be valuable to identify the primary dietary issues within this population subset and develop methods to change these without the financial burden which comes with a high calorie, healthy diet as outlined by Mackay et al (2018).

2.6.2 Ethnicity

The field of construction in NZ disproportionately consists of Māori and Pacifika males (Fahy et al., 2017; Novak et al., 2007; Rodriguez et al., 2017). It has been well established that food is intertwined with cultural identity within these populations. However it is also believed that these communities are not impacted by the health values projected by mainstream sources as they do not perceive themselves to be part of the mainstream in the first place (Rodriguez et al., 2017). Individual models of health have commonly failed to significantly change physiological factors such as weight, or dietary factors such as fruit and vegetable intakes in these communities due to the frameworks emphasis on individual responsibility and inability to account for the value/significance of food (Rodriguez et al., 2017). Rodriguez and George (2014) have suggested that long-term rhetoric around the genetic predisposition of Māori and Pacifika peoples to obesity and diabetes has led to a view of fatalism by many resulting in reduced use of medical support networks and contact with primary care physicians. However, this topic is a complex, multifaceted field of inquiry, requiring input from many disciplines and engagement from leaders of these communities in order to understand where support is needed to ensure long-term health and prosperity moving forward (Durie, 2012).

Novak et al (2007) completed a systematic review to assess if lifestyle interventions in blue collar workplaces would be an effective setting to combat CVD especially in Māori and Pacifika populations. The team assessed the barriers currently facing implementation of programs in New Zealand such as travel times, access to working age groups who are still healthy, and peer support structures, all of which are minimized by targeting workplaces. As unskilled and semi-skilled laboring positions disproportionately consist of Māori and Pacifika men, the author concluded that the setting is viable to cause significant improvement citing the past success of the Heartbeat Challenge (HBC) in Auckland's blue collar sector (Novak et al., 2007).

2.6.3 Gender

Masculine ideologies have been investigated in the past within blue collar industries with evidence suggesting that a high proportion of individuals in these sectors adhere to a traditionally masculine thought process (Du Plessis et al., 2013; Ogden, 2011). Traditionally masculine beliefs often include discussing vulnerability as a feminine trait and thus often underestimating their own susceptibility and the severity of common diseases (Sloan, Gough, & Conner, 2010). This trend of viewing ones health and lifestyle as adequate, despite health concerns being apparent, has been noted in multiple interventions targeting blue collar men (Cook et al., 2001; Groeneveld et al., 2010; Tonnon et al., 2014). Traditionally masculine men also commonly associate risk-taking behaviors such as drinking and working extensive hours with masculinity (Mahalik et al., 2007). Cooking and food preparation are commonly perceived as feminine tasks by this cohort as is self-care which includes having regular medical check-ups, which elevates their risk of progressing degenerative diseases (Caperchione et al., 2012; Mahalik et al., 2007; Ogden, 2011). Heavy drinking and the consumption of foods that offer instant gratification such as high fat and sugar foods as well as not meeting government recommendations for fruits and vegetables are also common manifestations (Mahalik et al., 2007). This in turn is linked to poor lifestyle behaviors such as diet which shortens the average males life expectancy (Mahalik et al., 2007).

It would be valuable to understand if these perceptions are apparent in New Zealand cohorts as well as how it varies depending on the age and cultural background of individuals, with evidence suggesting that health is a lesser consideration amongst younger cohorts of men (Du Plessis et al., 2013). There is also evidence demonstrating that men in New Zealand are concerned about their health, but are less likely to have seen their GP in the past 12 months (L. Johnson, Huggard, & Goodyear-Smith, 2008). Given men make up a large proportion of the construction industry there is a need to consider any psychological and sociocultural elements which impact them collectively as well as within the confines of construction.

2.7 Interventions and Programs Targeting Lifestyle Factors within the Construction Industry

Men at all levels of the construction industry have expressed concern in relation to health and wellbeing and have discussed its relationship with morale, productivity and longevity (Loudoun & Townsend, 2017; Viester et al., 2012), with many being forced to stop working prior to retirement age due to declining health (Claessen et al., 2009; Dong et al., 2011; Kudel et al., 2018). A number of interventions have been undertaken with the overarching goal to improve the long-term health, wellbeing, and work ability of men in the construction sector. Discussions surrounding the development and implementation of lifestyle interventions have identified a belief among employers that fostering lifestyle changes within the workforce is too time consuming or costly and thus is better left to the individual (Du Plessis et al., 2013; Townsend et al., 2016). Past interventions have yielded variable outcomes when attempting to improve the physical ability, dietary behaviors, physical activity, and overall feelings of wellbeing of men in the sector.

2.7.1 Unsuccessful International Interventions/Programs

Two programs were identified which were unable to produce statistically significant changes in the metrics they chose to investigate. Both were randomized control trials conducted specifically on construction workers with the goal of improving health, wellbeing, and work ability.

2.7.1.1 Finnish Intervention to Improve Work Ability and Reduce Disability Rates

A Finnish intervention by De Boer et al (2007) attempted to provide free counselling and one on one support to construction workers deemed at risk of exiting the workforce due to disability. Risk was determined by their physician when they attended a routine occupational health examination. The metrics used in this study were work ability, based on the work ability index (WAI), and the proportion of worker disability pensions at 9, 18 and 26 months. There was no statistically significant change in work ability or workers on disability pensions between the control group (n= 209) and intervention group (n= 89) at any of these time intervals. Issues identified within the program included low recruitment rates (De Boer et al., 2007). This was potentially due to the extra demand placed on physicians to classify individuals as at risk but also because the program required self-enrolment which many at risk individuals chose not to do. It was concluded that the program may have started too late for the target group, with individuals already being high risk when included in the study. The researchers cited previous interventions and programs conducted in the construction sector such as the Swedish Galaxen Model, discussed in *section 2.7.2.3*, which followed a multi-disciplinary approach

involving employers, employees, trade unions and personal case managers to better support the worker which had significantly better outcomes in reducing long term unemployment due to disability. They concluded that targeting issues at the organizational and individual level as well as targeting groups not yet deemed ‘at risk’ would likely yield greater outcomes within the construction sector (De Boer et al., 2007).

2.7.1.2 Scandinavian Intervention to Improve Physical Ability and Physical and Mental Health

A randomized control trial conducted in Scandinavia by Hengel et al (2013), involved 293 workers from 15 departments of 6 construction sites and contained a physical and mental component. Departments were assigned as controls (7 departments; n= 122 workers) or intervention (8 departments; n= 171 workers) groups at random. Physically, intervention participants received an initial consultation with a physiotherapist and were provided with 3 individually targeted recommendations and a follow up four months later to discuss their experiences over that time period. They were also asked to complete a flow chart each week surrounding fatigue and the use of small rest-breaks. For the mental aspect, participants received two “empowerment sessions” on site in which taking control of your own health, supporting other workers and communication with supervisors were all covered. Follow ups were carried out at 3-, 6- and 12-months assessing work ability using WAI, health status using the SF-12 questionnaire and sick leave based on company records. Loss to follow up was found to be significantly higher in less educated subsets of the cohort. At 12 months musculoskeletal symptoms, long-term sick leave and mental health were not significantly impacted. Based on evidence from past musculoskeletal investigations it was concluded that the program lacked the dosage needed to produce tangible results in the small population involved in this research. The team concluded that further research is needed in the sector surrounding factors that support healthy behaviors and reduce early retirement (Hengel et al., 2013). They also stated that there is a need to focus on multidisciplinary approaches which involve supervisors and managers.

2.7.2 Successful International Interventions/Programs

2.7.2.1 Health Under Construction (A National Netherlands Program)

The largest and most well documented intervention identified in this review was the Health Under Construction (HUC) study, initially conducted in the Netherlands between 2007 and 2009 (Groeneveld et al., 2010). The RCT offered 3 face-to-face sessions and 4 phone-based sessions to construction workers identified as at risk of CVD, according to the Framingham Risk Score, when they attended a voluntary periodic medical examination offered by occupational health services (OHS). Participants

had to agree to participate after being identified as high risk and were then randomly allocated as a control (n= 290) or intervention (n= 320) group after stratification for career. At 6 months the intervention group had elevated fruit intakes and physical activity during leisure time, reduced smoking rates and snacking, an average of 2kg weight loss and improved HDLc and HbA1c levels compared to the control group who received normal healthcare support. At 12 months, snacking was down in the intervention group (n=261) as was weight loss with an average loss of 1.8kg from baseline compared to the control group (n= 256). All other factors failed to remain significant when compared to controls (Groeneveld et al., 2010). An evaluation determined that the program was not cost saving for employers after assessment of absenteeism rates, however long term effects were not determined (Groeneveld, Proper, van der Beek, van Duivenbooden, & van Mechelen, 2008). This program was more costly than previous interventions as it required high levels of engagement with healthcare professionals (Groeneveld et al., 2008). A separate investigation was undertaken to determine how to improve participation rates with only 20% of individuals contacted agreeing to participate (Groeneveld, Proper, van der Beek, Hildebrandt, & van Mechelen, 2009). The primary causes of non-participation were determined as a lack of interest/motivation, belief that they were healthy despite being classified as ‘at risk’, personal health problems and a lack of trust for OHS. Those who dropped out/withdrew had similar reasons for doing so with disappointment in the program, for example having dates changed frequently and having to change counselors, also being cited (Groeneveld et al., 2009).

Based on the findings from the initial investigation, HUC was updated for release as a national program in the Netherlands with 3 major changes: smoking reduction was removed as a target, as separate national programs targeted this already, the screening tool was made available online for ease of access, and counselors were provided with additional training in the field of motivational interviewing (Tonnon et al., 2014). A process evaluation of the national program determined that 187 out of 7827 (2.4%) eligible individuals completed the program, with these individuals more likely to be white-collar, older and have a higher BMI than those choosing not to engage with the program. Despite the low participation rates, participant and counselor satisfaction was high with counselors stating that travel distances and working hours were the main issues for them (Tonnon et al., 2016). A qualitative investigation of the program’s structure was also run with all primary stakeholders in HUC. Limiting factors for construction workers included the perception that they were already healthy despite their at-risk status (Tonnon et al., 2014). There was also concern surrounding the impact of participation on their career with some stating that their boss would know they were unwell if they participated, which in turn may impact their employment. Participants discussed wanting their spouse to be a part of the program if it involved dietary factors and a need for the program to be more flexible, offering guidance

as opposed to a set of rules to follow (Tonnon et al., 2014). For occupational physicians (OPs), many were not willing to enroll workers into the program if they did not perceive the worker as willing to actively participate. This was due to there being minimal financial incentives offered by OHS while taking up a considerable amount of the OP's time. One method of reducing the demand on OP's was to provide counselors with the tools to engage and enroll participants themselves. Alternatively, if OPs continued to be the primary source of referrals, they would need to be incentivized to do so and may require training to improve their self-efficacy (Tonnon et al., 2014).

In conclusion, the program was largely successful in changing the lifestyle behaviors of workers involved. It ran regular consultations and evaluations to assess the content being presented and interviewed a number of primary stakeholders including workers, employers, OP's, counselors, and trade unions to identify issues with the programs structure. The primary issues at the time of the latest report was recruitment rates as a result of workers perceptions that they were healthy and due to OP's having limited time to invest in enrolling workers. There were also issues with counselors not receiving the necessary training. These operational issues were to be addressed ahead of further national implementation.

2.7.2.2 VIP in Construction (A Dutch Intervention Study)

VIP in Construction was an individually tailored intervention developed in 2010 for Dutch construction workers after it was identified that obesity was significantly increasing the instances of sick leave and disability as well as reducing worker productivity within the sector (Viester et al., 2012). The program sought to provide 2-4 individual face-to-face or phone-based health coaching sessions along with information and a pre-made "toolbox" over a 6-month period (Viester et al., 2018). The toolbox consisted of brochures, a calorie guide, pedometer, BMI card and waist circumference measuring tape, recipes and a knowledge tests, an overview of the company health promoting facilities, PEP forms, and an exercise card. All support was provided during work hours. Participants were recruited during periodic health screenings from a singular company which had 1021 active working staff in various professions carpenters, bricklayers, road workers, crane operators, and factory workers. In total, 314 individuals were randomized into the intervention (n = 162) or control (n = 152) groups. Metrics used included body weight, BMI, waist circumference, blood pressure, total cholesterol, physical activity level and dietary intake using the SF-12 questionnaire (Viester et al., 2018).

At the 12 month follow up the study had an 83% retention rate (Viester et al., 2018). At the end of the 6-month intervention period, body weight, BMI and WC had all significantly reduced in the intervention cohort compared to controls. It was theorized that these changes were the result of

increases in vigorous physical activity levels within the intervention cohort and reducing their overall intake of SSB's. However, at the 12-month follow-up none of these changes remained statistically significant. One suggested cause of this was the slight improvement in lifestyle behaviors and physiological measures in the control group between 6 and 12-months. The researchers noted that the control and intervention cohorts worked together, and that contamination is possible if the intervention cohort influenced the behaviors of their co-workers. They also noted that these results reflect past interventions which demonstrate short-term improvements which revert once workers no longer have access to the support structures provided. The team recommended that future programs should focus on identifying long-term strategies such as continued interactions with healthcare professionals, continued weight monitoring and development of company-wide strategies which involve both management and staff (Viester et al., 2018).

2.7.2.3 The Galaxen model (A National Swedish Program)

As opposed to an individual program, the Galaxen model, developed for construction workers in Sweden, is a framework designed to rehabilitate and prevent long-term sick leave or partial disability within the construction industry (Stenlund, 2005). Partially disabled individuals meet with representatives from the trade union, employer's organization, and regional employment office to develop a plan and determine the individual's capabilities. If suitable, individuals are then provided full time employment by Galaxen which is subsidized by the government. Galaxen then provide them with a role suitable for their condition. Conditions can range from heart disease to musculoskeletal disorder to psychological disorders. It was estimated that the financial benefit to society was approximately NZ$31,000 per individual employed by Galaxen as these workers were paying taxes and were not on unemployment benefits (Stenlund, 2005). In relation to prevention, the program has primarily focused on education and provision of equipment to help minimize musculoskeletal disorders within the sector (Stenlund, 2005). However, the program could be progressed to include education and support for lifestyle changes under the right conditions. If a similar program were developed in New Zealand, involving employers, trade unions, employees and government, then it is possible that the health and wellbeing of workers could be significantly improved long-term.

2.7.3 New Zealand Interventions/Programs

This review was only able to identify one lifestyle intervention undertaken specifically in a blue-collar industry within New Zealand. A further two programs were identified which directly included blue collar industries or were primarily targeted at male blue-collar workers. These were HBC and Rugby Union Fans in Training New Zealand (RUFIT-NZ) respectively.

2.7.3.1 A Health Promotion Program Targeting Diet and Physical Activity

The program run by Cook et al (2001) recruited 2 construction sites in southern Auckland and assigned one as a control site (n= 121) and the other as the intervention site (n= 132). Participant enrollment from each site was on a voluntary basis. The intervention site received 1 group class each month for 6 months discussing factors such as the benefits of exercise and nutrition and non-communicable disease (Cook et al., 2001). An extra session was also made available on alcohol after many participants enquired about its long-term health effects. At the 12-month evaluation, fat scores, relating to the percentage energy gained from fat, and blood pressure had reduced by 3.4% and 5.8mm/Hg respectively. Intervention participants were also 7.1% more likely to meet their recommended daily intake of vegetables compared to baseline. In comparison, over 12 months the control group had an increase in blood pressure while fat scores and vegetable intakes remained stable from baseline. The team noted that without the willingness and support of management figures of the control and intervention site, the program would not have been a success with workers stating they were less likely to participate outside of work hours. It was concluded that a more intensive, longer program focusing on the individual could provide greater long term reductions in NCDs in this sector of society (Cook et al., 2001).

2.7.3.2 The Heartbeat Challenge

HBC is the single largest workplace program identified which targeted the lifestyle factors of New Zealand workers including blue collar industries. While it didn't focus exclusively on the construction industry, approximately 54% of the 343 businesses involved in the wider Auckland district were industrial or commercial companies employing a blue collar workforce (Price et al., 2000). The program focused on empowering workers through provision of information, facilities, and access to healthy food options in order to enhance physical activity, dietary behaviors and reduce smoking. Companies that met a certain number of provisions were awarded the HBC credential which could be used to demonstrate their business acts in the best interests of its staff. Surprisingly, companies in industries forecast to be difficult to engage such as construction were as successful in receiving the

HBC award as others (Price et al., 2000). The program also had high approval ratings from companies, participants and administrators with its low impact approach and low functioning cost of NZ$175,000 for 1 year of operations which paid for 1 national coordinator, 2 part-time regional support staff and minor program expenses. 13 workplaces were also audited 16-24 months after receiving their award and were found to have either maintained or met further criteria, demonstrating that companies were actively engaging with the program as opposed to achieving the minimum to be recognized (Price et al., 2000). It is unknown when the program ended as there are no reports publicly available since Price et al (2000). However, a report by Novak et al (2007) stated that the program was still in operation in the greater Auckland region in 2007.

2.7.3.3 Rugby Union Fans in Training New Zealand

In 2019, RUFIT-NZ was developed from British programs Football Fans in Training and Rugby Union Fans in Training (Maddison et al., 2019). The program is presented by ex-All Blacks trainers and athletes who educate overweight men about the importance of diet and exercise in an environment that is engaging for that group, rugby (Maddison et al., 2019). This pilot study of 49 intervention participants and 47 control participants has shown promise with the intervention group experiencing significant positive changes in waist circumference, resting heart rate, diastolic blood pressure and cardiorespiratory fitness compared to controls at the end of the 12-week program. All participants in the intervention arm said they enjoyed the program and would recommend it to others. Structuring the program around a common interest, rugby, as opposed to standard educational programs was cited as being a core feature which may allow this program to succeed in a cohort of largely working-class men (Maddison et al., 2019). However, the program is only in its infancy with the pilot study completed in mid-2019.

2.7.3.4 Why Target Workplaces and Issues Facing Future Development

A report by Novak et al (2007) focusing on the cardiovascular health of men in construction and the efficacy of lifestyle interventions in the workplace concluded that work-based interventions had the potential to improve worker health and wellbeing in New Zealand. They noted that programs requiring active participation from participants would disproportionately benefit those with the means and tools to change, which in turn would be unfavorable for low SES and less educated populations (Novak et al., 2007). This is also reflected in broader research demonstrating that men with low incomes and low education levels in New Zealand are more likely to be in the pre-contemplation phase when it comes to fruit and vegetable consumption according to the transtheoretical model of health (Jury & Flett, 2010). Programs which targeted multiple risk factors simultaneously, such as exercise, diet,

smoking and alcohol, and place minimal demand on the individual have been demonstrated to benefit both male blue-collar workers and low SES men (Jury & Flett, 2010; Novak et al., 2007). However, a lack of data surrounding fiscal outcomes has hindered employer participation in programs such as HBC (Novak et al., 2007). In the US programs have demonstrated significant financial return for companies with return on investment (ROI) of between $1.42-$8.81 US by reducing medical costs, absenteeism, and staff turnover. It is difficult to transfer these figures over to New Zealand as companies in the US often provide medical coverage as part of employment packages (Novak et al., 2007). Given this, detailed evaluations of past and current programs could be invaluable in increasing company engagement with future lifestyle initiatives.

Despite the initial success of many of these programs such as the work by Goeneveld et al (2010), Hengel et al (2013) and Viester et al (2018), changes such as weight loss and improved biochemical markers are commonly reflected short term. Most long-term evaluations have produced non-significant changes in indicators of health. It was also demonstrated that many of these successful programs utilised ecological models, targeting major stakeholders including staff, managers, employment agencies, unions, healthcare providers and government departments (Groeneveld et al., 2009; Price et al., 2000; Stenlund, 2005) while less successful programs referenced the need for this moving forward (De Boer et al., 2007; Hengel et al., 2013; Viester et al., 2018). In order to understand the factors which should be targeted in New Zealand and the benefits action would have on individuals and businesses, there needs to be further discussions with the workforce and structured interventions with long-term evaluations.

2.8 Theoretical Model for Current Research

The following section has been written to investigate theoretical models developed to better understand psychological and psychosocial factors which influence the behaviors of individuals. The section above has demonstrated that ecological models of health are effective within the construction sector. However, there is a need to identify a psychological model to help understand the perceptions of individuals in the sector. One commonly used framework in the field of health behavior is the Health Belief Model (HBM) developed by social psychologists Irwin Rosenstock, Godfrey Hochbaum, Stephen Kegeles, and Howard Leventhalin in the late 1950s (US Department of Health Human Services, 2018). The model is commonly used in programs for detection and prevention of disease (US Department of Health Human Services, 2018).

HBM proposes that individuals' choices are made based on the perceived threat of a disease, which is determined from their perceptions about susceptibility and severity of a disease, along with the perceived benefits and perceived barriers to change. Self-efficacy to improve behaviors and cues to action were added to the model in the 1960's (Carpenter, 2010). Table 5 outlines some past research surrounding nutrition which has utilised HBM. These investigations demonstrate that HBM can be utilised in healthcare and lifestyle settings to improve the behaviors of those involved.

HBM has been criticized for common weaknesses identified during research. A review found many programs utilizing the model struggle to interpret social, economic and/or environmental factors influencing behavior which in turn leads to these factors being ignored, in favor of changes in beliefs and attitudes being pursued (Taylor et al., 2006). This was a particular issue in investigations surrounding behaviors in children and adolescence who have limited control over their behaviors (Taylor et al., 2006). An example of this is seen in Table 5, with one investigation surrounding school aged girls failing to impact behaviors despite seeing significant changes in attitude and knowledge (Naghashpour, Shakerinejad, Lourizadeh, Hajinajaf, & Jarvandi, 2014). The review concludes that due to the lack of definition surrounding the model's structure many studies falsely assume that behaviour is under one's volitional control. This in turn disregards factors including habitual, emotional, unconscious and/or otherwise nonrational behaviors. The reviewers also question perceived threats as a core theme, due to there being limited evidence of its predictive capabilities (Taylor et al., 2006).

Reference	Study Population	Intervention	Findings
(Khoramabadi et al., 2016)	130 pregnant Iranian women Intervention (n=65) Controls (n=64)	Intervention group received two, 2-hour education sessions. Control group received normal support. Participants received a questionnaire categorized by the 6 HBM constructs and questions on dietary behaviors at baseline and at a 6-month follow-up.	Knowledge, perceived severity & barriers, performance guide & individual performance significantly increased in the intervention cohort. Perceived benefits & susceptibility weren't significantly affected. The team concluded that utilization of HBM within health education programs can allow for effective healthcare delivery and targeting of key factors which influence behavior.
(Jeihooni, Hidarnia, Kaveh, & Hajizadeh, 2015)	120 osteoporotic Iranian women Intervention (n=60) Controls (n=60)	Intervention group received 8 educational sessions. Control group received normal support. Participants received a questionnaire developed using 6 HBM constructs and had BMD tested at baseline and at a 6-month follow-up.	All HBM construct score except for barriers increased significantly in the intervention cohort compared with controls as did BMD and dietary behaviors. The team concluded that, based on these findings and others in the sector, that educational programs which target key HBM constructs can result in significantly improve behavioral outcomes in individuals.
(Naghashpour et al., 2014)	188 Iranian junior high school women Intervention (n=95) Controls (n=93)	Intervention group received 8 classroom-based education sessions on the importance of calcium intake. Participants received a questionnaire developed using 6 HBM constructs at baseline and at a 2-month follow-up.	Attitudes and knowledge both increased significantly compared to the control group. However, behavior was not significantly affected. The team concluded that education can improved the perceptions of young women however, as they have limited control over dietary choices, parents must be targeted to produce long-term behavioral change.

Table 5: Summary of Nutrtional Research Utilising HBM

A meta-analysis by Carpenter (2010) has investigated studies utilizing the traditional, 4 construct HBM format (Carpenter, 2010). The analysis calculated effect sizes for each of the 4-primary constructs of HBM: susceptibility, severity, benefits and barriers. All factors had a net positive impact on behavior with changes to perceived barriers having the greatest effect size while changes to perceived severity was identified as having minimal impact, a finding consistent with previous investigations (Champion & Skinner, 2008). It was also found that susceptibility was a greater predictor in prevention compared to treatment studies while benefits and severity had an inverse relationship (Carpenter, 2010). Carpenter's analysis was unable to investigate additional HBM constructs, cues to action and self-efficacy, as there is limited research incorporating these additional constructs (Carpenter, 2010). Investigations into the influence of cues to action has been challenging due to the intrinsic nature of the construct with cues being insignificant to observers or even subconsciously identified by subjects (Champion & Skinner, 2008). It has been concluded by reviewers in the field that the updated HBM structure, incorporating cues to action and self-efficacy, incorporates themes which can be used effectively in preventative and treatment based health programs (Carpenter, 2010; Champion & Skinner, 2008).

Utilizing HBM, which is primarily an individual model of health, in the framework of an ecological model would allow for investigation of interpersonal and environmental factors which would otherwise be overlooked. In the context of construction workers interpersonal factors may include:

- The role of roommates, spouses or family members in food preparation, selection and education.
- The influence coworkers have on their eating habits both inside and outside of work.
- Perspectives of how advice from healthcare professionals impact behaviors.

At an environmental level, assessment of facilities on site, availability of food options at work, commute times, living situation, weekly hours worked, stability of work environment and job security could all positively or negatively impact dietary behaviors. It may also include how workers perceive eating behaviors within the construction sector as a whole. There should also be considerations of governmental influences such as programs which have been seen and perceptions surrounding national dietary recommendations.

3 Chapter 3: Research Study Manuscript

The following chapter is a manuscript written for submission to the American Journal of Men's Health which accepts research on subjects including public health and lifestyle disease prevention in men. The journal has a limit of 30 pages for original research which includes an abstract of 250 words or less, the body of text, references and appendices. Consent and transcript release forms along with a copy of the interview guide can be found in *appendices 4A, 4B and 4C* respectively.

Additional methods and findings can be found in Chapter 4 for phases 1 and 3 of the research respectively. This section investigates objective 1 of the thesis, which is:

1. Identify prevailing barriers and motivators perceived by male construction workers to be influencing their dietary behaviours and the dietary behaviours of their peers

The Constructing Health Study:
Factors Influencing the Dietary Behaviours of New Zealand Construction Workers

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3.1 Abstract:

The construction industry is a male dominated career group consisting largely of low to medium socioeconomic status (SES) workers. Non-communicable diseases including cardiovascular disease, cancer and diabetes, all of which are impacted by diet, have been demonstrated to significantly impact life expectancy and work ability within the construction sector. However, there is limited research surrounding the dietary behaviours of male construction workers, with none originating from New Zealand. This article seeks to identify barriers, motivators and demographic characteristics influencing the dietary behaviours of full-time male construction workers within New Zealand. Men who had worked in the industry for two or more years and were currently working in the Manawatu – Whanganui region were recruited to complete a brief dietary questionnaire. Of these men, a purposive sample (n= 13) completed individual (n= 11) or group (n= 1) interviews. Thematic analysis of these interviews suggests that a majority of participants were interested in their long-term health, though motivation to lead a healthy lifestyle was variable. The evidence also suggests that dietary patterns such as consumption of convenient, ultra-processed foods and sweetened beverages are common within these workplaces. Themes influencing food behaviours included female partners, nutritional knowledge, body weight, cost and convenience, healthcare providers, workplace environments and facilities and the mentalities of other staff and managers. Unlike reported in previous investigations these themes could not be labelled as predominantly motivators/facilitators or barriers to healthy eating with the exception of female partners, who were perceived as having an overwhelmingly positive influence on dietary behaviours.

3.2 Introduction:

Men working in blue collar industries are commonly identified as an at-risk group for preventable lifestyle diseases, shortened life expectancies and early exit from the workforce (Dong et al., 2011; Kolmet et al., 2006; Loudoun & Townsend, 2017). The most prevalent of these disorders have been identified as hypertension, cardiovascular disease, diabetes, cancer and musculoskeletal disorders (Claessen et al., 2009; Dong et al., 2011; Kolmet et al., 2006). Men in construction are also the most significantly impacted by obesity according to US data with worker productivity negatively correlating with weight as individuals become overweight or obese (Kudel et al., 2018). These conditions, as well as all-cause mortality, are known to be exacerbated by calorically dense diets high in processed foods rich in sugar and trans fats (Heileson, 2020; Rauber et al., 2018) and low in fibre, fruits and vegetables (Aune et al., 2017; Reynolds et al., 2019). Despite this, an overwhelming majority of health research addressing blue collar workers has focused exclusively on musculoskeletal disorders as these conditions can be directly linked to their career while lifestyle factors have been largely disregarded (Biswas et al., 2017).

A theory behind the lack of literature surrounding lifestyle behaviors in the blue-collar sector is that men, specifically young and middle-aged men, are a difficult to reach subset of the population especially in relation to health and lifestyle investigations (Caperchione et al., 2012; Du Plessis et al., 2013). Furthermore, men who prescribe to a more traditionally masculine set of behaviors, traits more commonly reflected in blue collar industries (Du Plessis et al., 2013; Ogden, 2011), have been demonstrated to place self-care, including healthy eating and seeking medical support, as a lower priority (Mahalik et al., 2007).

The research surrounding lifestyle behaviors in construction has identified factors such as time, food cost and availability, workplace culture, and knowledge of dietary recommendations as factors limiting change (Du Plessis, 2011; Hengel et al., 2012; Loudoun & Townsend, 2017; Okoro et al., 2016). The significance of these factors appears to vary depending on the population being investigated (Du Plessis, 2011; Gough & Conner, 2006; Okoro et al., 2016). The impact of interventions on workplace environments, employees and employers has also been evaluated with results suggesting that both businesses and individuals can benefit from improving worker health and that worksites are a viable environment for intervention (Novak et al., 2007; Townsend et al., 2016; Viester et al., 2012). A review by Novak et al (2007) on the efficacy of lifestyle interventions in blue-collar industries in New Zealand concluded that individual health education would be ineffective as it favors those who are already willing and have the means to change their behavior. Other factors need to be identified at individual, company and industry levels to foster significant, long-term change in the sector (Novak et al., 2007).

RCT's which have focused solely on education in this population have routinely failed to alter long-term behaviors or physiological or biochemical parameters, with many citing the need to target individual and organizational factors in future investigation (De Boer et al., 2007; Hengel et al., 2013). Reviews have demonstrated that incorporation of an ecological framework, one that targets the individual, their friends and family, and their broader environment including their workplace and community, are often more effect at improving lifestyle behaviours (Richard, Gauvin, & Raine, 2011).

Within New Zealand, a minority of the population meet both the daily fruit and vegetable recommendations while a majority exceed recommended caloric, trans fat and processed sugar intakes (New Zealand Ministry of Health, 2019c; University of Otago & Ministry of Health, 2011). Many of these factors as well as hazardous alcohol intakes are known to be considerably worse within certain subsets of New Zealand including men, Māori and Pacifika populations and low socioeconomic groups (New Zealand Ministry of Health, 2019c; University of Otago & Ministry of Health, 2011). Each of these demographics are known to be overrepresented within the construction sector with men making up between 92 and 98% of all trades and laboring positions, while socioeconomic status varies between low and moderate dependent on position (Fahy et al., 2017; Novak et al., 2007; StatsNZ, 2020).

Further research is needed on construction workers to understand their perceptions of health and nutrition. The current research seeks to explore the experiences of men working in the construction industry in New Zealand to identify the prevailing barriers and motivators effecting their dietary behaviors. It is believed that through enhancing this literature within the New Zealand context, future interventions can be better equipped to meet the needs of this at-risk group.

3.3 Methods:

The current study was a qualitative investigation looking at the dietary patterns, perceptions, and health status of male construction workers. The study consisted of three phases, of which phase two is reported here.

This investigation was approved by the Massey University Human Ethics Committee on the 21/09/2021. Approval code *SOA 20/32.*

3.3.1 Selection Criteria and Recruitment

Construction companies with active sites in the Manawatu-Whanganui-Horowhenua region were contacted to regarding recruiting their staff and provided with a letter of invitation. Site supervisor or project managers of companies that agreed to let their staff participate were provided with flyers to distribute to staff. Men who had worked in the industry for 2 or more years full-time and were currently working in the region was eligible to participate. The researcher visited sites and provided those interested with a more detailed information sheet. Men who volunteered to participate then completed the phase 1 questionnaire. A purposive sample was selected based on the information gained during phase 1. The sample was selected to represent a range of demographic characteristics and dietary behaviours reflecting New Zealand government recommendations in relation to fruits, vegetables, sweetened beverages, alcohol and fast-food purchases.

3.3.1.1 Depth Interviews

A semi-structured interview guide was designed utilizing an ecological model of health to ensure intrapersonal, interpersonal, and organizational factors were considered. These topics were discussed for both their positive and negative influence on dietary behaviours. The guide was designed using open questions that focused on the dietary behaviours of the individual without referencing themes identified in past research such as time, health or partners. This was intended to limit bias in relation to the topics workers wished to discuss. Later questions provided hypothetical scenarios which targeted these themes to gain a more in-depth scope of these topics. The guide built on the work of Du Plessis et al (2011) and Townsend et al (2016) who centralized their focus on the barriers and facilitators of healthy eating facing Australian men in the construction sector. Prior to engaging with study participants, guides were trialled on 5 men working in blue collar industries to ensure questions were being interpreted as expected and were allowing for a free-flowing conversation.

Interviews were carried out on worksites or in university facilities and were recorded using Voice Memo's® and transcribed using Microsoft Word 2016® transcription software. Thematic analysis was carried out using NVivo 12 Pro® with barriers and motivators set as major themes and sub-themes coded as the analysis progressed. Transcription and coding were conducted concurrently with the recruitment and data collection phases to allow for further investigation of emergent themes. In addition, this methodology allowed for a consistent re-assessment of the coding framework as new themes were added (Alhojailan, 2012; Fereday & Muir-Cochrane, 2006). While visiting sites, a checklist was taken of all eating facilities available at work sites for assessment of how this impacted individuals eating behaviours at work.

3.4 Results:

Thirteen purposely sampled individuals were selected from twenty questionnaire participants to complete interviews. These men worked for six companies on four active construction sites. These sites ranged in size from a seven-man team up to approximately fifty workers with three being suburban and one being a rural site. All sites had designated eating facilities containing at minimum, seating, clean running water, refrigeration, microwaves and boiling water. In total, twelve interviews were carried out with eleven being individual interviews while one involved two co-workers. Interview times ranged from 23 - 53 minutes with the mean duration being 40 minutes

Participants ranged in age from 18-69 years and had been in the industry for 2-50 years. Eleven out of thirteen were European with two identifying as Māori. Ten lived with a partner with five of these having children living at home. All participants were skilled tradesmen with one still classified as an apprentice, two working in leadership roles who worked both onsite and in an office and three having management positions, working primarily in an office environment. Roughly half of the individuals had healthy diets according to their dietary surveys, with low to moderate intakes of fast food and sweetened beverages, 2-3 servings of vegetables daily, 1-2 servings of fruit daily and regularly packing lunches and eating breakfast. The other half more frequently consumed fast food, regularly skipped breakfast and failed to pack lunches and ate 0-2 servings of fruits and vegetables daily.

Three participants were happy with their current diet with the other ten either being ready to change (n= 5), considering changing in the future (n= 2), or having changed their diet in the past year (n= 3) according to their questionnaire. When asked about these past or intended changes most men focused on removing foods such as sugary drinks and bakery goods or categories of foods such as carbohydrates or calories in general. Only 2 individuals discussed needing to add foods to their diet such as fruits, vegetables, or wholegrains.

Recruitment of staff was considerably more difficult than predicted. While eight out of thirteen construction companies were willing to let staff participate it is estimated that approximately 20% of individuals who received flyers or information sheets chose to participate.

3.4.1 Themes Identified Relating to Dietary Behaviours

Theme 1: Knowledge of government dietary recommendations is low and scepticism of nutritional information is common.

One key barrier which emerged is the lagging knowledge many men had about government recommendations and nutrition in general. 5+ a day and health star ratings were the only government recommendation commonly recalled. Some men expressed concern that the government did not know what was healthy or that the recommendations they have seen are contradictory.

> "we get so many mixed messages from everywhere about you shouldn't be eating this much red meat or you should be, shouldn't eat eggs, should eat eggs. Yeah, you know there is a lot of contradictory information out there in that sense." **(Participant 003)**

> "I mean what is perfect. Yes, I don't necessarily think what the government tells you is perfect, is correct anyway. I think everyone thinks they know." (**Participant 002)**

Participants focused on needing to reduce certain components of their diet with sugar, carbohydrates being the primary concern to improve their health. However, these individuals often did not know what is considered excessive for the foods they wanted to reduce.

> "I can see that they've got daily recommend intakes, that's 70% of your sugar intake for the day. But then, you know, I don't know what, if I'm eating this, how much sugar that's got in it and how much I'm blowing over a day." **(participant 006)**

> "I should probably research what I'm eating by looking at the ingredients and like sugar and stuff. But I'm, I don't really know what, what's considered high and what's considered low." (**Participant 010)**

Participants who could recall seeing government dietary recommendations often expressed that they didn't care or that these recommendations were not useful.

> "I think it's a crock of ****, I think it's **** poor what they've done. Health star ratings. It's a, it's a joke. Absolute joke, I don't look at that stuff. Yeah, I don't look at that stuff. I know it either has a lot of sugar or a lot of preservatives, and that's my decision" **(Participant 001)**

> "I don't know if I eat too much meat. But, you know, what's too much" **(Participant 005)**

> "You get a lot of information from the government, especially with Covid and all that sort of ****, and you just kind of tune out to it. And yeah, unless you want to in yourself, make the change then, doesn't matter what the government tell you" **(Participant 003)**

It should be noted that while this criticism of dietary recommendations was expressed by a number of men, some believed that the government and industry should provide more education and support in areas such as nutritional information, cooking, and food selection.

> "I think a lot of guys don't realize how easy it is to actually have nice food at work like you don't always just have to have sandwiches. Like it's not hard to have a sandwich press with how cheap they are or a microwave that you can heat stuff up on site." **(Participant 012)**

> "there will be a lot of guys on site that are completely useless at cooking and probably can't even cook eggs, you know" **(Participant 002)**

Theme 2: Work environments have the ability to foster poor behaviours or encourage positive change.

The second theme which emerged was the perception of food by workers in the construction industry. For example, fast food, bakery goods and sweetened drinks were commonly perceived as "normal".

> "get a pie or something like that, pastries and that, just because it's easy … this feels like the normal, like this is a normal way to behave in construction or something, you know" **(Participant 007)**

> "would have been a solid two years ago now that I've started doing that, I suppose you would call a tradie diet." **(Participant 011 discussing eating fast food during and outside of work).**

Many also suggested that bringing "healthy" food to work could lead to jokes at their expense.

> "I'm sure they'd probably get a bit of **** but, but I wouldn't pay any attention, like it would just be joking, you know" **(Participant 002 on how men may react to bringing a salad to work)**

> "when I was kickboxing, I was eating all my other stuff, it's hard cause even sitting around the table and you're eating this and like, of course you get **** for it" **(Participant 007 on eating salads and prepped meals at work)**

Being surrounded by individuals who ate a "tradie" diet caused many to feel tempted. Those trying to improve their diet discussed there being a cascading effect in relation to buying food at work.

> “if you get a van full of tradesmen and one or two of them want to stop at the pie shop, then the others will begrudgingly get one as well” **(Participant 005)**

> “You learn all the good bakeries and then when one person wants something then it's sort of a chain reaction really.” **(Participant 010)**

One suggestion made by participants 007 and 008 during their group interview was developing a buddy system, whereby two or more individuals support each other’s eating habits. This positive support was seen in some workplaces where individuals with less healthy diets, often younger men, were being persuaded to pack their lunch by more health-conscious, often older, staff members.

> “in a good way yeah. just constantly putting pressure on me to make changes. it's a good thing I think” **(Participant 011 on co-workers pressuring him to eat less fast food)**

> “We give *Participant 011* **** about what he eats and drinks. Because he used to drink lots and lots of Coke. So he got **** about that so he's cut it down” **(Participant 013 about Participant 011’s eating habits)**

> “our young apprentice, he used to be pretty, pretty bad but he started to bring a bit more stuff from home which is good.” **(Participant 012, a site manager about an apprentice)**

Another positive change that was identified was the perception that healthy eating practices were becoming more common within the industry. Several older staff discussed seeing considerable change within the past decade.

> “But look at alcohol. We used to have roof shout and all sorts of things that, you know, the company or the clients would put on and it was, it was poor leadership … society has made some huge inroads with alcohol and, you know, the same **** could happen with food” **(Participant 009 on drinking culture in construction)**

> “Only the last three or four years … you still see guys in our company that, you know, go down and get a couple of pies or a doughnut or you know whatever, for breakfast and again for lunch. And it's like, no wonder you're so ******** fat. But I've been seeing less of that in the past few years.” **(Participant 013 on changes he’s seen in eating patterns in construction)**

Theme 3: The mentality of staff differs considerably from managerial figures which could make it difficult to implement support programs

Three managers were interviewed, participants 009, 012 and 013, along with the nine staff members. Perceptions seemed to be conflicting between the two groups in regards to the need for worksite facilities and how they support behaviour. For example, multiple workers stated that water coolers were appealing and would help them drink more water while at work.

> "one of those water coolers. Like that'd be mean hey. A filter, a water filter … the convenience of that would be." **(Participant 008). In response participant 007 says "**Yeah I know, he [their employer] says, well just freeze it or just bring the bottle here, fill it up with water."
>
> It's a lot easier to drink it during the day. Cause you can be on site and the nearest water source is like 40 meters that way so it has to run through those pipes and it just gets hot and then you have to wait 10 minutes for it to get cold **(Participant 006)**

However, managers often believed these amenities were unnecessary and could add to their already high workloads.

> "guys get all into it and I'm like, put your drink bottle in the freezer the night before … from my point of view it's one more thing that I have to organize, keep clean, make sure the guys don't ruin, make sure it doesn't get covered in paint or dust or whatever" **(Participant 012)**
>
> "I see that as a double-edged sword really. You know if you don't have a fridge on site you don't have milk, you drink more water … You know if you want water, you'll drink tap water and if you're on site you'll drink water out of the hose." **(Participant 009)**

Hydrolyte sachets, which act as an alternative to sweetened drinks were also discussed. Workers believed these would help them drink more water.

> "yeah I'd drink more water for sure yeah. Because it just tastes better yeah." **(Participant 010)**
>
> "they're not, they're not sweet, but they're um, they can be better than just plain water." **(Participant 006 on Stevia sachets)**

In comparison one manager believed it was an added expense

> "It's a pretty big expense for the company, I sort of steer away from it because, yeah it is an expense and at the end of the day if you want it grab it and put it in your smoko bag … but if

you start doing that then where do you stop, buying the boys pies every day for lunch before you know it” **(Participant 012)**

In contrast, two participating sites had provided hydrolyte powders as a means of ensuring staff remained hydrated at work. One manger, participant 013, had also provided a water vat filled with ice while working in summer to help his staff drink more water and was actively discussing healthy eating with his staff.

Theme 4: The cost of food has a variable influence on the behaviours of workers.

Cost of food was sometimes identified as a barrier. Participants discussed having little money when they were young resulting in them opting for fast, convenient foods which cost as little as possible.

> “You know and you get to fill yourself up on a pie sandwich. It's tea. Baked bean toasties. We used to eat a lot of those when we were flatting because they were cheap” **(Participant 003 discussing when he started working)**

Similarly, many viewed aspects of healthy eating as too expensive with the cost of fruit often being raised.

> “I love fruit and like I do, go out and buy it, have it in my lunch. But yeah it's just ****** expensive. You know, when you can easily go and buy a packet of crackers, for $1.30” **(Participant 006).**

> “Lunch probably cost me $3.50 a day, yeah, or $4 a day. Yeah, if they can give me something that's going to fill me up as much as I can get $4 … and it’s cheap, $1.20 a loaf, just gone up but it was $1.20 a loaf. Well, you can't, you can't beat that.” **(Participant 005 on why he eats 4+ white bread sandwiches for lunch as opposed to buying food or using wholegrain bread)**

When asked how removing taxation from fruits and vegetables and implementing sugar taxes would impact their diet many were ambivalent, believing it wouldn’t affect their behaviours.

> “I’m not really buying fruit anyway. Got a lot of fruit trees at home so I'm not buying fruit even if I wanted any” **(Participant 010)**

> “I don’t think that'll change many people’s attitudes. They’ll still go out and buy, what they normally buy … They keep putting the tax up on cigarettes and people still smoke. Keep putting the tax up on Coke and people still drink it” **(Participant 003).**

Interestingly, some individuals, especially young men without financial responsibilities, seem to be influenced by having money in a different way. Instead of supporting a healthier diet, it perpetuates their ability to buy fast food on a regular basis.

> “I'm single bro, so I'm not really, like it's probably a thing that you probably start to realize when you have kids I suppose. But not at my age bro **(Participant 011 discussing the cost of buying fast food regularly).**

> “when they're younger they have the money and you know you spend your money that you earn, and savings aren't as much of a thing” **(Participant 012 discussing buying fast food as an apprentice)**

Theme 5: An excess of time leads to snacking while a lack of time supports convenience purchases.

Participants often discussed the influence time had on their eating habits when comparing their weekdays with weekends. Individuals who did not stay busy over the weekend often discussed snacking on convenience foods more and eating in excess.

> “I've always been a grazer. So, on the weekend and that, of course not during work. But on the weekends. Yeah. If we're not doing something, I'll have something going down my mouth.” **(Participant 001)**

> “yep eat a lot more. It’s terrible yeah. On the weekends, you know, I’ll get up and do a fry up on both Saturday and Sunday” **(Participant 006 on eating more food on weekends)**

The impact of the Covid-19 lockdown in March/April 2020 was also discussed as workers were home for 4-6 weeks. Many discussed snacking and eating in excess as well as drinking more alcohol than usual.

> “They all drank lots more. Some of them left their flat to go and join other flats for the lock down. So then, you know, let's get on the **** with those people for five weeks” **(Participant 003 discussing his work colleague’s alcohol intake over the lockdown)**

> “the two of us were spending over $300 at the grocery store a week. And that’s, well, half of that now, now that we’re back at work properly. But yeah it was just being at home. It was easy you know, just snacking out all day” (**Participant 006 on his partner and himself)**

Many also discussed cooking more during the lockdown. However, these meals were often viewed as less healthy and more of a treat, often being higher in calories.

> "I tried to be pretty good about it but yeah. It's pretty easy to have a cooked lunch or chuck something in the oven or something like that and then you eat a bit more." **(Participant 012)**

> "I probably ate worse, I think. Because, because I was, I had all the time in the world to cook up a fat boy breakfast every day you know." **(Participant 005)**

In contrast to leisure time being used to snack or eat in an unhealthy manor, many also discussed not having the time to prepare and plan meals. Often cooking dinner was left to their partners as they get home too late to cook themselves.

> "We've got 3 young kids. So my wife always makes dinner for them and they've normally eaten before I get home." **(Participant 002)**

> "I get home 5:30, and we like to eat about 6/6:30 watching the news kind of thing. Well I can't cook a casserole if I leave at 5:30 in the morning and I get home 5:30 in the evening, but she can." **(Participant 001)**

Not having the time to both eat well and exercise was also common, resulting in men prioritising one or the other.

> "So instead of increasing my physical activity, because I just don't have time to, I cut back on what I ate then would get rid of some of this." **(Participant 003 on weight loss decision).**

> "Tuesdays, Thursdays, you know you're out until, you know you get home about 8/8:30 from training and then you've still got to make your lunch. It's actually tough time wise" **(Participant 006 on playing rugby)**

One individual whose diet was particularly high in fast foods, confectionary items and sweetened drinks discussed the impact of having a highly irregular work schedule and no set work location.

> "It depends on, sometimes I work away, and just everything goes out the window because you end up buying food for every meal … if I knew I was going to be here long term I'd probably bring, you know, a can of chicken and some rice and eat that for lunch because I know I can heat it up and it's easy, it's done." (**Participant 006 on working away from home for 2 months)**

This can be compared with the observations made by a participant 001 whose team lived in hotels while working during the week. His perception was that these men ate quite well and were able to prepare their meals in spite of their disrupted work patterns.

> “These guys here you see they got peanut butter and all that stuff is very, you know you don't see much Coke. There are a few instant noodles down on the bottom. These guys are eating avocados and, and, and you know these are working guys and all that. But they shop for themselves. They all drink, big water drinkers very, very few Cokes” (**Participant 001)**

Theme 6: Female partners and family provide dietary information and control/influence a majority of food purchases and preparation.

The overwhelming influence female partners had on the dietary behaviours of participants was clear throughout interviews. Of the thirteen interviewees, ten lived with a partner with five also having children living at home. Another participant lived with his parents. As discussed, multiple men relied on their partner to prepare dinners. However, partners & family also controlled the grocery shopping and food selection.

> “My partner is very healthy so she governs a lot of that. And she's right into the veggie garden, so there's always fruit and veg on hand.” **(Participant 004)**

> “that's my wife. She buys the stuff and, you know, she listens to the stuff on the news” **(Participant 009 on why he eats less meat than the average participant)**

Men often believed their partner had a better understanding of nutrition. When asked about government dietary information and health information they would say their partner understood these topics and helped them understand.

> “I've heard, what is it, it’s three veg, it’s meat and 3 veg, or something like that, yeah? I don't think about it. My wife does.” **(Participant 001 discussing the 5+ a day campaign)**

> “That's why I started eating porridge in the mornings. Before I used to just have honey on toast. Because that was supposed to help me and also taking these tablets called Niacin” **(Participant 002 discussing his partner changing his eating habits to combat health concerns)**

Participants often cited their partners and family as being the primary motivation to change by encouraging healthy behaviours.

> “she’ll say, you can do it and if you have to buy one thing on a Friday so be it and we’ll work from there, or whatever. But yeah, she gets really disappointed when I come home and I’m like, I’ve had this and this and this today.” **(Participant 006)**

Theme 7: Weight motivates men to monitor eating habits but is also used a proxy for overall health.

Weight, specifically weight loss, was a common motivator for changing one’s diet. The reasons for wanting to lose weight included body image, health and work performance.

> “I just want to get low body fat percentage. Try to get some abs. Probably not this summer, but you know. Just try to get light, fit and healthy.” **(Participant 008)**

> “When I have done it, um, I notice a lot more energy, or a lot more go. You know you don’t, you just do and you can get into tight spaces and not lose breath. And you know, on a hot day you have a lot more stamina to carry on.” **(Participant 006 discussing past weight loss and the desire to lose weight again)**

> “For health mainly bro. Cause I've got bad genes honestly. Its hereditary … try to lessen my chances of being diagnosed with those things I suppose.” **(Participant 011 discussing wanting to lose weight to prevent diabetes and heart disease)**

An issue arose when men used weight as a proxy for health. Many believed it didn’t matter what you ate so long as you worked hard enough to burn it off. It was only when they started to gain weight that significant dietary changes were considered.

> “it wasn't relevant. If you were, you were doing the work it wouldn't stay on you.” **(Participant 009 on eating habits and how he wouldn’t gain weight regardless of what he ate)**

> “I’ll eat what I eat. I do enough. Some weeks I’ll do 20- or 30-hours training. So even if I ate well, I'm going to work it off” **(Participant 005)**

Theme 8: Results from healthcare professionals are valued while preventative information is not and support is not always conducive with change.

In order to gage how men valued the advice of healthcare professionals they were given two hypothetical scenarios. The first involved being told they were at risk of heart disease or type 2 diabetes. All men said they would change their diets as recommended, within reason.

> "If it's heart disease or diabetes at risk I'd want to change, most definitely" **(Participant 004)**
>
> "You'd certainly make little changes whether you can make the full recommendation change. I don't know. It depends how drastic the change they are recommending. Yeah, you'd be crazy not to." **(Participant 005)**

Five individuals from three different companies had received a workplace health screening which included blood pressure, blood lipids and blood sugar levels. These results were valued by many and had invoked behavioural changes for some workers.

> "I know a couple of them freaked out and rung their doctor straight away. But a lot of them were just like, ah yep, I'll get round to it, maybe. Sort of just let it pass over their head." **(Participant 007 discussing his co-workers).**
>
> "everyone that went to the check up from work was surprised you know. You're eating this wrong, or you're doing that or your blood pressure is up, or your cholesterol" **(Participant 013).**

The second hypothetical involved providing men with a nutritionist or dietitian to discuss eating habits and preventing long term health issues. Most men did not believe this would be helpful, citing that if they don't have anything wrong with them, then they will not change.

> "I wouldn't, jump into changing, as much as I would if there was physical evidence that what you're doing is, what's having an impact on you." **(Participant 002)**
>
> "We had a nutritionist work here for a while and she was interesting to talk to … But it didn't change anything. So, we had someone on the staff who would repeatedly talk about what were good choices and I don't think that changed anyone's eating habits." **(Participant 009)**

Interestingly, young, overweight men were open to the idea of receiving a diet plan and support as they were the most likely to discuss lacking confidence in their dietary choices.

"I would love someone to help me get my diet under control" **(Participant 008)**

"depends what their plan would be. Like if they gave me a plan and said follow this for however long, well I'd follow it until it finished, I suppose**." (Participant 011)**

Despite many men's willingness to change if a health issue arose, four individuals discussed not receiving enough help when a health concern was identified. This resulted in them being unable to change their behaviours and often becoming disparaged about their ability to change.

"She told me to watch this thing on Netflix bro it was like, I ******* forgot what it was called … she told me to watch it. which I didn't but yeah." **(Participant 011 on what he was told during a health screening while having high blood pressure, blood sugar, BMI and a poor family history)**

"they said I need to work on bringing it down, but not how to do it or what to do … They just told me like, you know you need to work on that, like I knew how too." **(Participant 006 on his experience with a GP after having high blood pressure readings)**

3.5 Discussion:

Before discussing the ramifications of the research findings, it is important to note the context of the individuals interviewed. The construction workforce in New Zealand is approximately 92-98% men, depending on position, who are primarily classified as having a low to medium SES (Fahy et al., 2017; Novak et al., 2007; StatsNZ, 2020). Māori and Pacifika populations are also over represented in the sector (Novak et al., 2007). As all participants were skilled tradesmen or currently working in management roles, findings cannot be construed to represent groups such as unskilled laborers. A majority of these individuals worked 5 days per week with most discussing working from 7/8am until 4:30/5:30pm which is not comparable to some of the previous literature which reported the lifestyle behaviours of men working 6-day work weeks or 12-day fortnights (Hengel et al., 2012; Lingard & Turner, 2014; Townsend et al., 2016)**.**

3.5.1 Workers Knowledge of Nutrition and Perceptions of Body Weight

Results of this study suggest that men in the construction sector have a basic understanding of nutrition. Most identified topics such as limiting processed sugars and total calories however many could not say what is a reasonable daily intake. Many could also recall seeing government information such as 5+ a day for fruits and vegetables and the health star rating and heart foundation tick on foods. However, issues arose in two distinct areas. Many men were highly sceptical of government information with recommendations for animal products regularly discussed as being unreliable or inconsistent. This scepticism has been discussed by UK construction workers who specifically associated government and mainstream media recommendations as fad-like and conflicting (Gough & Conner, 2006). Similarly, Australian men have discussed nutritional information being ever-changing and thus confusing (Caperchione et al., 2012). A lack of dietary knowledge is regularly identified as a barrier facing blue collar men (Du Plessis et al., 2013; Okoro et al., 2016; Viester et al., 2012). A number of interventions targeting the construction industry have utilised educational components in the past with some successfully altering factors such as body weight, dietary patterns and biomarkers (Tonnon et al., 2016; Viester et al., 2018) and others yielding statistically insignificant long-term outcomes (De Boer et al., 2007; Hengel et al., 2013). It was suggested that the success or failure of these programs could rely on targeting both individual issues, such as knowledge, and organisational issues such as time availability, job stability and work environment (De Boer et al., 2007).

The second issue identified surrounding the knowledge of staff was the perception that maintaining a "healthy" body weight and being in a physically demanding career would compensate for shortcomings in dietary behaviours. The perception that your physical work will "burn off" everything you eat has been reported in other investigations, especially among cohorts of younger men (Du Plessis, 2011; Gough & Conner, 2006). Excess body weight is a major issue in society and has been shown to significantly affect work ability and life expectancy within the construction sector (Arndt et al., 2007; Claessen et al., 2009; Di Angelantonio et al., 2016; Kudel et al., 2018). However, it has also been demonstrated that a diet lacking in key nutrients and high in ultra-processed foods can negatively impact the health of individuals in every weight bracket (Aune et al., 2018; Reynolds et al., 2019). There is a need to understand why this perception persists amongst men in this sector as it appears to be a significant barrier to engaging blue collar men in lifestyle programs.

Role of healthcare professionals

It was evident that men valued professional advice from healthcare providers and having access to physical information such as blood pressure, lipid panels and blood glucose. Most believed they would change their lifestyle if a healthcare professional said they were at risk of developing type 2 diabetes or heart disease. Health has been shown to be a concern for men in this industry (Kolmet et al., 2006) and is the reported reason many reduce alcohol, smoking, overall calories and increase consumption of fruits and vegetables (Alavinia et al., 2007; Lingard & Turner, 2014; Viester et al., 2012). However, most in the current study were ambivalent to receiving preventative support from dietitians or nutritionists citing that there was nothing wrong with them now.. Surprisingly, the only group that was receptive to receiving preventative support were overweight males in their early to mid-20s. These young men all wanted to lose weight, however the reasons behind this varied. There is a need to explore different styles of presenting information to this group. An intervention by Lingard and Turner (2014) experienced resistance to aspects of the intervention such as yoga, with workers being reluctant to participate. An alternative modality of presenting information may improve engagement with lifestyle programs. An example would be *Rugby Union Fans in Training New Zealand,* which contextualises lifestyle behaviours towards rugby, a common interest in the blue-collar sector (Maddison et al., 2019).

Issues arose when participants had received advice from healthcare professionals with multiple participants recalling encounters where the advice or support provided was insufficient. The descriptions provided of being told to “work on it” or “watch a documentary”, seem similar to an issue faced by the Health Under Construction (HUC) program developed in the Netherlands. During HUC, healthcare providers could refer construction workers who were at risk of early exit from the industry due to declining health, however many would only refer workers who they perceived would engage with the program (Tonnon et al., 2014). This trend of professionals investing time in individuals who they perceive to be actively engaged could also be present in this investigation. However, further investigation would be needed to determine whether bias from healthcare providers is an issue. As reported, half of the workplaces interviewed in the current study had provided health screenings to staff which was valued and had caused some behavioural changes.

3.5.2 Perceptions of staff Versus Employers

Past research from Australia has suggested that the deadline orientated nature of the construction sector places immense pressure on managers and site supervisors, making it increasingly difficult to engage them in lifestyle interventions (Loudoun & Townsend, 2017; Townsend et al., 2016). Similar research has also reported the sense of individualism presented by men in the construction industry in relation lifestyle behaviours, with this perception being amplified by managers and supervisors (Du Plessis et al., 2013; Townsend et al., 2016). These themes were also present in the current investigation to an extent. Workers showed interest in receiving support in the form of water coolers and hydrolyte powders while two managers believed this is costly, unnecessary or would add to their own workload. It is understandable that management take cost into consideration far more than tradesmen as they are in charge of the workplace budget and spending. When developing interventions in this sector, time constraints placed on site managers must also be considered.

The value of having a manager who was engaged and willing to support lifestyle changes was also identified. Two managers had discussed directly supporting younger tradesmen with their diet and two job sites had offered products which assisted men drink more water. As discussed above, health screenings are another support program that have been implemented to improve health and wellbeing. It has been repeatedly demonstrated that workers, especially young men in the industry, are influenced by managers and more senior staff either in a positive or negative nature (Du Plessis, 2011; Lingard & Turner, 2014; Loudoun & Townsend, 2017). Given this, it appears advantageous for lifestyle programs in this sector to have the support of managers and site supervisors, which means taking into consideration the deadline-based structure of the industry and the stress placed on these men.

3.5.3 Work Culture and Environment

Du Plessis et al (2013) investigated how masculine ideologies can influence the behaviours of construction workers. They suggested that subcultures of men may adhere to dominant norms of masculinity such as stoicism and self-reliance, resulting in them taking less interest in their own health and being less willing to receive support. This was reflected in this study population with some men not going to their doctors regularly and many being uninterested in the prospect of receiving support from a nutritionist of dietitian. It was also present in the recruitment process, with participation rates estimated at around 20% despite the inclusion of health screenings as a means to increase staff engagement and the study being conducted during work hours. It is believed that participants may be more health conscious than the general construction sector, with some suggesting that less healthy

workers had chosen not to take part in the current investigation. Previous research has demonstrated that men, especially young and middle-aged men, are a difficult group to engage in lifestyle programs focused on prevention (Caperchione et al., 2012; Tonnon et al., 2016).

Risk-taking behaviours including binge drinking and eating high sugar, high fat foods that offer instant gratification are also described as common manifestations of traditional masculinity either due to men perceiving ‘healthy’ eating behaviours as feminine (Mahalik et al., 2007) or due to socioeconomic disadvantage resulting in a need for instant gratification (Kolmet et al., 2006). These subcultures were evident in this population with many men discussing the concept of a “tradie diet” or believing that eating ‘healthy’ meals such as salads and pre-made meals may lead to ridicule by their co-workers. While some men discussed this ridicule as being light-hearted in nature, others did suggest that it made improving their dietary behaviours more challenging.

3.5.4 Female Partners

While still on the topic of masculine stereotypes, the common theme of female partners acting as primary motivators and support should also be discussed. For some participants this was a necessity as they worked long hours, had young children, and their partners were primarily at home, meaning it was a matter of time availability. However, many relied on their partners for most aspects of their diet including learning about healthy options, purchasing, and preparing foods as they perceived their partners to have a greater knowledge of these subjects. Similar reliance on partners was identified by past research (Du Plessis, 2011; Lingard & Turner, 2014). During an intervention targeting lifestyle behaviours in the construction, men have discussed wanting to include their partners if it involves a nutritional component as their partners control most food choices (Groeneveld et al., 2008).

Some individuals discussed sharing the cooking load while many discussed having their preferred or signature dishes which they made on occasion while their partner cooked a majority of meals. Within the literature it has been demonstrated that men often lack confidence in their cooking abilities and are more likely to discuss cooking as a skill to be done on certain occasions, while women more commonly perceive it as a care-giving task (Szabo, 2014). It has been demonstrated that individuals who cook regularly and are confident in their cooking abilities, on average, eat more vegetables and consume less fast food (Utter et al., 2018). Developing men’s self-efficacy in relation to cooking and changing the mindset many have in relation to food could drastically change the behaviours seen in this population.

3.5.5 Cost Versus Convenience.

In the current study, both time and cost appeared to have a significant effect on the purchasing of convenience foods. For instance, limited time at and after work was discussed by workers as incentivising fast, convenient foods. Throughout the literature, limited time is a common theme discussed by blue collar men in regard to both food preparation and consumption (Alavinia et al., 2007; Caperchione et al., 2012; Du Plessis, 2011). Participant 012 linked this back to knowledge, suggesting that a number of men don't know how to make good tasting, affordable food quickly. Having an excess of time, such as on weekends, was also seen to negatively influence participants dietary behaviours, with many reporting eating more calorically dense and self-gratifying foods. Similar behaviours were also discussed for the Covid-19 lockdown, which saw workers at home for six or more weeks. This trend of excess time negatively influencing the dietary behaviours of workers has also been reported by Lingard and Turner (2014) who suggest that poor dietary behaviours during time off from work stems from a need to relax and get out of their high intensity weekly routines. There is a need for research that distinguishes between these two forms of time availability, with the former primarily being a lack of time availability during the working week and the latter being the use of excess time during periods of rest and recovery.

Cost of a healthy diet was less commonly cited as a barrier within this population however it was still raised in relation to specific foods such as fruit. The alternative, i.e., a surplus of money, was seen to negatively influence eating patterns especially amongst young workers, by allowing them to purchase fast food on a regular basis for convenience. Similar themes have been identified in previous research in which fast food was chosen over cooking as it fit into the budget of young tradesmen who didn't have other financial obligations while also being considerably more convenient (Du Plessis, 2011). Research in New Zealand has demonstrated that a healthy diet, as outlined by the NZMoH, can cost less than the average diet if caloric intake meets government recommendations (Mackay et al., 2018). A primary barrier facing this population appears to be the perception that convenience out ways the cost associated with fast food purchases. Programs such as the Heartbeat Challenge have attempted to correct issues of affordability and accessibility within the workplace by guiding workplaces to offer health conscious food options either at on-site canteens or by controlling the contents of vending machines (Price et al., 2000).

3.5.6 Eating Facilities

As all the sites visited during this investigation had quality, clean eating facilities consisting of refrigeration, seating, running water and microwaves, the current investigation has limited ability to comment on the impact poor quality or no eating facilities has on the workforce. A majority of men felt ambivalent towards the impact eating facilities at work had on their behaviours. While some believed having facilities such as fridges, microwaves and running water were supportive of a healthy diet, many believed they would pack a cooler bag or eat their food cold if necessary. This contrasts with qualitative and quantitative investigations elsewhere which suggest that having quality, well designed facilities were imperative to supporting healthy eating practices (Okoro et al., 2016; Townsend et al., 2016). Quantitative results by Okoro et al (2016) suggested that many high protein foods such as eggs, fish and dairy are eaten far more frequently if facilities are available (Okoro et al., 2016). Future research could focus on specific subsets of this population such as 'road crews', with one participant suggesting that these workers lack access to any facilities, and thus buy convenience foods on a more frequent basis at work.

3.6 Implications and Recommendations for Future Research

Based on the current investigation we propose 3 recommendations for future research, with each focusing on a different level of the ecological model. The first focuses on the individual. Future investigations are needed surrounding the perceptions of specific subsets of construction workers including unskilled and semi-skilled laborers and transient workers who do not work on established sites for extended periods, such as those hired by employment agencies. The current investigation and prior research primarily relate to skilled tradesmen working on developed sites and as a result, factors such SES, workplace facilities and job stability may be misconstrued to represent cohorts of workers who face vastly different barriers. It has been established that individuals with a higher SES, greater job stability and greater levels of education commonly have healthier lifestyle behaviours as well as being easier to engage in lifestyle research.

The second relates to interpersonal relationships of this group. To the researchers knowledge, there are no investigations which have interviewed the partners, family, friends or healthcare providers of men in this sector and their perceptions of how lifestyle behaviours could be improved. This investigation has demonstrated that female partners play significant role in dietary behaviours. It's also been demonstrated that interactions with healthcare providers vary for men in this sector. Understanding the perspectives of these stakeholders could offer new pathways to improving the lifestyles of these men.

The third recommendation relates directly to managers and other organisations in the sector. There is a need for interventions both within workplaces and at sites such as trade schools and material suppliers all of whom are in regular contact with workers. A majority of interventions to date have focused on empowering and educating workers on job sites and presenting information on a health basis. Both the current and previous work has demonstrated that health is not the only motivator for men in this industry. There is also a need to present information through different modalities, such as the RUFIT-NZ program which presents health advice under the pretence of common sporting interests. Understanding how men in the sector are impacted by these different programs and presentation styles could prove valuable in producing long-term changes in the sector.

3.7 Conclusion

This study is the first known investigation into the perceptions of male New Zealand construction workers in relation to how different aspects of their lives impact their dietary behaviours. It supports findings from other nations that factors such as nutritional knowledge, workplace environment, time availability, cost, and support from healthcare professionals and female partners, are perceived by men in the sector to influence their dietary behaviours. However, unlike previous investigations which often categorised these themes as either facilitators or barriers (Du Plessis, 2011; Townsend et al., 2016), these results suggest that the influence of these factors is more nuanced, with many having the potential to either positively or negatively impact behaviours. The evidence suggests that while men in the sector are mindful of their health, many do not consider the long-term ramifications of lifestyle behaviours and would opt to wait until a health issue is identified before enacting real change. These perceptions appear to be associated with a lack of detailed knowledge relating to nutrition and scepticism towards government nutritional information. However, it cannot be concluded whether a lack of knowledge influences perceptions or if the perceptions of workers are the cause of a lack of knowledge. While the scope of this investigation is limited, involving a relatively small number skilled tradesmen on small worksites, these results can be used within the New Zealand context to broaden our understanding of the barriers and facilitators influencing the lifestyle behaviours of men in the construction sector and other blue-collar industries.

These results, and those of previous investigations (Du Plessis, 2011; Okoro, 2016; Lingard & Turner, 2014) and interventions (Groeneveld, 2010; Tonnon, 2016; Viester, 2018), suggest that while perceptions of workers may be hindering change, current education and support programs targeted at the individual are not producing long term changes in lifestyle behaviours. In order to improve the collectively poor health status of men in the construction sector (Dong et al., 2011; Novak et al., 2007), interventions are needed which involve workers at an individual level, their employers and through

the business and broader community by re-assessing time schedules and including partners and family in lifestyle changes. It is clear that some individuals and companies are already making a concerted effort to improve the health and wellbeing of their workforce through individual support and company-based services and facilities. It is hoped that future investigations will take into consideration the highly demanding nature of this industry and develop methods to assist men at an individual level while also considering the broader scope of factors which impact their behaviours.

4 Chapter 4: Phase 1 and 3 Pilot Study Methods and Findings

The following chapter outlines the method and findings of Phases 1 and 3 of the Constructing Health Study. These pilot studies were developed with the knowledge that recruitment would not be substantial enough to produce statistically significant outcomes and instead seeks to present the behaviours, health status and perceptions of this cohort which may be useful in future investigations. The following objectives will be covered in the chapter:

1. Undertake a pilot study to investigate the dietary behaviours of male construction works.

2. Carry out a pilot study investigating the body composition and health status of men in the construction sector and how this information impacts their perceptions of disease risk and dietary quality.

The letter of invitation sent to companies, advertising flyer information sheets for phases 1 & 2 and phase 3 can be found in *appendices 2A, 2B, 2C and 2D* respectively.

4.1 Phase 1 Pilot: Questionnaire.

This section outlines the methods and findings for the phase 1 dietary questionnaire pilot. Dietary data was grouped into 4 categories: meat consumption, unhealthy dietary behaviours, healthy dietary behaviours, and food selection and dietary patters with graphs found in *appendix 1A*. The questionnaire used for phase 1 can be found in *appendix 3*.

4.1.1 Methods:

The questionnaire was developed to focus on poor dietary behaviours seen in research surrounding construction workers in other nations as well as in demographics which are heavily represented in the sector within New Zealand including men, Māori and Pacifika and low SES populations (Novak et al., 2007). Questions were selected from the 2008/09 New Zealand Adult Nutrition Survey (University of Otago & Ministry of Health, 2011) and the New Zealand Healthy Dietary Habits Index (Wong, Haszard, Howe, Parnell, & Skidmore, 2017). Four questions relating to the individuals perceived susceptibility and severity of non-communicable disease and their perceptions of their current diet were also included to allow for comparison between phase 1 and phase 3 perceptions. Demographic information was also included for purposive sampling of phase 2 participants.

4.1.2 Results:

Twenty individuals from seven separate companies who were working on four active sites in the Manawatu-Whanganui regions completed the phase 1 dietary questionnaire. These individuals ranged in age from 18-69 years and had worked in the industry for between 2 and 50 years. The most notable observations made from this data includes:

- Meat consumption, which included white and red meats, is above the national average with the average participant eating 13+ servings per week. It is also higher than rates seen in men, Māori, Pacifika, and low SES populations according to the *2008/09 NZ Adult Nutrition Survey (University of Otago & Ministry of Health, 2011)*.
- Fish consumption is low even compared to these population subsets with the average being less than one serving per week for both fresh seafood and fried/battered seafood.
- Fast food and SSB consumption are relatively high for men under 30 who averaged 4+ per week, while low and no consumption primarily consisted of older participants.
- 7 out of 20 participants classify as having harmful drinking behaviours due to commonly drinking 5+ standard drinks on a single occasion. Similarly, 6 out of 20 are classified as risky drinkers due to consuming 15+ standards drinks per week according to New Zealand criteria (New Zealand Ministry of Health, 2019a).
- 40% of participants met recommended daily fruit consumption of 2+ compared to the national average of 55% for men (University of Otago & Ministry of Health, 2011). Those who met recommendations were more likely to live with a partner.
- 30% of participants met recommended daily vegetable consumption of 3+ compared to the national average of 59% for men (University of Otago & Ministry of Health, 2011). Those who met recommendations were more likely to live with a partner.
- Half the participants eat breakfast every day while Sixteen out of twenty pack their lunch at least 3 times per week. Low rates, such as eating breakfast or packing lunch two days a week or less were more commonly seen in men under the age of 30.
- Participants overwhelmingly knew about health star ratings but did not believe it affected purchases their purchases
- Low sugar is considered more often than low fat and low salt when purchasing food.

Many of the detrimental dietary behaviours seen here, such as high consumption of ultra-processed, high calorie foods and elevated alcohol intakes are reflected in other nations when investigating the construction sector and blue-collar industries more generally (Du Plessis, 2011; Gough & Conner, 2006; Okoro et al., 2016). This data also suggests that many poor behaviours are perpetuated in young men under the age of 30 and that men who do not live with a partner may eat fewer fruits and vegetables.

Despite the data suggesting that this cohort adheres to a worse dietary composition than the national average, there is evidence that many are actively considering their behaviours. This is seen with a majority having changed or considering change in the future. However, according to phase 2 these changes primarily revolve around removing unhealthy foods such as sweetened drinks, ultra-processed and convenience foods. There is a need for more widespread data collection on this topic to determine whether these observations are an accurate reflection of the construction sector in New Zealand.

4.2 Phase 3 Pilot: Health Screening

Of the twenty participants who completed the phase 1 questionnaire, twelve volunteered to take part in the phase 3 health screening. The average worker who took part in phase 3 was considerably older than phases 1 and 2 with ages ranging from 20-69 and the average being 43 years of age. The average age of those that chose not to participate was 27 years old. Tabulated data for the health screening and follow up questions can be found in *appendix 1B*. The phase 3 consent form, results sheet, questionnaire can be found in *appendices 5A, 5B and 5C*.

4.2.1 Methods

Body composition and health screenings were conducted at the Human Nutrition Research Unit (HNRU) at Massey University, Palmerston North. All participants who completed the phase 1 questionnaire were offered the opportunity to participate. BMI was calculated using calibrated weight scales (accurate to within 0.01kg) and wall mounted height measure (to the nearest 5mm). Waist circumference was measured at the umbilicus using a tape measure (to the nearest 5mm). All measurements were taken while subjects wore skins or other skin-tight clothing and no shoes. Body composition was measured using the BodPod® which calculates body fat percentage through the displacement of air as the subject sits inside the device. Blood pressure was measured twice using a Omron® blood pressure cuff (to the nearest mmHg) with the mean of the two results being used. Variations greater than 10mmHg required a third measure. Blood pressure was taken prior to

BodPod® or blood measures to limit distorted readings. HDLc, TC and TC/HDLc ratio were measured using the CardioChek® and PTS panels® Lipid Panel (pts Diagnostics). Blood glucose levels were measured using the FreeStyle Optimum Neo® and FreeStyle Optimum blood glucose test strips. An individual was defined as having hypertension when readings were >140/90mmHg. Concerning lipid profiles were defined as a TC/HDLc ratio >6mol/L or a TC > 8mmol/L. Concerning blood glucose readings were defined as <2mmol/L or >9mmol/L. In the event that a participant had results which were deemed a direct risk to their health according to SOPs, they were provided with a standardized form of the results and advised see their medical practitioner (*appendix 5D***).** All values were based on the previously carried out Well-Lad study (Quilter, 2016).

At the end of phase 3, participants discussed their results with the researcher. They then answered four questions from the phase 1 questionnaire, questions 16-19 (a*ppendix 3*), regarding perceived susceptibility and severity of CVD and T2D, and their perceptions of their current diet and how it relates to their risk of developing these diseases. This was to assess whether engagement with the research and the phase 3 health screening had altered perceptions.

4.2.1 Results

It should be noted that two participants, 001 and 013 were taking blood pressure medication at the time of testing. As factors such as smoking were not taken during the initial screening, 5 year cardiovascular risk status cannot be determined for individuals as outlined by the 2009 New Zealand Ministry of Health Cardiovascular Guidelines Handbook (New Zealand Ministry of Health, 2009). Results of the final questionnaire can be seen in table 3 of *appendix 1B***.**

4.2.1.1 Physiological Results:

Table 1 in a*ppendix 1B* outlines the physiological data collected from individuals including BMI, body fat percentage, WHR, and blood pressure. In order to compare the results from BMI with BodPod® and WHR, overweight and obesity class 1 were grouped together as “above recommended ranges” while obesity class 2 and above were grouped as “a potential concern for the individual’s health”. This was due to evidence suggesting that individuals classified as obesity class 2 and above having significantly worse long-term health outcomes (Elagizi et al., 2018) as is also seen in the construction industry (Claessen et al., 2009; Dong et al., 2011). This is not to suggest that overweight and obesity class 1 classifications do not elevate risk, however, there was a need to group individuals as having “excess fat” as this is how body fat percentage classifications are made using the BodPod®.

Body composition data was collected to make observations on the accuracy of BMI in men who work in physically demanding careers. Given the sample size, no statistically valid results can be produced from the data. Observationally there is no notable difference in classification between BMI, body fat percentage or WHR. BMI classified seven out of twelve as having excess body weight and two out of twelve as having a risky body weight with the remaining three being in the normal range. Body fat percentages classified five individuals as having excess body fat and three as having risky body fat while two participants had low body fat percentages and the final two were in the normal range. The mean of all 3 measures placed the population as being marginally in the excess body fat range.

One factor that should be considered is that of the 12 individuals who participated in phase 3, four worked partially in an office environment while two worked full time in an office environment. These were participants 001, 007, 012 and 013 and participants 002 and 009 respectively. The average age of this cohort was also high at 43 years of age, which can contribute to increases in body weight (Elagizi et al., 2018). Results may vary if the population consisted solely of skilled tradesmen or included unskilled or semi-skilled laborers and engaged more younger tradesmen.

4.2.1.1 Biochemical Results:

Table 2 in *appendix 1B* outlines the biochemical data collected from individuals including blood glucose levels, total cholesterol, HDL and TC/HDL ratio. Ranges were set based on the 2009 New Zealand Ministry of Health Cardiovascular Guidelines Handbook (New Zealand Ministry of Health, 2009). As seen, total cholesterol was a common issue in this population with 8 out of 12 participants being outside the recommended ranges. However, 6 out of 12 participants had TC/HDL ratios within the recommended range with another individual unable to get a result due to their cholesterol levels exceeding the CardioChek® ranges. As outlined by the 2009 New Zealand Ministry of Health Cardiovascular Guidelines Handbook, TC/HDL ratio is a more reliable measure of an individual’s risk of cardiovascular events than individual measures (New Zealand Ministry of Health, 2009). A larger cohort of men would more definitively identify whether cholesterol is a concern within the construction sector.

4.2.1.2 Questionnaire Outcomes:

As can be seen in *appendix 1B*, Table 3, there were limited changes in questionnaire responses to each of the four questions. Changes in perceptions were also small, mainly consisting of changing from agree to strongly agree or neutral to disagree. However, there were two changes in perceptions which appeared to consistently trend in one direction.

The first notable change is the number of individuals who strongly agreed that developing heart disease or diabetes would be a serious concern. However, meta-analysis has demonstrated that perceived severity, as utilised in the Health Belief model, has the weakest association with behaviours while perceived barriers has the greatest association (Carpenter, 2010). Given this, it is unlikely that this change in perspective has significantly influenced the behaviours of individuals.

The second change saw five individuals no longer believing that their diet increased their risk of heart disease or type 2 diabetes. This is in spite of many having elevated TC and TC/HDL ratios and some having elevated blood pressure readings.

Given these results, there is no evidence that the present investigation has influenced the perceptions of this cohort. Similarly, in order to determine whether the screening has influenced behaviour there would need to be a separate dietary assessment for all those involved.

5 Chapter 5: Conclusion and Recommendations

5.1 Summary of Findings:

The aim of this study was to utilise an ecological model of health to identify barriers, motivators and demographic characteristics influencing the dietary behaviours of full-time male construction workers within New Zealand and present pathways to improve dietary profiles.

The objective of phase 2 was to identify the prevailing barriers and motivators perceived by male construction workers to be influencing their dietary behaviours and the dietary behaviours of their peers. The results suggest that men perceive a broad range of factors, identified in this study as themes, to be influencing their dietary behaviours. Of these, female partners have a largely motivating/facilitating influence on most men while senior staff and management figures have the potential to positively influence staff, especially younger employees, as has been found previously (Du Plessis, 2011; Townsend et al., 2016). However, managers were often unwilling to provide extra services, citing their high workload which is common in the construction sector (Loudoun & Townsend, 2017; Townsend et al., 2016). Workplace environment had a similar impact with diets often being affected by peer pressure and work requirements while also being supported at times through a health-conscious team member. Participants commonly had a basic understanding of nutrition and used weight as an indicator of health status. While many participants respected the advice of healthcare professionals only young overweight men were interested in receiving support from a nutritionist to prevent long-term health concerns. Some men had also reported receiving poor support from healthcare professionals in the past when they needed it, which in turn impeded their ability to change. Finally, the perceived effects of cost, time and workplace eating facilities were highly variable in this cohort with many believing that each had the potential to positively or negatively influence behaviour and that self-motivation would overcome these issues.

Objective one was to utilise a pilot questionnaire to gain insight into some of the dietary behaviours of men working in the construction sector. It appears that dietary patterns of this cohort are worse than the average New Zealand male with fewer meeting fruit and vegetable recommendations (University of Otago & Ministry of Health, 2011) while approximately half exceeded recommended alcohol intakes (New Zealand Ministry of Health, 2019a). Other concerning dietary patterns included the majority eating 13+ servings of meat and less than 1 serving of fish per week and a select few, especially young men, eating fast food 3+ times per week while drinking 7+ SSB's per week. Older participants and those with partners were seen to have collectively better diets through eating breakfast and packing lunches regularly, eating more fruits and vegetables and less fast food and SSBs.

These results may present a false image of the industry with many phase 2 participants discussing eating far more fast food and sweetened drinks than they had presented on the questionnaire. Many also discussed there being individuals with far worse dietary habits who chose not to take part in the study. In order to determine if these trends are widespread within the construction sector there would need to be broader distribution of the questionnaire.

Objective three involved the assessment of body composition and health status of men in the construction sector and how this information impacted their self-perceived risk of disease and desire to change their diet. Of the twelve participants involved in the phase 3 screening, health status was variable with total cholesterol and TC/HDLc ratios being above recommended ranges for eight and five participants respectively. The primary concern identified was weight and body composition given nine individuals had BMIs above recommended ranges, two of which were classified as obese class 2 or higher. Similarly, eight had body fat percentages above recommended ranges, of which three were classified as high risk due to having a body fat percentage above 30%. These factors increase individuals risk of developing CVD and T2D (New Zealand Ministry of Health, 2009). There was no conclusive evidence suggesting that BMI miscategorised individuals as overweight or obese compared to body composition results, as was initially hypothesised.

The final questionnaire showed that more participants strongly agreed that developing CVD and T2D would be a serious issue, an increase in perceived severity. However, participants were less likely to believe their diet was increasing their risk compared to phase 1 and were largely neutral about their risk of developing CVD or T2D when they are older. This suggests there was no considerable change or even a decrease in perceived susceptibility. Many individuals also stated that they were now happy with their diet. Without re-assessing the dietary patterns of the cohort, it cannot be determined whether these changes in perceptions have influenced behaviours.

The data from the questionnaire, interviews and health screenings suggest that unhealthy dietary behaviours are common within the construction sector in New Zealand and that the health of this population could be negatively impacted. The extent to which this is true should be investigated in greater depth to understand the scope of the problem. Furthermore, there are many multifaceted factors influencing these behaviours which could be targeted at individual, organisational and at a governmental to promote health and wellbeing in the sector.

5.2 Limitations:

One significant limitation to the quantitative scope of this investigation is the small sample size with 20 respondents to the initial dietary questionnaire and 12 participants involved in a health screening. Given this, no statistical analysis has been undertaken with results being presented as an initial view of the construction sector. In order to infer that dietary behaviours are systematically poor and that the health and wellbeing of the population is at significant risk there will need to be greater investigative work undertaken. Recruitment presented as a considerable issue in this study. As a result, it is recommended that future investigations will need to consider different methods of incentivisation beyond offering health results and participation during work hours.

The population involved in this investigation does not provide a wide view of the construction sector. All participants were working on active sites which had quality eating facilities and were relatively small scale, ranging from 5 staff up to approximately 80. All participants were also skilled tradesmen. As such, the following topics are outside of the scope of this investigation:

- Previous investigations surrounding large scale job sites, such as hospitals and skyrises have been found to face barriers unique to those settings (Lingard & Turner, 2014; Townsend et al., 2016).
- Semi-skilled and unskilled laborers and tradesmen are not represented in this research. This could impact factors such as income, education level and job security of this group.
- Given the small team environments, managers may not face the demanding nature and complex leadership structures discussed on large worksites (Townsend et al., 2016).
- Given participants worked on active sites with eating facilities, any discussion of having limited eating areas, as would be the case for travelling workers or road working crews, relies on participants recalling their past experiences with the topic.

Given participation in the research was voluntary, it is possible that health-conscious individuals are over-represented. It has previously been demonstrated that men who are younger, less educated, overweight/obese, and classified as having a low SES are less likely to participate in health and wellbeing programs (Caperchione et al., 2012; Groeneveld et al., 2009; Hooper et al., 2016). Multiple participants in this investigation also noted that workers with poor behaviours were not interested in participating.

5.3 Recommendations:

The following section will discuss potential future directions of research within New Zealand and internationally in relation to male construction workers. Recommendations have been broken down into three categories; individual, organisational, and government targets and revolve around the 3 phases of this research as well as information ascertained during the literature review.

5.3.1 Individual

At an individual level, the primary target of intervention has been the knowledge of workers as it relates to planning, purchasing, and understanding health ramifications. In the past this has been done through group classes or individual consultations (De Boer et al., 2007; Tonnon et al., 2016; Viester et al., 2018). While there is evidence of lagging knowledge and scepticism of government recommendation and nutrition there is also a need to focus on skills and support networks. Cooking education, engaging with men and their partners to develop a plan for the future, and developing buddy systems at work are all methods of supporting men which are outside of the current support networks available.

In terms of research, greater focus is needed on specific subsets of this population, especially groups which have been hard to engage in the past. These groups may include:

- Unskilled and semi-skilled tradesmen and laborers
- Low socioeconomic groups and high NZDep regions
- Men in transient, unstable employment such as those hired by employment agencies.
- Young men entering the workforce.

Similarly, the following investigations could produce data to help isolate and identify key lifestyle issues facing this population:

- National dietary questionnaire data from within construction and blue-collar industries. The dietary questionnaire data from this investigation does not have the statistically power necessary to draw conclusions due to the small sample size. Similarly, relying on population data from the 2008/09 New Zealand Adult Nutrition Survey or the annual NZ Health survey does not offer a clear outline of the dietary practices of this group as they are not defined categories within the data.
- Understanding the dietary patterns of men in the industry both at and outside of work would help isolate when deleterious dietary behaviours are most prominent. This investigation

suggests that dietary behaviours are worst when men are at work and needing to travel for work. However, this cannot be confirmed. When undertaking such an investigation it must be remembered that this population is difficult to engage. Therefore, any investigation like this needs to place minimal demand on workers. Similarly, the process would likely need to be incentivised, either being presented as a work requirement or through monetary rewards for engaged individuals.

- Widespread health screening data would help understand both the health status of the industry as well as fields of concern such as weight, cholesterol, or blood pressure. This would likely need to be done on work sites as offering this as an optional task outside of work time would favour those who are already willing to change their behaviours. The current research saw about half of the workplaces involved already offering this service. If this is reflective of the industry in New Zealand it is possible that a strong source of data already exists within these companies and the healthcare providers they associate with.

5.3.2 Organisational

A key theme identified in this investigation which is reflected in past research is the poor dietary health of young men entering the workforce. In order to combat this, simple programs could be put in place within trade schools such as:

- Offering information on how to plan, pack and cook foods on a budget and in a time effective manner. Having this information supplied by someone who is knowledgeable of the demands of the sector would likely benefit how this information is received.
- Offering foods at trade school which promote healthy behaviours.
- Developing partnerships with local food providers to make fresh foods more appealing and accessible to this group.

Targeting the workplace environment and the mentality of staff is also a key factor. Site managers and employers need to understand that their behaviours and perspectives have a significant effect on their staff and staff behaviours as has been shown here. Changing the perspectives and behaviours of site managers could be invaluable in starting to change the lifestyle behaviours seen in the industry. Similarly, introducing nutrition as part of the work environment could support gradual change within the industry. Examples include:

- Having nutritional advice as part of toolbox talks/team meetings. This is currently done for topics such as sun safety and hydration within the industry as they are seen as direct workplace concerns.
- Changing the food environment to support healthy choices. By offering alternatives to SSBs, such as cooled water or electrolytes workers behaviours can begin to change.

It has been demonstrated that staff appreciate support from employers. However, in order for this to happen researchers need to publish evidence that programs actually produce results and have a ROI. This includes government programs such as the Heartbeat challenge which is believed to have run for over a decade without any publicly available evaluations after the first 2 years. Without incentivisation, employers are already working in a highly stressful industry which functions on deadlines and cannot be expected to engage with demanding workplace interventions. Successful methods which have already been adopted by some include health screenings for staff. Workers have demonstrated that they care about their health and are willing to change. Removing the barrier of travelling to a healthcare provider is a simple method of improving early detection of health concerns and can be incorporated in with standard workplace screenings which test hearing, sight, skin cancer etc.

5.3.3 Government

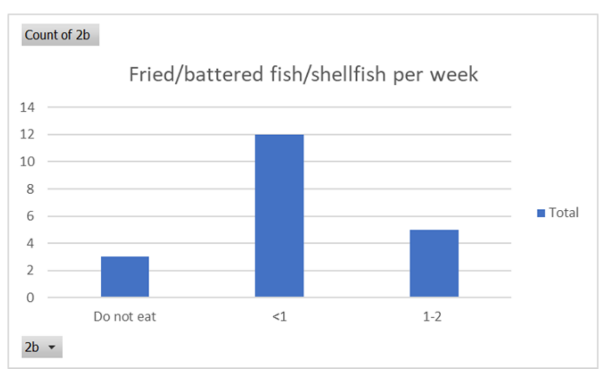
Governments should be taking note of systems such as the Galaxen model or Health Under Construction which aid individuals who are impacted by poor health but also helps prevent long-term health conditions on a national scale. In a nation with public healthcare such as New Zealand it is the government which benefits from the improved health of its citizens thus it is the government that is incentivised to ensure they remain healthy. As has been demonstrated, workplaces are a valid site for intervention. However, the government could help support men in the community by:

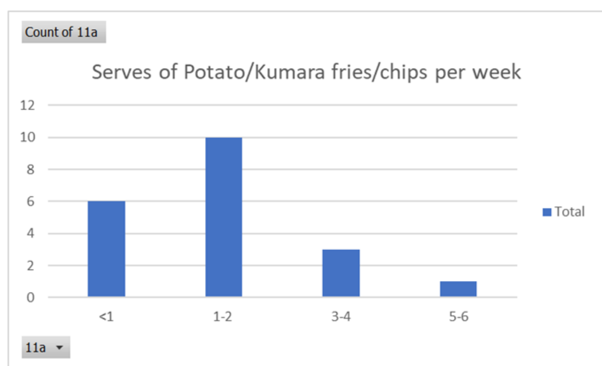
- Development of programs which are appealing to this group like RUFIT. These need to be time effective and malleable to the region's needs. Similarly, programs such as HBC which place minimal demand on workplaces are ideal for this industry.
- Incentivising healthcare professionals to support this group. Men in the sector need to know that if they receive a diagnosis, healthcare staff are able and willing to support them.
- Produce nutritional campaigns which target working class men. Information needs to be succinct and easy to recall. Given the only nutrition topic which could commonly be recalled is 5+ a day, it is believed that information relating to nutrition is not currently being registered by men.

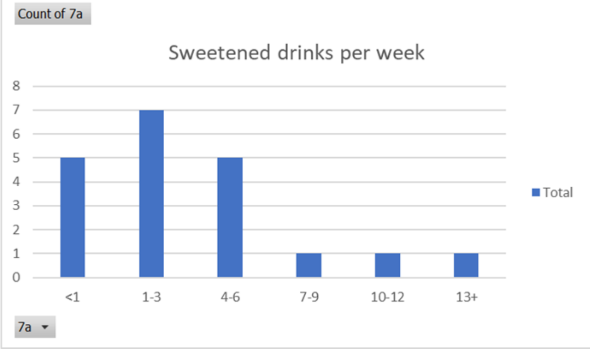
6 Chapter 6: Appendices

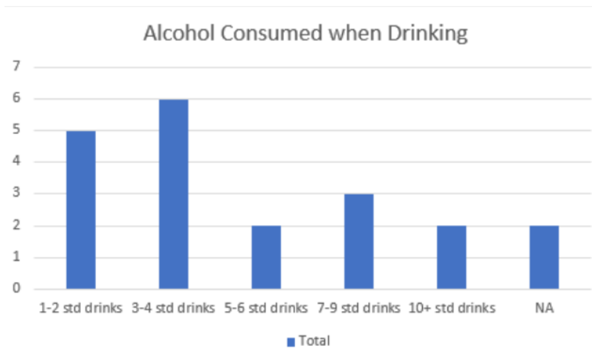
6.1 Appendix 1A: Data from the Phase 1 Dietary Questionnaire

Unhealthy dietary behaviours:

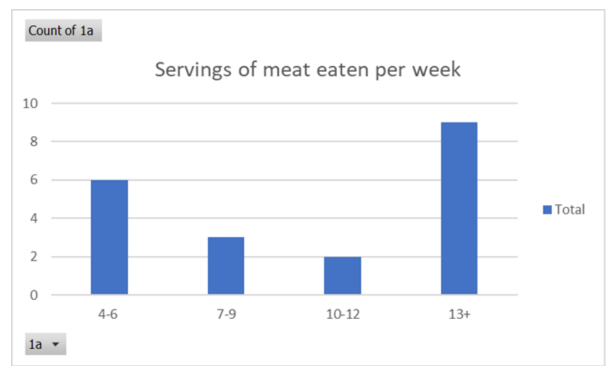


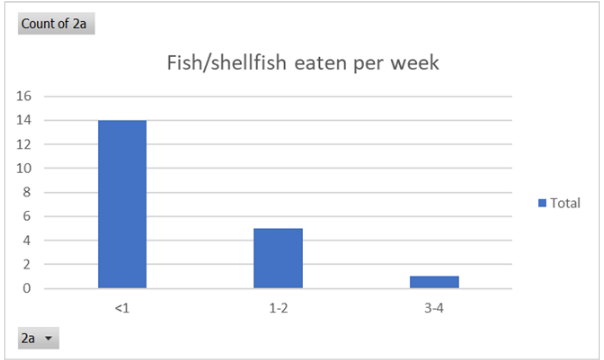




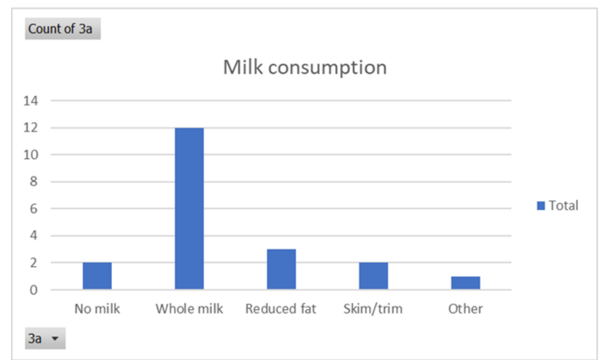


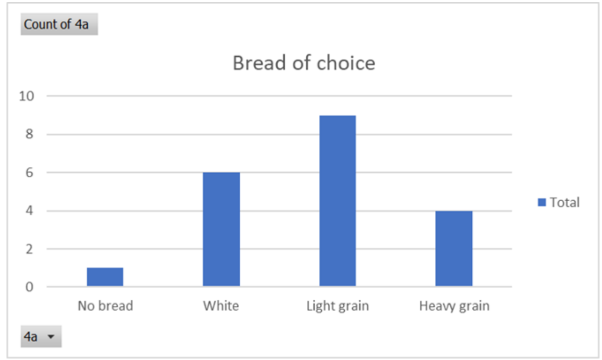
Meat consumption

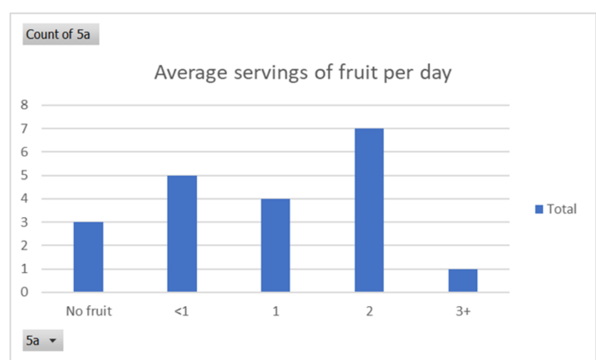


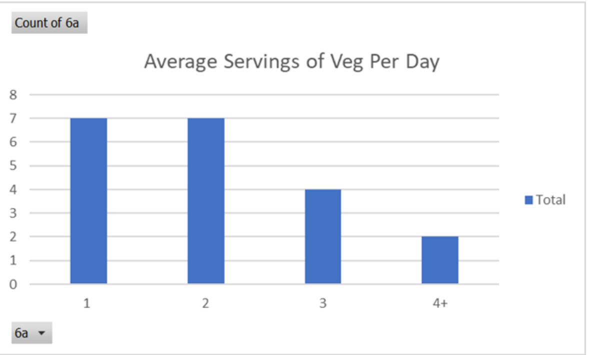


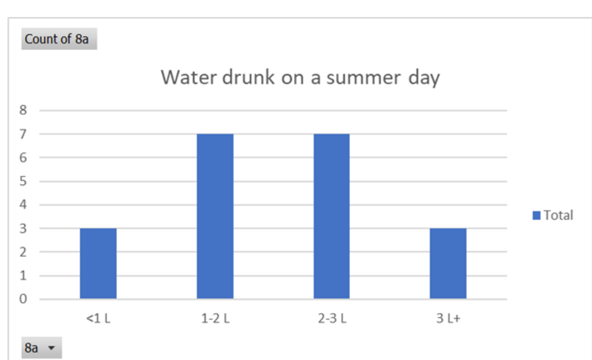
Healthy Dietary Behaviours:

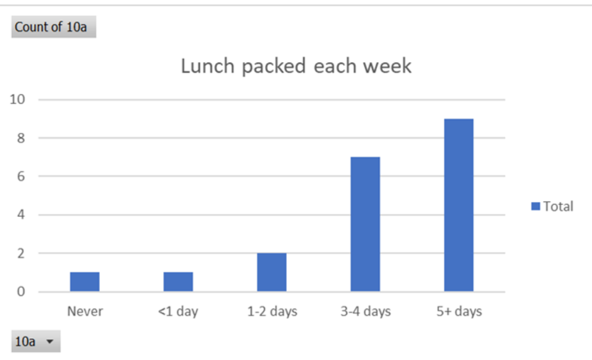


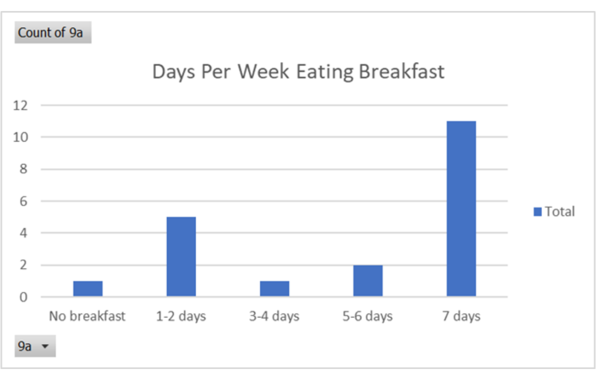




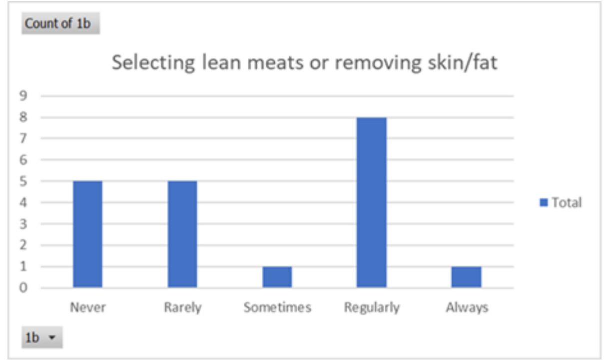


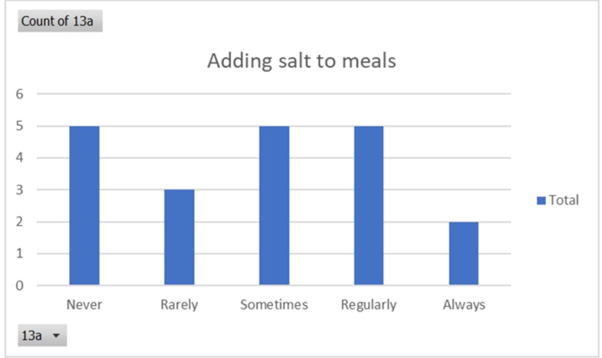


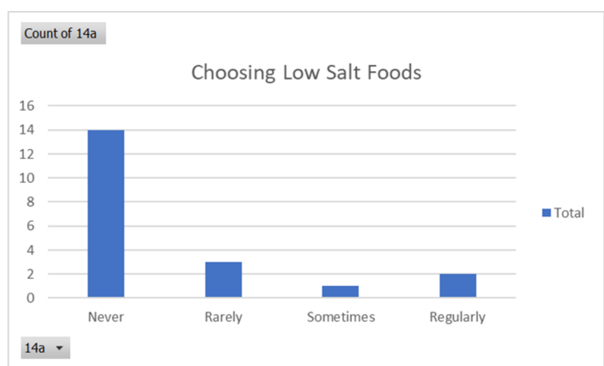


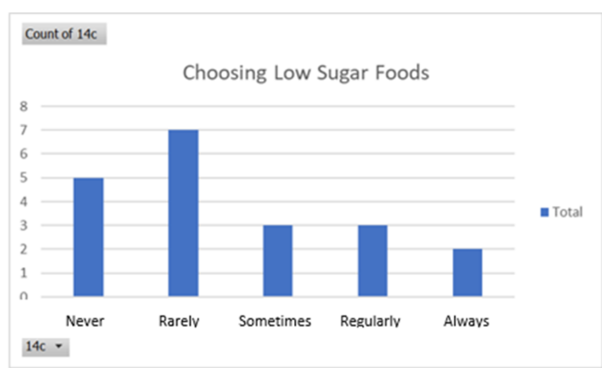


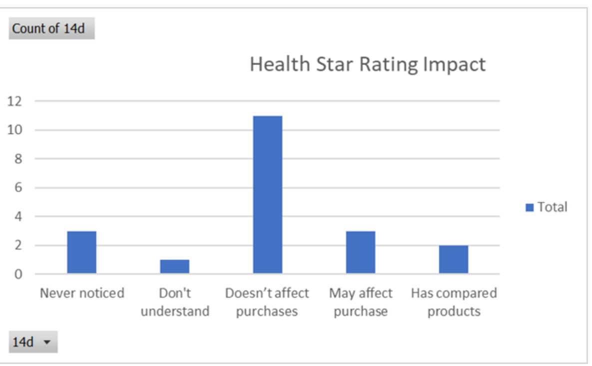
Food Selection and Eating Patterns:

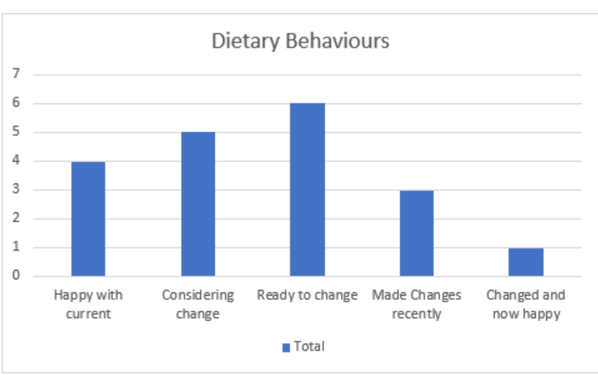












6.2 Appendix 1B: Tabulated data from the Phase 3 Health Screening

Participant #	BMI (kg/m^2)	Body Fat Percentage	Waist-Hip Ratio	Blood Pressure (mm/Hg)
001	26.7	29.7	NA	137/88
002	25.3	27.4	0.89	121/69
005	24.9	14.1	0.90	130/74
006	44.6	35.9	1.02	124/80
007	23.4	8.4	0.84	121/73
009	27.4	28.1	0.96	147/85
010	24.4	12.6	0.93	111/45
011	43.2	37.9	1.02	135/82
012	25.8	15.0	0.89	129/82
013	32.3	32.7	1.07	132/82
015	22.3	25.2	0.97	140/82
020	25.1	8.6	0.93	125/68
Mean score	28.8	23.0	0.95	129/76

Table 1: Data from physiological tests completed during phase 3 of the Constructing Health Study. Results are colour coded as follows to indicate the outcomes for each individual. No colour = Below recommended range, Green = Within recommended range, yellow = above recommended range, red = A result that is a potential concern for the individuals health.
For mean scores, participant 001 was excluded for WHR given NA value.

Participant #	Blood Glucose	TC	HDL	TC/HDL Ratio
001	8.3	5.5	0.9	6.1
002	5.3	5.13	0.93	5.5
005	5.1	>10.36	>3.11	NA
006	3.9	2.72	0.79	3.5
007	5.1	4.94	1.17	4.2
009	5.7	4.92	1.35	3.7
010	4.6	3.73	1.27	2.9
011	4.2	5.71	0.75	7.6
012	5.3	3.96	1.86	2.1
013	4.3	5.83	1.04	5.6
015	6.4	4.38	1.87	2.3
020	7.1	3.09	1.38	2.2
Mean Score	5.4	4.54	1.21	4.15

Table 2: Data from biochemical tests completed during phase 3 of the Constructing Health Study. Results are colour coded as follows to indicate the outcomes for each individual. Results are colour coded to indicate the outcomes for each individual. Green = within recommended range, yellow = outside normal range, red = A result that is a potential concern for the individual's health.
For mean scores, participant 005 data was excluded for TC, HDL and TC/HDL ratio due to exceeding equipment limits

Participant Number	Question 16 Phase 1	Question 16 Phase 3	Question 17 Phase 1	Question 17 Phase 3	Question 18 Phase 1	Question 18 Phase 3	Question 19 Phase 1	Question 19 Phase 3
001	4	5	3	2	3	3	4	5
002	4	2	4	4	3	3	5	5
005	1	4	3	3	3	1	4	5
006	3	1	1	4	5	2	5	5
007	2	2	2	1	2	1	4	5
009	1	1	3	3	3	3	4	4
010	3	1	1	1	2	2	2	5
011	3	3	4	4	4	4	5	5
012	4	4	3	3	3	3	5	5
013	1	4	3	2	3	2	5	4
015	5	1	1	2	2	1	4	5
020	1	1	2	3	2	2	3	4

Table 3: Table of response from participants who took part in phases 1 and 3 of the Constructing Health Study. Questionnaires for phases 1 and 3 can be found in appendices 3 and 5C respectively. Questions 17, 18 and 19 were a 5-point Likert scale ranging from strongly disagree to strongly agree. Responses have been colour coded to demonstrate changes in perceptions between phases 1 and 3.
Red = perceived susceptibility, severity or association to diet has lessened between phases.
No colour = No change between phases.
Green = perceived susceptibility, severity or association to diet has increased between phases.
Question 16 has been colour coded to present how dietary behaviours have changed between phases 1 and 3
Yellow = Individual wanted to change or had changed and is now happy with their diet
No colour = no change in dietary behaviours
Blue = Individual was happy and now has changed or wants to change

6.3 Appendix 2A: Letter of Invitation for Construction Companies

Letter of Invitation

The Constructing Health Study:

Factors Influencing the Dietary Behaviors of Men Working in New Zealand Construction

School of Food and Advanced Technology

Kia ora,

My name is Liam Kelly, I am a master's student studying Human Nutrition at Massey University. I am currently developing research which will look at the diets of men in the construction industry and am hoping to engage companies in the Horowhenua-Manawatu-Whanganui districts. This research came about as there is very little information about blue collar men, their diets and how it is affected by different part of their lives. No research on the topic has been run in New Zealand. Men in this profession commonly have shorter life expectancies due to diet related lifestyle diseases which we believe could be reduced if effective programs were introduced.

Research in other parts of the world has shown some success with benefits both the individual through improved long-term health and the company by reducing sick leave and long term leave due to injury or illness. We hope to develop a base of information in New Zealand so that similar programs can be started here.

We are hoping that you may be interested in participating in the study. The following would be required:

- We would provide flyers to the site supervisors in the region. We hope that they can distribute these to workers.
- Workers would need to get in contact with us through the channels provided. We can provide them with a more detailed information sheet and answer questions they may have.

Phase 1: We would send workers a questionnaire online or by mail. This is only short and would take them 10-15 minutes which they could do in their own time.

Phase 2: We would like to go onto worksites to interview some of the workers while at work. This would take less than 1 hour. We would also like to look at any eating facilities they have available. We understand that this would mean workers would miss an hour out of their day to be with us. We are willing to work with you to make this fit in as we don't want to disrupt the site. We are open to discussion about how this would work. In the event of level 3 restrictions or higher resulting from COVID-19, interviews will be moved online to adhere to government and university regulations.

Phase 3: This is an optional component. We would invite workers to travel to Massey Universities Human Nutrition Research Unit for a series of tests. We would look at the body composition using a device called the BodPod, which can accurately tell us the lean mass and body fat of the individual. We would also look at blood sugar and cholesterol as well as blood pressure. We can provide them with all results and interpret them. This could be done outside of work hours, so we do not take up more of your companies' time. In the event of level 2 or higher restrictions resulting from COVID-19, this phase would be postponed in order to meet government and university regulations.

This study poses no direct risk to anyone involved and they would be helping to advance the knowledge base in New Zealand. No companies or individuals involved in the research will be identified in any published reports. Companies and individuals will also be provided with final reports before they are published.

Important information:

- During this study any information provided by an individual would be confidential and would not be available to anyone other than the research team and that individual. We cannot provide health or interview material to the company as this would be a violation of privacy.
- The study is open to any man who has worked in the construction industry for 2 years and is currently working in the Manawatu-Whanganui regions. Participants will need to speak English fluently.

We hope that you consider allowing this research to take place on your work sites. If you would like more information please feel free to contact me via email; Liam.kelly.3@uni.massey.ac.nz, or via phone; 02041828153.

Thank you for your time.

6.4 **Appendix 2B:** Flyer for Constructing Health Study

Constructing Health Study:

What Foods do Men Working in New Zealand Construction Eat and Why?

If you are a man working in the construction industry we would like your help with our research study.

Study Overview:

Men in the construction industry are thought to have a greater risk of developing preventable health issues related to their diet. Despite this increased risk there has been very little research into their food choices. The Constructing Health Study aims to learn more about what construction workers in New Zealand eat and what changes they would like to make. To achieve this we would like to talk with you about your eating habits and what influences them.

There are 3 parts;

- Phase 1: A short questionnaire about your eating habits and views on related topics.
- Phase 2: An interview to talk about topics which effect your diet. This will take less than 1 hour and take place during work time. Due to time constraints, we may not ask everyone who completes phase 1 to be interviewed.
- Phase 3 (optional): Free health screening, including body composition (muscle mass and body fat), blood sugar levels, cholesterol and blood pressure. This is available for anyone who completes phase 1.

Participants will receive:

- A copy of the study results.
- A copy of your individual health screening results.

Location

- Phase 1: Can be done via mobile, computer or on paper copy mailed to you.
- Phase 2: At your worksite.
- Phase 3 (optional): The Human Nutrition Research Unit, Massey University, Palmerston North

The study needs men:

- Of any age
- Who have worked in construction for 2+ years.
- Are fluent in English
- Are working in the Manawatu-Whanganui region.

If you are interested in helping with this groundbreaking research please contact us:

- Liam Kelly
- Research coordinator
- Liam.kelly.3@uni.massey.ac.nz
- 02041828153

We will send you an information sheet which goes over the study in more detail.

Once involved you can pull out of the study at any time.

6.5 Appendix 2C: Phase 1 & 2 Information Sheet for Constructing Health Study

School of Food & Advanced Technology

The Constructing Health Study:

Factors Influencing the Dietary Behaviors of Men Working in New Zealand Construction

INFORMATION SHEET

Researchers Introduction

Kia Ora,

My name is Liam Kelly and I am the research coordinator of the Constructing Health Study. I am a masters student studying Human Nutrition at Massey University. I am being supported by my supervisors, Janet Weber and Jane Coad, two members of the nutrition group in the School of Food & Advanced Technology. We are running this study to learn more about what men working in the construction industry eat and why. This has been done in other nations but never in New Zealand. We hope that through this research we can suggest changes or support networks that will be useful long term. Please read this information sheet carefully before deciding whether you would like to participate in the study. If anything is unclear or you would like more information please contact us. This document is for your information and you should keep it for your reference

Research Coordinator:	**Supervisor:**
Liam Kelly School of Food & Advanced Technology Massey University, Palmerston North 4442 Tel: 02041828153 Email: Liam.kelly.3@uni.massey.ac.nz	Dr Janet Weber School of Food & Advanced Technology Massey University, Palmerston North 4442 Tel: 06 951 7562 Email: j.l.weber@massey.ac.nz

Project Description and Invitation:

Research in overseas countries suggests that men in the construction industry may be at an increased risk of diet related preventable diseases. In New Zealand very little is known about the diets of men working in construction. This study aims to understand what men working in the industry typically eat, and the challenges in choosing, buying and preparing food. We also hope to understand what affects these choices. By understanding this information, we can begin to support men in the industry with their long-term health and wellbeing. We would like to invite you to take part in the Constructing Health Study being carried out at Massey University. We are looking for wide range of participants from all areas of the construction industry. This document provides you with information about the study to help you decide whether it is right for you. If you would like more information or simply have some questions please feel free to contact Liam Kelly via email or phone.

Participant Identification and Recruitment

We would like to recruit at least 30 male construction workers. Our aim is to include workers from a range of trades and ages. We also hope to recruit more than one worker from each worksite. To take part in the study you should:

- Be male
- Have worked in the construction industry for a minimum of 2 years
- Be working in the Horowhenua-Manawatu-Whanganui region.
- Be fluent in English.

Several construction companies in the Horowhenua-Manawatu-Whanganui districts have been contacted and asked to invite their employees to participate in the study. We have also been in contact with site managers to ask for their support with the program. While your employer may tell you about the study and provide time for you to participate, they will not have access to any of the information you provide. It will remain in the possession of you and the research team.

Risks & Benefits of the study:

There will be no direct costs to you for participating in the study. It will however require 1 hour of your time during work hours and 10-15 minutes of personal time.

The main benefit of taking part in this study is your contribution to the research. There is not much information about the eating habits of men working in construction in New Zealand. This information could lead to development of programs, support networks and workplace practices to help improve the health of men in the industry.

Everyone who completes phase 1 of the study will also be invited to participate in phase 3 which involves a body composition test and general health screening at Massey University. This is optional. Anyone who wishes to participate will receive all results from all the tests done as a thank you for participating.

There are no direct personal risks to you from participating in the study. Interviews will be organized with both yourself and your supervisor/employer to ensure we do not interrupt work schedules and so that pay will not be lost.

Taking part in this study involves:

This study has 3 phases. All participants will need to complete phase 1 and are invited to participate in phase 3. Some participants will be asked to participate in phase 2.

Phase 1: Completing a short online questionnaire about your eating habits and how you prepare and choose foods. It will also ask about your views on health and eating and some personal information needed for the study (like age, job type and current health). This should take 10-15 minutes to complete and can be done via mobile, computer or as a paper copy that we can mail to you.

Phase 2: From the men who complete the phase 1 questionnaire we will invite some individuals to take part in phase 2 of the study. This involves a face-to-face interview with the researcher to discuss your current eating habits and how different situations affect what you choose to eat. The interview will be recorded using a mobile phone with talk-to-text software so there is a written copy. You will be given a copy of what you said in the interview and can read over and correct it before we use it in the study. This will be at your worksite at a time that suits you and your employer. This part of the study will take less than 1 hour. In the event of COVID-19 community transmissions, resulting in level 3 restrictions or higher, interviews will be moved online and done via Zoom. We understand that internet access may be an issue for some participants and will work with individuals to help them remain part of the study.

Phase 3: Body composition measurement and health screening. All participants who complete the phase 1 questionnaire will be invited to visit the Human Nutrition Research Unit (HNRU) at Massey University, Palmerston North. You will receive a short information sheet about this part of the study after completing phase 1. You can then choose to participate if you would like.

At the end of the study all participants (from phase 1, 2 and/or 3) will be sent a summary of our findings. Companies will also be sent a copy of the research summary. There may be a presentation at Massey University to discuss results to which all participants will be welcome to attend. It is anticipated that results of this study will be published in a New Zealand based research journal and shared with employers and organizations in the construction industry.

Data Management

We will keep your name and contact details private and they will be stored in a locked filing cabinet in a locked office separate from the results. All material will be destroyed in 10 years' time. All the information we collect about you will be kept confidential.

Each participant will receive a personalized code meaning your name will not be linked to your data. Results of this project may be published or presented at conferences or seminars. No individual will be able to be identified.

Participants' Rights:

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- Decline to answer any question in the questionnaire or interview.
- Withdraw from the study at any time. You will not need to provide a reason.
- Ask questions about the study at any time. It is encouraged.
- Ask for the recorder to be turned off at any time during the interview.
- Have access to a summary of the project and its findings at the end of the research.

Project contacts

There are several researchers involved in this project; however, if you have any questions, concerns or complaints about the project or any of the tests and activities planned, please contact the lead researcher in the first instance.

Liam Kelly, MSc candidate/ Lead Researcher

Phone: Liam's phone or HNRU phone; 06 356 9099 ext. 85541

Email: Liam's email or HNRU@massey.ac.nz

School of Food & Advanced Technology

Massey University

Palmerston North

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application SOA 20/32. If you have any concerns about the conduct of this research, please contact Dr Negar Partow, Chair, Massey University Human Ethics Committee: Southern A, telephone 04 801 5799 x 63363, email humanethicsoutha@massey.ac.nz.

Compensation for Injury

If physical injury results from your participation in this study, you should visit a treatment provider to make a claim to ACC as soon as possible. ACC cover and entitlements are not automatic, and your claim will be assessed by ACC in accordance with the Accident Compensation Act 2001. If your claim is accepted, ACC must inform you of your entitlements, and must help you access those entitlements. Entitlements may include, but not be limited to, treatment costs for rehabilitation, loss of earnings, and/or lump sum for permanent impairment. Compensation for mental trauma may also be included, but only if this is incurred as a result of physical injury.

If your ACC claim is not accepted you should immediately contact the researcher. The researcher will initiate processes to ensure you receive compensation equivalent to that to which you would have been entitled had ACC accepted your claim.

6.6 Appendix 2D: Phase 3 Information Sheet for Constructing Health Study

School of Food & Advanced Technology

The Constructing Health Study: Factors Influencing the Dietary Behaviours of Men Working in New Zealand Construction

Information for Phase 3:

Thank you for participating in phase 1 of the Constructing Health Study. This form is to provide you with information about phase 3, which involves measuring body composition and a general health screening. Please read the information below and keep this form so you understand this optional part of the Constructing Health Study. Thank you

General information:

Phase 3 is being run at the Human Nutrition Research Unit, Massey University, Palmerston North. Everyone who participated in phase 1 is welcome to be involved. We encourage group visits if multiple members of a work team are participating but can also work with individuals. We will attempt to fit in with your work schedule, offering weekend and after hour sessions. You will however need to travel to the university as much of the equipment cannot be moved off site.

The purpose of this phase is to understand the general health status of men working in the industry. We will also ask you some questions before and after your visit to understand whether it affected your views on certain topics. As compensation you will receive a report covering all your results.

The tests involved in Phase 3:

There are multiple tests we would like to run in phase 3. These include measuring body composition and some blood tests. The blood tests involve a finger prick to collect small amounts of blood. This may cause mild pain and discomfort. We will ask that you wash your hands before these tests and provide a covering to prevent infection.

The following explains the measurements in detail:

- Height and weight measurements will be conducted in private. Body weight will be measured using calibrated weighing scales (you will be asked to remove your shoes and outer clothes) and standing height will be measured using a wall measure. We will also measure your waist

circumference with a tape measure. These measurements will allow us to calculate your BMI which is often used as a marker of body fat; waist circumference is used as an approximation of the amount of centrally located fat.

- Body composition will be measured using two pieces of equipment.

BodPod®: You sit comfortably inside the BodPod (which is like a space capsule with a seat and a big window) while computerised pressure sensors determine the amount of air displaced by your body. Testing is highly accurate, safe, and quick, and takes about 5 minutes. You will be asked to wear a close-fitting swimwear or skins under a dressing gown.

Bioelectrical Impedance Analysis (BIA): You stand on the device with your hands by your side gripping the handles. The device will quickly estimate your body composition through a weak electrical current. There is no direct risk from the electrical current however those with a heart monitor or pacemaker are asked to inform researchers.
People who have a higher amounts of muscle mass are often incorrectly classified as overweight by BMI which is why we wish to use both methods.

- We will measure your blood pressure and your blood cholesterol and blood glucose. Blood pressure is measured using an automated cuff placed on your upper arm. The blood tests help assess cardiovascular health. The blood tests are done using point-of-care machines and involve getting drops of blood by pricking your fingers. This means the results are available immediately.

At the end of these tests we will fill in a form showing you all your results as well as the normal ranges for each test. We can also explain these results, so you understand everything that is written down.

If these tests identify a potential health concern you will be provided with a form by the research supervisors outlining the concern. These tests are not run at a clinical standard and cannot be used for diagnosis. As a result, the researchers would recommend that you take this information to your GP or other healthcare professional to have follow up tests done.

In the event of community transmission of COVID 19 resulting in level 2 restrictions or above in the Manawatu, we will need to post-pone this phase of the research. This is to ensure we comply with physical distancing laws and university policy.

Confidentiality:

All results from any tests collected during phase 3 will be linked to your unique participant code. This is to ensure these remain confidential. No individuals outside of yourself and the research team will have access to this information. This means your employer and other participants will not know your results.

If you are interested in participating in phase 3 but have more questions please feel free to contact Liam Kelly, research coordinator, via phone, 02041828153, or via email, liam.kelly.3@uni.massey.ac.nz. We may get in contact with you to find out if you would like to participate if we do not hear from you beforehand.

Thank you for your consideration

6.7 Appendix 3: Phase 1 Dietary Questionnaire

Constructing Health Study: Phase 1 questionnaire

Thank you for choosing to participate in phase 1 of the Constructing Health Study. Please read this information carefully.

All data obtained from participants in this survey will be treated as confidential and only the research team involved will have access to participant responses. Participation is voluntary, and you reserve the right to refuse to participate. If you have any questions about the questionnaire or study in general, please contact Liam Kelly (lead researcher) via phone or email provided in the information sheet.

By agreeing to participate, you consent to the researchers collecting information about you, and reporting your responses in aggregate form to others, including in academic publications and public reports. You may withdraw your responses within one week of completion by contacting any of the research team.

- o I have read, understood and agree to the statements above and in the information sheet provided and consent to participate in this research

Page Break

Q 1 (a): On average, how often do you eat meats other than fish per week?
Please consider breakfast (bacon, ham etc), lunch (pies, sandwiches etc), dinner (roasts, BBQ, microwave meals etc), and snacks (jerky, rolls etc)

- o I do not eat red meat
- o Less than once
- o 1-3 times
- o 4-6 times
- o 7-9 times
- o 10-12 times
- o 13+ times

Q 1 (b): How often do you intentionally select lean cuts of meat or cut fat/skin off when preparing and eating meat?

- I do not eat meat
- Never (it is not something i consider)
- Rarely (I may consider it for certain meals)
- Sometimes (I will do it when I remember)
- Regularly (I often select meats when shopping and/or remove excess fat/skin)
- Always (I only select lean cuts of meat and remove all excess fat/skin)

Q 2 (a): On average, how often do you eat fish or shellfish per week? Not including battered or fried fish.
E.g. canned, fresh or salted fish

- I do not eat fish/shellfish
- Less than once
- 1-2 times
- 3-4 times
- 5-6 times
- 7+ times per week

Q 2 (b): On average, how often do you eat battered or fried fish or shellfish per week? This would include fish from fish and chip shops.

- I do not eat battered or fried fish
- Less than once
- 1-2 times
- 3-4 times
- 5-6 times
- 7+ times

Page Break

Q 3: What type of milk do you use most often?

- I do not use milk
- Whole or standard milk
- Reduced fat
- skim or trim milk
- Soy milk
- Other (rice milk, goats milk, oat milk, almond milk etc)

Q 4: What type of bread do you eat most often?

- I do not eat bread
- White bread (tip top, supermarket brand etc)
- Light grain or brown bread (Molenberg, Freya's, Ploughmans etc)
- Heavy grain bread (Vogels, Burgens etc)

Q 5: On average, how many servings of fruit do you eat per day? Include all fresh, frozen, canned and stewed fruit. Do not include fruit juice or dried fruit. Please use the graphic below for examples of serving sizes.

- I do not eat fruit
- Less than 1 serve
- 1 serve
- 2 serves
- 3+ serves

Q 6: On average, how many servings of vegetables do you eat per day? Include all fresh, frozen and canned vegetables. Do not include vegetable juices or potato fries. Please use the graphic below for examples of serving sizes

- I do not eat vegetables
- Less than 1 serve
- 1 serve
- 2 serves
- 3 serves
- 4+ serves

Page Break

Q 7: How many sweetened drinks do you have per week? Sweetened drinks include soft drinks (regular and sugar free), energy drinks, flavored milks (including iced coffee) and sports drinks. Do not include tea or coffee which you add sugar to.

- Less than 1
- 1-3
- 4-6
- 7-9
- 10-12
- 13+

Q 8: How much water would you normally drink per day while working during summer?

- I do not drink water
- Less than 1L
- 1L - 2L
- 2L - 3L
- 3L+

Q 9: How often do you eat breakfast per week?
(We describe breakfast as the first meal of the day eaten within 2 hours of getting up).

- I do not eat breakfast
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

Q 10: How often do you pack a lunch for work per week?

- I do not pack lunches for work
- Less than 1 day
- 1-2 days
- 3-4 days
- 5+ days

Q 11: How often do you eat potato or kumara fries/chips per week?

- Less than once
- 1-2 times
- 3-4 times
- 5-6 times
- 7+ times

Q 12: How often do you purchase fast food per week?E.g. Mcdonalds, bakery foods, snacks from a dairy, subway
(A beverage alone is not counted as a purchase for this questionnaire)

- I do not eat fast food
- Less than once
- 1-2 times
- 3-4 times
- 5-6 times
- 7+ times

Page Break

Q 13: How often do you add salt to your food after it has been cooked or prepared?

- Never (I do not add salt to food)
- Rarely (It may be considered for certain meals)
- Sometimes (I will add salt if I want to)
- Regularly (I will often add salt to meals)
- Always (I add salt to a majority of my meals)

Q 14 (a): How often do you choose low salt varieties of foods instead of the standard variety?

- Never (It is not something I consider)
- Rarely (I consider it but it rarely affects my purchases)
- Sometimes (If a product is low salt I am more likely to buy it)
- Regularly (I will choose low salt foods if they are available)
- Always (I actively find food options that are low in salt)

Q 14 (b): How often do you choose low fat varieties of foods instead of the standard variety?

- Never (It is not something I consider)
- Rarely (I consider it but it rarely affects my purchases)
- Sometimes (If a product is low fat I am more likely to buy it)
- Regularly (I will choose low fat foods if they are available)
- Always (I actively find food options that are low in fat)

Q 14 (c): How often do you choose low sugar varieties of foods instead of the standard variety?

- Never (It is not something I consider)
- Rarely (I consider it but it rarely affects my purchases)
- Sometimes (If a product is low sugar I am more likely to buy it)
- Regularly (I will choose low sugar foods if they are available)
- Always (I actively find food options that are low in sugar)

Q 14 (d): How does the health star rating of a food product effect you purchase? The health star rating is found on most packaged foods and looks like this:

Please select an option which best represents you:

- I have never noticed this.
- I have noticed it but don't understand it.
- I understand it but it doesn't affect my purchases.
- A high or low rating may impact whether I buy a product.
- I have compared products to find which has the best rating.
- I select a majority of my groceries based on their rating.

Page Break

Q 15 (a): How often do you have a drink containing alcohol?

- I do not drink alcohol
- Once per month or less
- Up to 4 times per month
- Up to 3 times per week
- 4+ times per week

Q 15 (b): On average, how many standard drinks of alcohol would you have on a day that you are drinking? Please use the graphic below for examples of a standard drink of alcohol

- 1-2 standard drinks
- 3-4 standard drinks
- 5-6 standard drinks
- 7-9 standard drinks
- 10+ standard drinks

Page Break

The following questions are designed to help us understand your current view of eating and health. They will also assist us if you are part of phase 2 of the study.

Page Break

Q 16: Which statement most fits how you think about your diet?

- I'm happy with how I currently eat and am not thinking of making any changes.
- I'm thinking of making some changes in the future.
- I'm ready to make changes to my diet.
- I've made some changes in the past year to what I eat.
- I changed what I eat in the past couple years and am happy with it now.

Q 17: There is a high chance that I will develop heart disease/diabetes when I'm older.

- strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Q 18: My diet makes it more likely that I'll have heart disease/ diabetes when I'm older

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Q 19: It would be serious if I had heart disease/ diabetes

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Page Break

Q 20: Please answer the following questions on personal information.

- Age ____
- Ethnicity ____
- Career/Position ____
- Years working in the industry____
- Living situation (partner, children, roommates etc)_________________________________
- Highest level of education (high-school graduate, UCol graduate, undergraduate degree

etc) ____

Q 21: Please select any health conditions below which you have been diagnosed with

- Heart disease
- High blood pressure
- Liver disease/cirrhosis
- Diabetes
- Gout

Page Break

Q 22: Please enter your contact information below. This will be used by the research to stay in contact with you throughout the research. Your name and contact information will be kept separate from all other information you provide during this study.

- First Name ____
- Last Name ____
- Email address ____
- Phone Number ____

Thank you for completing the questionnaire for Phase 1 of The Constructing Health Study. We will get in contact if we would like to interview you as part of Phase 2.
We will also send you an invite to participate in Phase 3, run at the Human Nutrition Research Unit at Massey University.

6.8 Appendix 4A: Phase 2 Consent Form

School of Food & Advanced Technology

Massey University

Palmerston North

The Constructing Health Study:

Factors Influencing the Dietary Behaviors of Men Working in New Zealand Construction

PARTICIPANT CONSENT FORM - INDIVIDUAL

I have read, or have had read to me in my first language, and I understand the Information Sheet attached as Appendix I. I have had the details of the study explained to me, any questions I had have been answered to my satisfaction, and I understand that I may ask further questions at any time. I have been given sufficient time to consider whether to participate in this study and I understand participation is voluntary and that I may withdraw from the study at any time.

1. I agree/do not agree to the interview being sound recorded.
2. I wish/do not wish to have my recordings returned to me.
3. I agree to participate in this study under the conditions set out in the Information Sheet.

Declaration by Participant:

I ___________ [print full name]__________ hereby consent to take part in this study.

Signature: ________________________ Date: ________________

6.9 Appendix 4B: Transcript release Document

School of Food and Advanced Technology

Massey University

Palmerston North

Constructing Health Study:

Factors Influencing the Dietary Behaviors of Men Working in New Zealand Construction

AUTHORITY FOR THE RELEASE OF TRANSCRIPTS

I confirm that I have had the opportunity to read and amend the transcript of the interview(s) conducted with me.

I agree that the edited transcript and extracts from this may be used in reports and publications arising from the research so long as it remains anonymous.

Signature: .... **Date:** ....

Full Name - printed ....

6.10 Appendix 4C: Phase 2 Interview Guide

The following is an example of an interview guide used in phase 2 of the investigation. Guides were altered dependent on the respondents response to question 16 of the phase 1 questionnaire **(appendix 3)** with this guide being for participants who responded, “I’ve made some changes in the past year to what I eat”.

Interviews began by asking participants about their normal dietary habits on workdays and days off. Participants were then asked about government information and provided with a series of scenarios covering topics such as health, work environment and family. The final question related to the COVID-19 lockdown which occurred in March-April of 2020 in New Zealand and how this impacted their eating behaviours.

Questions:

1. Could you describe what a normal day of eating looks like on a workday?

Probes:

a. Could you provide examples of workday breakfast, lunch, dinner and snacks?

b. Does this vary a lot from days you have off? In what ways?

2. In your questionnaire you said you’ve made some changes to your diet in the past year. Can you tell me about these changes?

3. So, you’ve made changes like -------. What benefits do you see coming from these changes?

Probes:

a. **If they discuss health**: Where did you hear that these changes are healthy?

Probe: *(Enter responses to q16, 17 and 18, heart disease/diabetes).* Do you believe your health is at risk?

Probe: *(Enter final question: personal and family health history)*. How have these impacted you’re eating behaviours?

b. **If they discuss body Image**: is it about being lean, strong, athletic? Where did they get this information?

c. **If they discuss work ability**: Is it about energy, strength, socialisation? How do these changes help?

d. **If they discuss being an example for children, family etc**.: What is the example you are trying to set?

4. Were there any parts of your life that made these changes difficult?

Probe:

Are there any changes that you haven't been able to commit to? Why?

a. **If they discuss work:** How does your work crew think about food at work? Why would a change be an issue here?

b. **If they discuss time:** Do your work hours stop you from changing? How would having more time change how you eat?

c. **If they discuss social life:** Is food a large part of your social life? Do you believe changing to a healthier way would affect this?

5. Can you tell me what you know about the government dietary recommendations?
   If they do not know, discuss (5+ fruit and veg, limit red meat, alcohol to 2-3 standards per day, limit processed sugars and saturated fats)

Probes

a. Do you believe these recommendations are helpful for someone working a physical role like yours? Why/why not?

b. Do you follow recommendations or advice from anywhere else? TV chef, friends, a doctor etc.

c. I saw you (Responses to Q 13d, health star and 13a, b and c, choosing foods). Is this kind of information helpful for you to choose what to eat?

6. Provide the following hypotheticals and discuss how they would affect their diet.

Doctor says you are at a high risk of heart disease or T2D.	You start feeling tired and unwell regularly.	Government campaigns for 2 fruit, 3 veg and tax sugary drinks
Family says that they are worried about your dietary habits.	Work introduces affordable lunches that change from day to day.	A nutritionist comes to your work and talks about meal plans and health 1-2 times a year.

Are there any other events you can think of that would cause you to change diets and how?

7. On site I saw you have, --------------, does this help you with bringing food to work?
   (If they have no facilities would having a fridge, microwave etc would benefit them).

Probes:

a. **If there's a vending machine**: Does ease of access promote better or worse eating habits?

b. In question 4 you said ------ about your team in relation to food. Do you believe the facilities available affect their eating habits? In what ways?

c. Have you worked at any sites in the past that supported or negatively affected your eating habits? What did they do differently?

8. Final question: Did you continue working during lockdown?

Can you recall any changes, positive or negative, that occurred in your diet during the Covid lockdown? **Cooking more, eating "better", snacking, stress eating …**

Probes

a. **If they did not work during lockdown:** Would you say you ate differently~~healthier~~ because you had more time available? Why/why not? What parts of your diet changed?

b. Have any of these changes continued since lockdown ended?

Worksite Facility Check List

Designated eating area:	Fridge:	Distance from stores:
Is the area sanitary:	Microwave:	Food available nearby:
Distance from worksite:	Tables and chairs:	
Water source:	Bench top:	Food on site:
Refrigerator:		

6.11 Appendix 5A: Phase 3 Consent Form

School of Food & Advanced Technology

Massey University

Palmerston North

The Constructing Health Study (Phase 3):

Factors Influencing the Dietary Behaviors of Men Working in New Zealand Construction

PARTICIPANT CONSENT FORM - INDIVIDUAL

Please tick to indicate you consent to the following *(Add or delete as appropriate)*

I have read, or have had read to me in my first language, and I understand the Participant Information Sheet.	Yes ☐	No ☐
I have been given sufficient time to consider whether or not to participate in this study.	Yes ☐	No ☐
I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without this affecting my medical care.	Yes ☐	No ☐
I consent to the research staff collecting and processing my information, including information about my health.	Yes ☐	No ☐
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.	Yes ☐	No ☐
I wish to receive a summary of the results from the study.	Yes ☐	No ☐

Declaration by Participant:

I ___________________________________ hereby consent to take part in this study.

Signature: ________________________ Date: _________________

6.12 Appendix 5B: Phase 3 Results Sheet for Participants

Constructing Health Study:

Factors Influencing the Dietary Behaviours of Men Working in New Zealand Construction

Body Composition and Blood Analysis Results

Name		Date Taken	

Physical Assessment

Your Body Mass Index (BMI):

Your Height (m)			
Your Weight (kg)			
Your BMI (kg/m^2)		Ideal BMI (kg/m^2)	

Your BMI is calculated using your height (m) and weight (kg) and is a general guide as to whether your body fat levels are low, healthy or high, and the level of risk to your health. However, BMI is most applicable at the population level and may not be accurate at an individual level. For example, if an individual has high levels of muscle mass they may be incorrectly classified as overweight or obese despite being healthy.

BMI table for New Zealand Men

BMI (kg/m^2)	Body Composition	Health Risks
Less than 18.5	May be underweight	Increased risk of osteoporosis and malnutrition
18.5 – 25.0	May be healthy	
25.0 – 30.0	May be overweight	Higher risk of type 2 diabetes and heart disease
Over 30.0	May be obese	Even higher risk of type 2 diabetes and cardiovascular disease

Your Body Composition:

Lean (kg)			
Fat (kg)			
Total Weight (kg)			
Lean (%)			
Fat (%)		Ideal Fat %	

Body composition is one of the important indicators of disease risk. The BodPod provides an indication of the actual amount of fat on your body. A high body fat percentage can pose serious risks to your health.

Body Fat table for New Zealand Men

Body Fat (%)	Body Fat Rating	Explanation
Less than 5	Risky (low body fat)	Too little body fat can present health risks. If in doubt, check with your health care professional.
5 - 8	Ultra Lean	Fat levels sometimes found in elite athletes.
9 - 12	Lean	Lower body fat levels than many people. This range is excellent for health and longevity.
13 - 20	Moderately Lean	Fat level is acceptable for good health.
21 - 30	Excess Fat	Indicates an excess accumulation of fat over time.
More than 30	Risky (high body fat)	Too much body fat can pose serious health risks. Ask your health care professional about how to safely modify your body composition.

Your Waist-to-hip ratio (WHR):

Waist circumference (cm)			
Hip circumference (cm)			
Your WHR		Ideal WHR	less than 0.95

Your WHR is calculated by dividing your waist circumference (cm) by your hip circumference (cm). It is an indicator of whether you are carrying excessive levels of fat in the abdominal region. Excess abdominal fat puts you at greater risk of type 2 diabetes and cardiovascular disease. For men, a WHR greater than 0.95 means you have a higher risk of type 2 diabetes and cardiovascular disease.

WHR table for New Zealand Men

WHR	Risk rating for lifestyle diseases
Less than 0.85	Very low - an excellent result
0.85 - 0.89	Low - a good result
0.90 – 0.94	Average
0.95 – 0.99	High - increased risk
Greater than 0.99	Very high risk

Your Blood Pressure (BP):

Your BP (mm Hg)		Ideal BP (mm Hg)	
Systolic		Systolic	
Diastolic		Diastolic	

Your BP is a measure of the force your blood exerts on your blood vessel walls. High BP (hypertension) can cause an increased risk of health problems such as heart attacks and stroke. The first number (systolic pressure) refers to the pressure in your circulatory system after the heart contracts. The second number (diastolic pressure) refers to the pressure in your circulatory system before your heart contracts. BP is variable and a single high or low measurement may not reflect your usual BP; it should be monitored over time to detect trends and changes. The below table provides some guidelines

however BP is age dependent. It commonly increases with age but although considered ‘normal’, this is associated with increased health risks.

Blood Pressure Table

	Systolic blood pressure (mm Hg)	Diastolic blood pressure (mm Hg)
Low BP	<99	
Optimal BP	<120	<80
Normal BP	<130	<85
High-Normal BP	130-139	85-89
Mild Hypertension	140-159	90-99
Significant Hypertension	≥160	≥100-109

Blood Tests

Your Blood Test Results:

Test	Description	Your result	Ideal range
Blood glucose	A measure of blood sugar. High levels require further testing as they may indicate diabetes.		3.5 – 7.7 mmol/L
Total Cholesterol (TC)	A measure of the total amount of cholesterol carried in the blood. High total cholesterol is associated with increased cardiovascular risk and stroke.		Less than 4.0 mmol/L
HDL	A measure of ‘good cholesterol’ levels, this is a protein which carries cholesterol from the tissues back to the liver. Low levels indicate increased risk of cardiovascular disease.		Greater than 1.0 mmol/L
TC/HDL ratio	Used in prediction of cardiovascular risk.		Less than 4.0 mmol/L

Please note:

- These results were valid on the day that the measurements were taken and under the specific conditions on that day. It is possible that since your appointment, some of these measurements would have changed.
- These measurements were taken for the purpose of health research and should not be used for clinical diagnosis without further advice from a medical professional. **If any of your results are outside of a recommended 'safe' range a researcher will provide you with a formal letter and advise you see your normal healthcare provider to follow up these results.**
- If your results for any of the tests fall outside the "ideal" ranges, the following links can provide you with useful information from the New Zealand Heart Foundation. This information can assist you to improve your long-term health and wellbeing.

Weight loss information:

https://www.heartfoundation.org.nz/wellbeing/healthy-eating/how-to-lose-weight

Blood Sugar and Diabetes Information:

https://www.heartfoundation.org.nz/wellbeing/managing-risk/managing-diabetes

Cholesterol Management and Treatment Information:

https://www.heartfoundation.org.nz/wellbeing/managing-risk/managing-high-cholesterol

Thank you for generously providing your time to take part in phase 3 of the Constructing Health Study.

6.13 Appendix 5C: Phase 3 Follow-up Questions

Constructing Health Study:

The following questions are meant to help the researchers understand your views in relation to your health and how these may change over time. Please select one option from each of the 4 questions below that best fits your personal views.

Question 1: Which statement most fits how you think about your diet?

- ○ I'm happy with how I currently eat and am not thinking of making any changes.
- ○ I'm thinking of making some changes in the future.
- ○ I'm ready to make changes to my diet.
- ○ I've made some changes in the past year to what I eat.
- ○ I changed what I eat in the past couple years and am happy with it now.

Question 2: There is a high chance that I will develop heart disease/diabetes when I'm older.

- ○ strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

Question 3: My diet makes it more likely that I'll have heart disease/ diabetes when I'm older

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

Question 4: It would be serious if I had heart disease/ diabetes

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

Thank you for taking part in the Constructing Health Study. At the end of phase 3 you should be given a copy of

- Your health screening results
- Your BodPod printout

You can also be emailed a full summary of the study results if you have indicated on the consent form. If you would like a copy and previously said you did not please let the researcher know and they will be sure to send it to you.

6.14 Appendix 5D: Letter of recommendation for participants with potentially dangerous health screening results.

Human Nutrition Research Unit Nutrition Science Department
School of Food & Advanced Technology

Constructing Health Study:

Factors Influencing the Dietary Behaviors of Men Working in New Zealand Construction

MASSEY UNIVERSITY
COLLEGE OF SCIENCES
TE WĀHANGA PŪTAIAO

[Date]

[Name of Participant]

[Address of Participant]

Dear [Name of Participant]

We are writing to you to let you know the result of your [test/measurement] assessed on [date] in the Massey University Human Nutrition Research Unit (or other venue) indicates that your result is not within the normal range.

Your result is [xxxx]. The normal range [published by xxxx or similar] is xxxx.

The test was done as part of a research project and Massey University does not offer a diagnostic service. There is no reason for alarm, but we recommend you show this letter when you next see your general practitioner or other health professional to discuss whether further investigation is recommended. However please be advised that consultation with your GP and any follow-up will be at your own expense

Please feel free to contact me if you have any questions

Best wishes

Liam Kelly

Phone: 02041828153

Email: liam.kelly.3@uni.massey.ac.nz

School of Food & Advanced Technology

Massey University

Palmerston North

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