Obesity and NSW Coal Mining

Project No. 20648

Final Report

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The Centre for Resources Health and Safety, University of Newcastle

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This research in the NSW coal mining sector builds upon the development of the Blueprint for the Management of Overweight and Obesity in the NSW Mining Industry, in order to investigate the existing obesity management programs and outcomes from their implementation at a site level. In addition, the prevalence of overweight and obesity in NSW coal mining was examined with the assistance of Coal Services Health data from periodic and pre-employment medical examinations. The results of this research can inform future policy and program implementation for the management of overweight and obesity at a site level across NSW coal mines. In addition it provides further evidence to assist and guide the implementation of the Blueprint for the Management of Overweight and Obesity across mining organisations in NSW.

This research project highlights the benefits of research and industry partnerships to address industry-identified needs. These partnerships must be collaborative with both sides sharing in the creation of research questions, methods and interventions. Without such industry partnerships, ensuring the success of research and the implementation and sustainability of appropriate programs would not be possible.

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Key Terms

Terms	Meaning
Body Mass Index (BMI)	Body mass index (BMI) is the international index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by height in metres squared (kg/m^2).
Overweight	Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. A person with a BMI equal to or more than 25 is considered overweight.*
Obesity	Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. A person with a BMI of 30 or more is generally considered obese.*
NSW General Population	New South Wales Population Health Survey which reported on the health of NSW residents (across 15 geographical local health districts which came into existence in January 2011), aged 16 years and over.
Australian General Population	Respondents to the 2011-2013 Australian Health Survey. An adult respondent was aged 18 years or over, chosen from an Australian household dwelling who was selected and interviewed about their own health characteristics.

*http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

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1 EXECUTIVE SUMMARY

1.1 PROJECT SCOPE

The Centre for Resources Health and Safety (CRHS) at the University of Newcastle has a strong relationship and understanding of the mining workforce through its engagement with industry representatives and advisory group members, particularly through their work in mental health.

In 2016, the research team from the CRHS, in collaboration with NSW Mining and Ethos Health, developed the Blueprint for the Management of Overweight and Obesity in the NSW Mining Industry. The Blueprint is a framework, which identifies key directions for the industry to promote effective weight management.

The workplace is an important setting for obesity prevention, yet there is limited evidence available on effective workplace prevention and management programs targeting overweight and obesity. Focusing interventions only on individual behaviours fails to address the social, cultural and environmental factors, which may predispose a coal miner to being overweight or obese.

The aim of this study was to examine workplace wellness initiatives targeting overweight and obesity that have been trialled in NSW coal mines, and the outcomes of these at a site level. In addition, the prevalence of overweight and obesity in NSW coal mining was investigated using existing Coal Services Health periodic medical examination data from 2012 to 2014.

The building of such evidence provides valuable information about the challenges and benefit of current workplace wellness initiatives targeting overweight and obesity within the NSW coal mining industry, which can help improve the capacity of the industry response and appropriate support systems and strategies to reduce levels of overweight and obesity.

1.2 SUMMARY OF FINDINGS IN THE NSW COAL MINING INDUSTRY

Prevalence of overweight and obesity in NSW coal mines

This study provides empirical evidence regarding the scope of overweight and obesity in the NSW coal mining industry in Australia. Prevalence of overweight and obesity was analysed using Coal Services Health periodic medical assessments of 10,869 open cut and underground mine employees between 2012 and 2014.

The majority of employees were: non-smokers (83.17%), male (95.59%), and from either open cut (41.6%), or underground (50.2%) coal mine sites.

Our findings show that overweight and obesity is a significant issue for the NSW coal mining industry. Body Mass Index (BMI) and waist circumference, both recognised measures of overweight and obesity, were used to determine the prevalence of overweight and obesity in NSW coal mine employees. Almost half of all the coal mine employees in NSW had a BMI which classified them as overweight (47.41%), with a further 27.08% classified as obese. This puts a large proportion (74.49%) of the NSW coal mining population at risk. The waist circumference measures identified 26.76% had an increased waist circumference (94-101.9cm), and 35.71% had a substantially increased waist circumference (>102cm).

Similar to the Australian General Population, age is a factor associated with overweight and obesity. Within the NSW coal mining population, 80.0% of males aged 50-59 years, and 81.0% of males aged over 60 years, were found to be overweight or obese.

Weight is also associated with high blood pressure (BP), other cardiac risk factors, alcohol dependence and psychological distress. In NSW coal mine employees, when BMI was compared to BP of participants in the overweight category, 50.0% had elevated BP, 51.0% had high BP Stage 1 and 44.0% had high BP Stage 2. High BP is a risk factor for chronic diseases including heart failure, chronic kidney disease and stroke. Additionally, NSW coal mine employees in the overweight category were more likely to have moderate (48.0%) or high (48.0%) cardiac risk factors; high-risk alcohol dependence (51.0%); and moderate (48.0%) or high/very levels of psychological distress (45.0%).

When age was considered, risk factors in relation to BP and cardiac risk levels increased with age. Participants aged between 40-49 years and 50-59 years had a higher percentage of Stage 1 and Stage 2 high BP. In the same age categories, participants were also more likely to have moderate cardiac risk level (43.0% and 41.0%), or high cardiac risk level (23.0% and 57.0%).

These results indicate that overweight and obesity in NSW coal mine employees is significant and is associated with other health risk factors such as increased BP, high cardiac risk factors, increased alcohol use and psychological distress; all of which are modifiable with appropriate intervention.

Online survey: Existing wellness initiatives

A total of 68 respondents completed the online survey (52.0% completion rate). The participants were personnel from occupational health and safety (60.0%), management (37.0%) and human resources (3.0%); from open cut (73.0%) and/or underground (27.0%) coal mines.

Our findings show that a number of different workplace wellness initiatives have been offered or trialled at mine sites and made available to all staff (90.0%), permanent contractors (25.0%), family members (20.0%) and to part-time or casual contractors (4.0%). The following initiatives had been offered:

- health and wellness education sessions
- workplace health challenges (e.g. weight loss challenge)
- smoking cessation programs
- installation of water coolers in lunch/break rooms
- consultation with a nutritionist or health educator
- subsidies for weight management (e.g. gym membership)

Incentives to participate in wellness initiatives were offered at 29.5% of sites such as merchandise, prizes or gift vouchers (29.5% of sites did not offer any incentives for participation). As part of some wellness programs, gym memberships or visits to professionals such as dieticians or physiotherapists were subsidised by the organisation. Initiatives were mostly made available outside (72.3%), or during (48.9%) work hours. Some initiatives were run as part of worksite monthly safety focus/education sessions, or incorporated in quarterly staff training days.

Company Health and Safety Managers were the main drivers of the workplace wellness initiatives at 70.5% of sites. External consultants were also utilised (27.3%). A small number of sites also listed peers, workplace champions or ambassadors and company managers as driving wellness initiatives.

Determining what wellness interventions were implemented varied. Employee consultation about wellness initiatives was limited, with 11.0% indicating consultation occurred through Occupational Health and Safety Committees, or by conducting internal surveys with staff. Needs for interventions were determined through assessment of Coal Services Health data and following site risk assessments in a small number of instances. Almost half of the survey participants (49.0%) indicated that a needs assessment had not been conducted with the workforce prior to implementation of initiatives. Reasons for wellness programs to be implemented included:

- improving employee health
- reducing injury
- improving employee morale
- enhancing productivity

Evaluation of wellness initiatives was limited. Almost half of the participants (45.0%) indicated that the wellness initiative implemented was successful in improving the overall health of employees, based on measuring participation rates in initiatives. A quarter (25.0%) of participants indicated that the impact of the initiatives had been measured at an organisational level, however return on investment of initiatives was mostly 'unknown' (40.0%) or the initiative was either not successful or not measured (55.0%).

Whilst our results showed some anecdotal evidence of the benefits of the various programs, very few initiatives had been measured, evaluated or sustained. Where workplace wellness initiatives were not measured, reasons identified mostly included a lack of time or resources dedicated to the task, or difficulty/unsure how to measure results.

There were some long-term environmental worksite changes reported as a result of some initiatives. Changes to more healthy food options in vending machines were reported to have been implemented across 38.0% of sites, and 26.2% reported making changes to workplace routine employee health screenings. A similar number of sites also indicated that they aligned their health and productivity strategies with business goals (26.2%), or rewarded positive employee health changes on an ongoing basis (23.8%). Some sites reviewed or made changes to workplace policy in relation to employee education (14.3%) or provided additional management training on the importance of employee health promotion (19.1%). Further research is needed to examine the effectiveness and sustainability of these reported workplace changes.

Focus groups: Attitudes and responses to workplace wellness initiatives

Focus groups were held at five NSW coal mine sites between 11th July and 13th September 2018 with a total of 46 participants. The focus groups were conducted in collaboration with the mine sites regular Occupational Health and Safety Committee meetings. Participants were from a range of employment areas including management, production, operations, maintenance and health and safety personnel. The majority of participants were from open cut mines (78.3%) and the remainder from underground sites (21.7%). Five key themes emerged from the focus group data:

i. Work characteristics

Several factors emerged from the focus groups relating to work characteristics including shift length, rosters, work travel commute, job role, meal breaks and access to healthy food options. All participants that took part in the focus groups agreed that given the complexity of the nature of mining – shift rotations, sedentary tasks and shift breaks – that the workplace should take some responsibility for ensuring the health of its staff.

ii. Resources

All participants felt that resources for health and wellness were more readily available during mining 'boom' times. Gym subsidies and healthy food options had been reduced during economic downturns and had not been restored to previous levels. Where participants commented that organisational financial investment in health initiatives had improved or was well supported, they indicated that issues existed with the ongoing maintenance of health interventions, specifically the lack of dedicated health and safety resources to sustain programs and employee motivation.

iii. Culture

A number of factors emerged from the focus groups in relation to workplace culture, particularly lack of staff consultation, the workplace focus on mining production and issues associated with 'macho' culture. Participants strongly expressed that staff were rarely consulted on matters relating to health and safety in the workplace and that decisions and initiatives were made by upper management. There was also a feeling amongst staff that workplace culture was predominantly 'production driven' and concerned with meeting quotas and improving efficiency, rather than focused on fostering a productive and healthy workforce. Whilst there was an understanding among participants that the workplace cannot control lifestyle choices outside work (e.g. diet, exercise, alcohol use), there was consensus that behaviour change could be influenced in the workplace with those in management positions leading by example and supporting employees to make healthy lifestyle choices.

iv. Education and training

Participants identified that health topics were discussed more frequently at training days, however there were a number of challenges identified. Time dedicated to health education and training was limited. Participants also stated that the delivery of health messaging was not always appropriate to encourage understanding or engagement, or that topics were limited to a focus on fatigue-related talks.

v. Fit for work

Each site maintained a 'Fit for work' policy which meant employees were not under the effect of fatigue, alcohol and/or other drugs, and were medically fit to carry out their specific role each shift. However, a number of variables across sites in relation to this policy were discussed, including no enforcement of breaks on shift or less opportunity to take regular fatigue and stretch breaks, which were more widely accepted in the past. Employees were also subject to periodic medical testing every three years (or sooner if identified as at risk), however establishing medical management plans for at risk employees requires further attention. Some participants felt that it was the organisations responsibility to monitor and manage staff health to ensure they are entirely fit for work.

This study identified a range of workplace and employment characteristics, many of which are potentially modifiable factors, which can guide interventions that aim to reduce the risk of overweight and obesity in mining employees.

Implications of findings

The levels of overweight and obesity in the NSW coal mining industry are significant. The interaction between overweight and obesity with other health related problems including increased BP, high cardiac risk factors, increased alcohol use and psychological distress, is an important finding and supports the need for overweight and obesity to be considered alongside other workplace strategies to support a healthy and productive workforce.

The workplace and employment characteristics identified in this study suggest that potentially modifiable factors can guide interventions that aim to reduce the risk of overweight and obesity in mining employees. In line with evidence about workplace characteristics, the more prominent the positive attributes of the workplace, the greater the work setting can support a range of health promoting behaviours including strong commitment to safety and adaptation to work demands. In the long term, the commitment of the industry in recognising the importance of overweight and obesity as part of its overall approach to occupational health and safety is likely to bring benefits in health outcomes and workplace productivity.

The existing risk identification, mitigation, response and recovery models for health and safety in the industry, as described in the NSW Mining Blueprint for Management of Overweight and Obesity, provide a framework for the industry and company response. A number of recommendations have been proposed for the NSW mining industry, which include building a culture of workplace health through leadership support and employee input, providing sufficient education and training, ensuring adequate resources, and regularly measuring and evaluating programs. Given the potential returns on investment from the implementation of programs to address overweight and obesity in workplaces, these results warrant further attention across the mining industry.

2 INTRODUCTION

This report presents the results of the Obesity and New South Wales (NSW) Coal Mining research project (No. 20648). The report describes the prevalence of overweight and obesity in NSW coal mines. It also outlines what workplace wellness interventions targeting overweight and obesity have been trialled at a site level and what the outcomes of these have been at both an individual and organisational level.

2.1 CONTEXT

Obesity is a major health problem in Australia, with almost two thirds (63.0%) of Australian adults classified as being overweight or obese (1). Excess body fat is an established risk factor for numerous chronic diseases including heart disease, diabetes and some cancers (2), which are subsequently associated with poor quality of life and increased risk of premature death. Other non-life threatening co-morbidities that can affect those who are overweight or obese include musculoskeletal pain, osteoarthritis, dementia, gout, gallbladder disease, sleep apnoea and fatigue (3). These health complications can have a profound impact on individuals, their community and society as a whole. It is estimated that disease and disability due to overweight and obesity costs the Australian health system billions of dollars through both direct costs such as demand on health care services and resources, as well as costing the taxpayer indirectly from productivity losses, increased use of welfare

and forgone tax revenue (4). Recent estimates place the cost of health burden to the Australian economy from overweight and obesity at $8.6 billion (1, 5), without taking into account costs from reduced wellbeing and missed earnings. Obesity is associated with a 2-12 year decrease in life expectancy (6), which can largely affect both lost earnings for the individual and revenue for the government.

Employees who are obese have higher rates of absenteeism and presenteeism, reduced productivity, increased injury and illness, slower recovery rates and increased workers' compensation costs (7). The increased risk for non-life threatening health conditions such as musculoskeletal disorders and sleep apnoea can interfere with an individual's capacity to work effectively, and negative attitudes toward weight and discrimination can also lead to increased absences from work (8). Obese employees take more sick leave than healthy weight employees and for a longer duration (9, 10). In Australia, obese employees are 17.0% more likely than non-obese employees to be absent from work for at least one day, with estimates of total days lost from the workplace in the millions (7). In addition, the average length of absenteeism is greater for obese and overweight employees (3.2 days) compared to non-obese employees (2.3 days for underweight, and 2.8 days for healthy weight employees) (7). In 2010, workplace absences in Australia were estimated to cost an average of $3,741 per employee per year (11), meaning this degree of absenteeism can have a profound economic effect. Obesity is also associated with presenteeism (or the practice of working ineffectively while sick), which is consequently associated with loss of productivity (12). Overweight and obesity is also associated with higher incidence of workplace accidents and nonfatal injuries (7, 10), and longer injury recovery times (10). This may be associated with the effect of increased physical load from excess bodyweight on musculoskeletal injury, and potentially in some circumstances that plant and equipment is not designed to accommodate excess bodyweight. Being overweight or obese may also increase workers compensation claims due to injury (13, 14).

The fundamental cause of overweight and obesity is an energy imbalance between energy consumed and energy expended and where this imbalance occurs, excess energy is stored as body fat (15). An individual's dietary intake and physical activity are directly and indirectly influenced by a complex interplay of social, environmental, behavioural, genetic and physiological factors, of which the workplace is one modifiable factor. Consideration of the factors contributing to obesity in the workplace will assist with developing suitable approaches for improving diet and physical activity among mining employees.

2.2 OVERWEIGHT AND OBESITY IN THE NSW COAL MINING INDUSTRY

There is limited empirical evidence of the extent and impact of overweight and obesity in the Australian mining industry. In 2014, the NSW Minerals Council engaged Ethos Health to prepare a report on the levels of obesity in the NSW Mining industry. The report based on Coal Services Health data found that the rates of overweight and obesity in NSW coal miners are considerably worse than national figures. Data collected from 10,796 NSW mining employees who completed compulsory health assessments (including measuring height and weight to calculate Body Mass Index [BMI]) between January 2012 and December 2014, identified 84.8% of males and 58.0% of females were overweight or obese (16), which is higher than the national adult population of 71.0% males and 56.0% females (1). Within the Coal Services Health cohort, factors found to be associated with overweight and obesity were gender (predominantly male) and increased age (16). This aligns with evidence that

men account for more than 90.0% of the NSW mining workforce (17), and that national population data shows prevalence of overweight and obesity is greater in men (1). Factors that did not seem to influence BMI included location of the mine (urban, regional, or rural), and type of operation (i.e. underground or open cut) (16).

Based on similar occupations and other industry studies, factors associated with overweight and obesity are hypothesised to reflect gender bias from a male-dominated workforce including level of education (18), long working hours (19), sedentary nature of work (20), and workplace stress, low autonomy and control (21). Interestingly, a smaller study conducted in one NSW underground coal mine found no significant association between shift work and average BMI (22), despite evidence that shift work is associated with higher BMI in other occupations (23-26), and in Australian men (21).

In the NSW mining industry, measurements of body weight, and indicators of physical fitness and physiological health, are required at recruitment and periodically through employment to monitor the potential development of occupational illnesses and injuries (27). However, this does not appear to be sufficient to prevent some miners increasing their body weight to a point where it affects their fitness for work. Fitness for work based on BMI is difficult to determine, and impossible to decree given that currently only fatigue, alcohol and drugs are legislated indicators of fitness for work (28).

2.3 EVIDENCE-BASED WORKPLACE WELLNESS INITIATIVES IN THE AUSTRALIAN COMMUNITY

Workplace wellness initiatives are employer instigated programs to help and support employees in either overall wellness or targeted health behaviours important to the workforce (29). Overall wellness programs may be developed to tackle a number of disease risk factors and combine elements of physical activity, healthy eating and mental wellbeing. The workplace is an ideal setting for introducing wellness initiatives for a number of reasons (29). Primarily, large groups of people working together create an ideal environment for using social networks to support behaviour change (30). In addition, as most people spend a significant amount of their waking hours at work, the workplace environment plays a significant part in peoples' daily lives and health. For example, workplace location can play a role in employees' access to food outlets and opportunities for physical exercise. Meanwhile, the nature of the occupation itself can play a role in opportunity for physical activity. Sedentary jobs for example are linked to decreased physical activity and weight gain, cardiovascular disease and diabetes (31, 32). In terms of initiating a workplace wellness initiative, a supportive leadership approach to changing workplace health behaviours has been shown to be beneficial because it encourages adherence, as well as a practical framework for change (by changing company policies and practice) (29, 30).

In Australian workplaces, wellness initiatives are becoming more popular. According to a 2014 global survey, 47.0% of workplaces in Australia are now using some form of health promotion service in the workplace (33), though only half of these initiatives had measured specific outcomes therefore their success is difficult to evaluate. Barriers and facilitators to participation commonly relate to aspects of program implementation, employee characteristics or attitudes, or social and environmental supports (34). In a 2017 study on barriers and facilitators to participation in workplace health promotion activities in Tasmania, respondents who believed that: their organisation placed a high priority on workplace health promotion activities; they had the support of their managers to participate; or colleagues were interested in taking part; were more likely to participate (34). These factors are

consistent with building a culture of health where middle managers and direct supervisors support initiatives and ideally lead by example (34).

2.4 TYPES OF WORKPLACE WELLNESS INITIATIVES TRIALLED IN THE MINING SECTOR

The mining industry faces a unique set of challenges to the implementation of successful workplace wellness initiatives. The mining and resource sector is typically male-dominated (17), consisting of shift work, longer shifts (12 hours), rotating rosters (disrupting sleep and circadian rhythms) and workplaces which are often located in rural and/or remote areas that may require a challenging commute to work and a degree of physical and social isolation (35). Those who work in the mining industry have shown to have higher than population average levels of psychological distress (36) and are more likely to drink at hazardous or harmful levels (37). NSW mine employees are also more overweight and obese than the Australian General Population (16, 22).

Anecdotally, a number of workplace wellness initiatives have been trialled across the NSW mining industry, however the results and outcomes of these initiatives have not been captured. In partnership with key stakeholders, the NSW mining industry launched a proactive response to overweight and obesity in the mining workplace in 2016, with the development and launch of the Blueprint for the Management of Overweight and Obesity (38). The aim of the Blueprint is to provide a framework to guide and support employees and workplaces in the management and maintenance of healthy weight to optimise health and wellbeing. The Blueprint identifies the roles and expected contributions of various stakeholders (including industry, mine sites, employees, service providers, research institutions, regulatory bodies, health care organisations, unions and communities); outlines a framework for action (identifying leadership, policy and systems, culture, education and training, partnerships, and communication and engagement); and models an action and implementation plan.

2.5 HEALTH AND SAFETY IN THE MINING INDUSTRY

Health promotion programs can help prevent work-related illness or injury, however there is limited evidence of workplace wellness initiatives previously trialled in the NSW mining industry. The sector has always maintained a strong emphasis on safety and injury management; however, within the occupational health and safety domain, there has been less emphasis on the health component until recent years. This would appear to be particularly relevant when considering preventive aspects of health, where companies have struggled to identify the most appropriate strategies to maintain and enhance the health and fitness levels of mine employees (39).

Under NSW Coal Order 41, all employers of coal mine employees /operators in NSW must ensure that their workforce, both employed and contractors, undergo pre-placement medical assessments and periodic health surveillance medicals (40). Pre-placement medicals are conducted prior to an individual commencing a new role to confirm they are fit to undertake the associated physical requirements of the role safely, as well as provide baseline health measures for ongoing health surveillance (40). Periodic health surveillance is used to monitor workers health regularly over time to identify any adverse health effects as a result of harmful exposure in the workplace, as well as early detection for risk of long-term occupational illnesses (40). Under Order 43, employees identified at their periodic health surveillance as >130kg are reported to the mine site and the mine Doctor is responsible for establishing a medical management plan with the employee to assist them to lose

weight (27). The capacity for, and limits to physical adaption and work demands however, still require attention.

The mining industry has responded to legislation and increased awareness of risks by also testing employees for drug and alcohol intoxication, as well as excessive fatigue. If a worker is found not to have either medical problems or impairments related to drugs, alcohol or fatigue, then they are considered fit for work (41). The Australian government does not regulate work health and safety in the mining industry, but rather each state and territory has its own regulatory framework. In NSW, work health and safety requirements are regulated through the Work Health and Safety (Mines and Petroleum Sites) Act 2013; and the Health and Safety (Mines and Petroleum Sites) Regulation 2014. A challenge in defining fitness for work in mining however is that the actual physical fitness requirements of many work tasks have been underemphasised in recent years (39), particularly since changes to job tasks with the introduction of new technologies.

2.6 PROJECT AIMS

This study aimed to investigate what workplace wellness interventions targeting overweight and obesity have been trialled in NSW coal mines, and the outcomes of these at a site level. It also aimed to determine the prevalence of overweight and obesity in NSW Coal Mining and compare this to national obesity data. Specifically:

1. What is the prevalence of overweight and obesity in the NSW coal mining population (based on Coal Services Health [2012-2014] data)?
2. What, if any, workplace wellness weight management programs have been implemented at a site level, and what have been the outcomes of these at both an individual and organisational level (including how the programs were received by employees and how these programs were evaluated and measured)?

3 METHODS

3.1 ETHICS

This study was approved by the University of Newcastle's Human Research Ethics Committee on the 20th April 2018; Approval No H-2018-0122.

3.2 STUDY DESIGN

This study was conducted as a mixed method study, which included a review of existing pre-employment and periodic medical examinations data from the years 2012 to 2014, supplied by Coal Services Health, to investigate the prevalence of overweight and obesity in NSW coal mining.

A cross-sectional online survey with key personnel (Managers/Occupational Health and Safety/Human Resources) at both underground and open cut coal mine sites was conducted, to investigate what interventions targeting wellness, overweight and obesity have been trialled in NSW coal mines and the outcomes of these at a site level.

Focus groups were conducted with Occupational Health and Safety Committee members on-site to gain further insight about what wellness and weight management initiatives had been trialled, how these were received by employees, how they were evaluated and measured and what outcomes were achieved.

3.3 DATA COLLECTION AND RECRUITMENT

Coal Services Health maintain a database of periodic and pre-employment medical information on miners in the NSW coal industry. As part of the original pre-employment medical tests, miners consent to their data being used collectively with Coal Services Health (no identifying mine site, employment details or location are included). Data was collected on 10,869 open cut and underground mine employees across NSW between 2012-2014 and supplied to the researchers by Coal Services Health.

Mine sites were recruited with the help of Kristy Prior, Partnership and Innovation Manager at Coal Services Health. An email was sent to all identified Health and Safety Manager's from the Coal Services Health mailing list. A total of 131 participants were invited to take part in an online survey to collect information about what interventions targeting wellness and overweight and obesity have been trialled in NSW coal mines and the outcomes of these at a site level. The online survey included 21 questions and took approximately 10-15 minutes to complete. The recruitment email also included an opportunity for managers to express an interest in a researcher visiting their site to conduct a focus group.

3.4 DATA ANALYSIS

Descriptive analysis was used to analyse the existing Coal Services Health periodic and pre-employment medical data, to determine the prevalence of overweight and obesity in NSW coal mines. This dataset was cleaned and analysed using statistical package STATA/IC 15.0 (Statacorp, 2017). Data analysis included general descriptive statistics of the sample to provide information on: demographics (age, gender); health factors (BMI, waist circumference, blood pressure, cardiac risk factors, smoking status, alcohol use levels and psychological distress levels); and workplace characteristics (underground or open cut mine participants). Furthermore, bi-variate analysis (Chi-square) was conducted to explore whether the BMI and waist categories differed by participants characteristics, with two-sided level of significance, $p < 0.05$.

The online survey data was entered into a conventional statistical package (Excel), for analysis. Data analysis included general descriptive statistics of the sample to provide information on the demographics (worker role, underground/open cut), aspects of workplace wellness initiatives undertaken, and attitude to workplace health and wellbeing initiatives.

Focus group data was transcribed verbatim and data analysis commenced upon completion of all focus groups. Data was initially analysed inductively using a group meeting process, whereby the researchers read the transcripts and coded them according to key themes, categories and issues using a thematic analysis process. A discussion followed with researchers to identify codes and categories which best described the experience of the participants until a consensus was reached (42). The codes were categorised into initial themes, and five key themes emerged from the data.

Data was entered, stored and analysed on firewall and password-protected University/health service servers, with access restricted to approved project investigators.

4 RESULTS

The results presented below represent the prevalence data from Coal Services Health, the results of the online survey and focus groups.

4.1 PREVALENCE OF OVERWEIGHT AND OBESITY IN NSW COAL MINES – COAL SERVICES HEALTH DATA

Data on 10,869 open cut and underground mine employees across NSW between 2012 and 2014 was analysed. The majority of employees were: non-smokers (83.17%), male (95.59%), and from either open cut (41.6%) or underground (50.2%) coal mine sites.

4.1.1 BMI AND WAIST CIRCUMFERENCE

BMI and waist circumference are well established indexes for classifying overweight and obesity (43). BMI is calculated by dividing weight in kilograms by height in square metres (kg/m2). The classification of BMI for adults is: underweight (<18.5 kg/m^2); healthy weight (18.5-24.9 kg/m^2); overweight (25-29.9 kg/m^2); or obese (>30 kg/m^2). BMI in the overweight or obese category is an indication that excess body fat has accumulated to an extent that it is likely to be detrimental to health. Waist circumference (i.e. distance around the waist) is a common measure used to check for fat held around the stomach. Having extra body fat around the stomach (>88 cm [35 in.] for women and >102 cm [40 in.] for men) increases a persons' risk of heart disease and other chronic conditions such as diabetes.

Almost half of all the coal mine employees in NSW had a BMI which classified them as overweight (47.41%), with a further 27.08% classified as obese (see Figure 1).

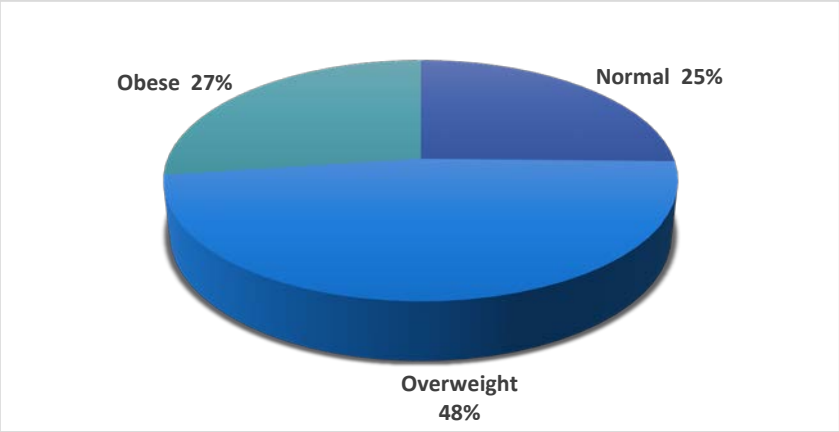

Figure 1. Distribution of Coal Mine Employees by BMI (%)

Similarly, a large percentage of miners also had increased or substantially increased waist circumference. The number of coal miners with increased waist circumference (94-101.9cm) was 26.76%, and those with substantially increased waist circumference (>102cm), 35.71% (see Figure 2).

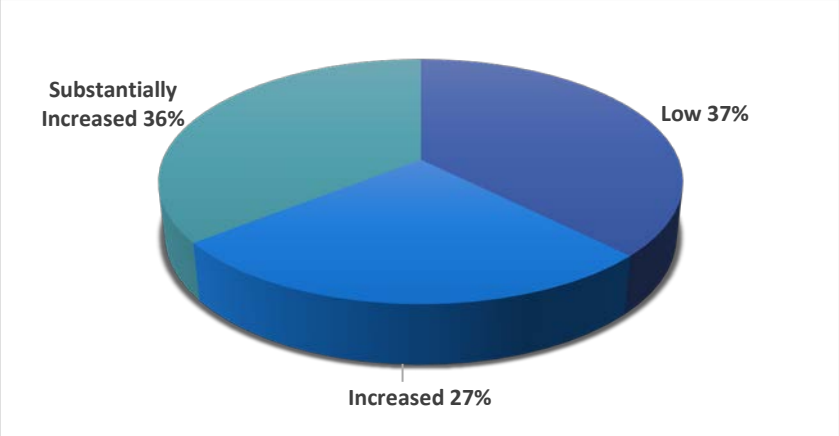

Figure 2. Distribution of Coal Mine Employees by Waist Circumference

4.1.2 BLOOD PRESSURE AND OTHER RISK FACTORS

When BMI was compared by different characteristics such as blood pressure, cardiac risk level (i.e. risk level associated with diabetes, high cholesterol, and stroke), alcohol use levels and psychological distress; results generally indicated that those in the overweight category were at higher risk than those of normal weight.

When BMI was compared to blood pressure (BP) of participants in the overweight category, 50.0% had elevated BP, 51.0% had high BP Stage 1 and 44.0% had high BP Stage 2. Overweight participants were also more likely to have moderate (48.0%) or high (48.0%) cardiac risk level; high-risk alcohol dependence (51.0%); and moderate (48.0%) or high/very high levels of psychological distress (45.0%). Results are outlined in Table 1 below.

Table 1. BMI Category (%) by Different Characteristics

Characteristics		n (10,869)	% Healthy (BMI <25)	% Overweight (BMI 25-30)	% Obese (BMI >30)	p value
Age group						
	<30	1,614	43	43	14	p<0.01
	30-39	3,070	29	46	25	
	40-49	3,011	19	50	31	
	50-59	2,577	19	49	31	
	>60	432	19	43	38	
Gender						
	Male	10,245	24	49	27	p<0.01
	Female	586	53	25	22	

Work location					
Open Cut	3,863	23	46	31	p<0.01
Underground	4,662	26	49	24	
NA	762	34	44	22	
Blood pressure*					
Normal	2,229	46	43	11	p<0.01
Elevated	1,590	33	50	17	
High BP Stage 1	4,320	21	51	28	
High BP Stage 2	2,730	11	44	45	
Cardiac risk level**					
Low	5,979	35	47	19	p<0.01
Moderate	2,937	16	48	36	
High	1,953	12	48	40	
Alcohol level					
No known risk	9,046	27	47	26	p<0.01
Risky or Hazardous	1,585	20	47	33	
High Risk/alcohol dependence	238	21	51	28	
Psychological distress					
Low	10,007	25	48	27	p=0.60
Moderate	483	25	48	27	
High/very high	270	24	45	31	
Smoking status					
No	9,030	25	48	27	p=0.50
Yes	1,720	26	46	28	

*Blood Pressure: Normal (SBP<120 and DBP<80mmHG); Elevated (SBP120-129 and DBP<80mmHG); High BP Stage 1 (SBP130-179 and DBP 80-119mmHG); High BP Stage 2 (>180 and >120mmHG).
**Cardiac risk level: Low (<5-9); Moderate (10-15); High (16->30).

Participants risk factors in relation to BP and cardiac risk level also increased with age. Participants aged between 40-49 years and 50-59 years had a higher percentage of Stage 1 and Stage 2 high BP (see Table 2). In the same age categories, participants were also more likely to have a moderate cardiac risk level (43.0% and 41.0%), or high cardiac risk level (23.0% and 57.0%) (See Table 3).

Table 2: Blood Pressure by Age Group

Age group	Normal (n=2219)	Elevated (n=1566)	High BP stage 1 (n=4252)	High BP stage 2 (n=2667)	p value
<30	513 (23)	353 (23)	524 (12)	224 (8)	
30-39	779 (35)	508 (32)	1,213 (29)	570 (21)	
40-49	544 (24)	397 (25)	1,254 (29)	816 (31)	p<0.01
50-59	358 (16)	268 (17)	1,098 (26)	853 (32)	
>=60	25 (1)	40 (3)	163 (4)	204 (8)	

Table 3: Cardiac Risk Level by Age Group

Age group	Cardiac risk level (%)			p value
	Low (n=5970)	Moderate (n=2879)	High (n=1855)	
<30	1,584 (27)	26 (<1)	4 (<1)	
30-39	2,704 (45)	328 (13)	38 (2)	
40-49	1,341 (22)	1,239 (43)	431 (23)	p<0.01
50-59	327 (5)	1,184 (41)	1,066 (57)	
>=60	14 (<1)	102 (4)	316 (17)	

4.2 INDIVIDUAL AND ORGANISATIONAL RESULTS – ONLINE SURVEY

A total of 68 respondents completed the online survey (52.0% completion rate). The participants were occupational health and safety personnel (60.0%), management (37.0%) and human resource personnel (3.0%); from open cut (73.0%) and/or underground (27.0%) coal mines.

4.2.1 WORKPLACE WELLNESS INITIATIVES TRIALLED

A number of different workplace wellness initiatives have been offered or trialled at mine sites. The majority of respondents indicated that they had offered employees health and wellness education sessions, workplace health challenges (e.g. weight loss challenge), smoking cessation programs, installation of water coolers in lunch/break rooms, consultation with a nutritionist or health educator, and/or provided subsidies for weight management (e.g. gym membership) (See Figure 3).

Some sites offered incentives to participate in the wellness initiatives such as merchandise, prizes, or gift vouchers (29.5%). As part of some wellness programs, gym memberships or visits to professionals such as dietitians or physiotherapists were fully subsidised by the organisation. Some of the mine sites however did not offer any incentives to staff participate in their wellness initiatives (29.5%).

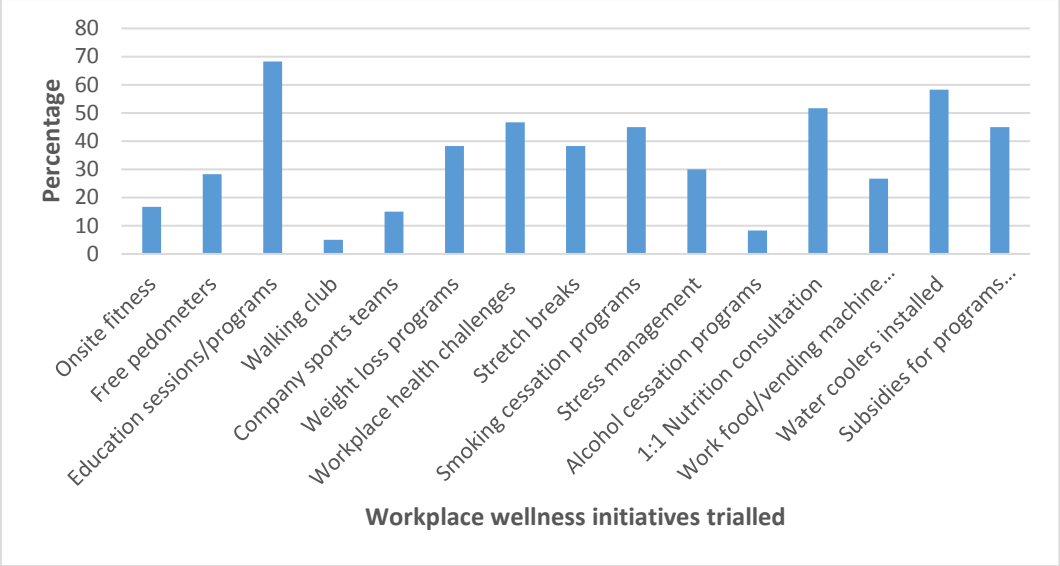

Figure 3. Workplace Wellness Initiatives Trialled

Where initiatives were trialled, almost half of the survey participants (49.0%) indicated that a needs assessment had not been conducted with the workforce prior to its implementation, or that it was unknown if staff were asked about the types of wellness programs they wanted to see implemented (28.0%). Where consultation occurred (11.0%), initiatives were identified through the Occupational Health and Safety Committees; assessing Coal Services Health data; implemented in response to site risk assessments; or by conducting internal surveys with staff.

Workplace wellness initiatives were communicated to employees through a number of channels. The majority of sites indicated that staff were made aware through company Occupational Health and Safety Committees. Staff were also informed through company communications such as newsletters, memos and noticeboards, Toolbox Talks and other workplace education sessions (see Figure 4 below).

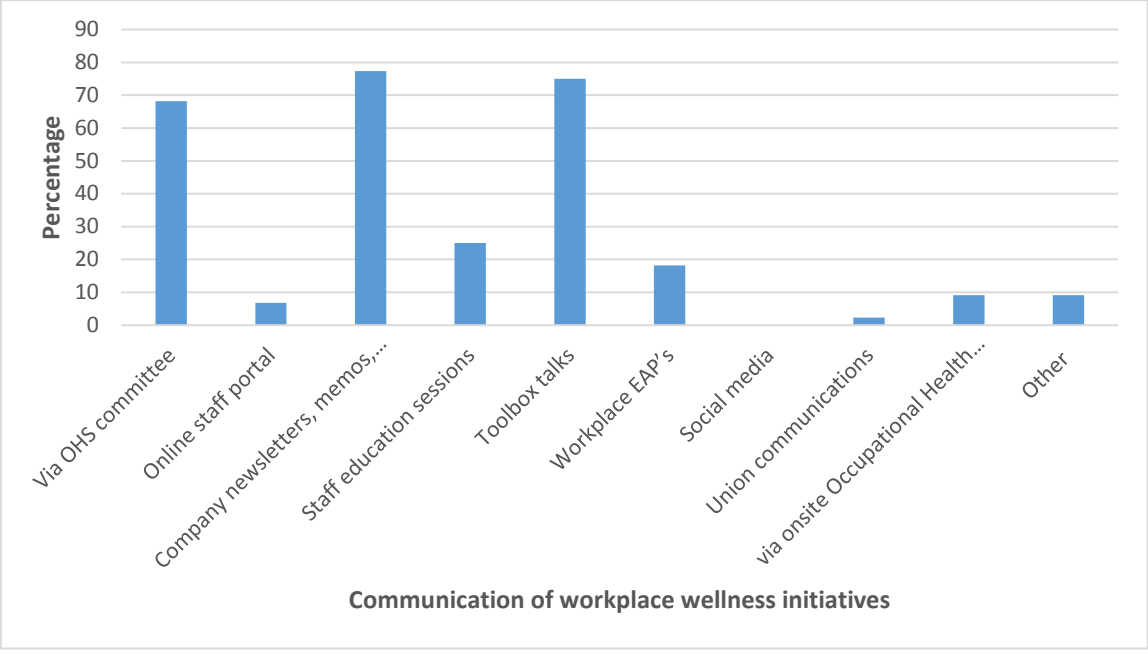

Figure 4. Communication of Workplace Wellness Initiatives

4.2.2 IMPLEMENTATION OF WORKPLACE WELLNESS INITIATIVES

A large majority of participants indicated that the reason worksites had implemented a wellness program at some point was to improve employee health, reduce injury and/or improve employee morale and productivity (see Figure 5). Forty-five percent indicated that the wellness initiative was successful in improving the overall health of employees, and 55.0% indicated that the initiative/s was either not successful or not measured.

Figure 5. Reasons for Implementation of Wellness Programs

When asked if the impact of the workplace wellness initiative was recorded or measured at an organisational level, 25.0% of participants said 'yes', 28.0% said 'some' had been measured, and the majority indicated that 'no' they hadn't, or the impact of the wellness initiative was 'unknown'. Most sites measured employee participation rates in the initiatives (22.0%), rather than organisational level measures. Where participants indicated that return on investment was measured, the following figure (Figure 6) captures what was measured.

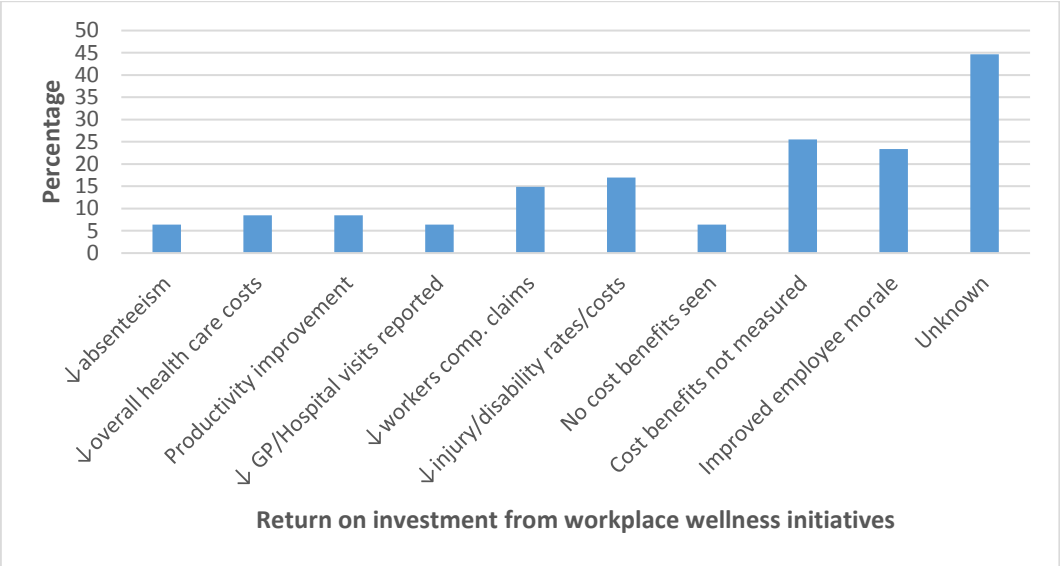

Figure 6. Return on investment of Workplace Wellness Programs

Where workplace wellness initiatives were not measured, reasons identified mostly included a lack of time or resources dedicated to the task, or difficulty/unsure how to measure results. Three participants listed in 'other' that pre- and post-implementation measures would have been useful measures.

At those sites where workplace wellness initiatives were implemented, 90.0% allowed all employees access to the initiatives. A further 25.0% provided access to permanent contractors, 20.0% to employee's family members and 4.0% to part-time or casual contractors. The majority of initiatives were made available outside of work hours in employees own time (72.3%), with almost half available during work hours (48.9%). Some initiatives were run as part of a worksites monthly safety focus/education sessions or incorporated in staff training days. Most programs were implemented during work hours but the initiatives were broader and required out of hours activity and commitment from the individual.

4.2.3 MANAGERS VIEWS OF WORKPLACE WELLNESS

Company Health and Safety Managers were the main drivers of the workplace wellness initiatives at 70.5% of sites. External consultants were also utilised (27.3%). A small number of sites also listed peers, workplace champions or ambassadors and company managers as driving wellness initiatives. A number of sites also indicated that the main drivers were unknown; that no main drivers were identified; or the organisation did not take ownership for the programs, leaving self-motivated individuals to drive their own wellness goals.

Managers were asked to what extent they agreed with a number of statements in relation to workplace health and wellbeing. More than half of participants agreed or strongly agreed that *Management supports employees use of sick days for illness or mental health; Management encourages healthy behaviours at work; Management encourages healthy behaviours outside of work*; and *Management foster a supportive organisational culture and a healthy work environment*.

In response to the following statements management were more neutral or disagreed: *Management ensure employee health and wellbeing is high on the agenda; There is an attitude/culture among employees which encourages healthy behaviours at work; There is an attitude/culture among employees which encourages healthy behaviours outside of work* (see Table 4 below).

Table 4. Extent to which participants agree with workplace health and wellbeing statements

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Management supports employees use of sick days for illness or mental health	6.98%	9.30%	13.95%	55.81%	13.95%
Management encourages healthy behaviours at work	2.27%	4.55%	20.45%	54.55%	18.18%
Management encourages healthy behaviours outside of work	4.55%	6.82%	18.18%	54.55%	15.91%
Management ensure employee health and wellbeing is high on the agenda	6.82%	9.09%	31.82%	40.91%	11.36%
Management foster a supportive organisational culture and a healthy work environment	6.82%	11.36%	15.91%	54.55%	11.36%

There is an attitude/culture among employees which encourages healthy behaviours at work	4.55%	31.82%	27.27%	29.55%	6.82%
There is an attitude/culture among employees which encourages healthy behaviours outside of work	4.55%	22.73%	40.91%	27.27%	4.55%

Some long term environmental worksite changes were implemented as a result of workplace wellness outcomes. Just over one third of participants (38.0%) reviewed or made changes to healthy food options for the cafeteria or vending machines at their site and 26.2% made changes to workplace routine employee health screenings. A similar number of sites also indicated that they aligned their health and productivity strategies with business goals (26.2%) or rewarded positive employee health changes on an ongoing basis (23.8%). Some sites reviewed or made changes to workplace policy in relation to employee education (14.3%) or provided additional management training on the importance of employee health promotion (19.1%). Further research is needed to examine the effectiveness and sustainability of these reported workplace changes.

4.3 ATTITUDES AND RESPONSES TO WORKPLACE WELLNESS INITIATIVES - FOCUS GROUPS

Five focus groups were held between 11th July and 13th September 2018 with a total of 46 participants. The focus groups were conducted in collaboration with the mine sites regular Occupational Health and Safety Committee meetings. Participants were from a range of employment areas including management, production, operations, maintenance, and health and safety staff. The majority of participants were from open cut mines (78.3%) and the remainder from underground (21.7%). Each focus group took approximately one hour to complete and was audio recorded to ensure accuracy of responses. The research facilitator asked a series of questions intended to gain insight about what wellness and weight management initiatives have been trialled at each mine site, how these were received by employees, how they were evaluated and measured and what outcomes were achieved at the mine site as a result of the initiative. Five key themes emerged from the data, which included: i) Work characteristics; ii) Resources; iii) Culture; iv) Education and training; and v) Fit for work.

4.3.1 WORK CHARACTERISTICS

Several factors emerged from the interviews relating to work characteristics including shift length, rosters, work travel commute, job role, meal breaks and access to healthy food options. All participants that took part in the focus groups agreed that the workplace needs to take some responsibility for ensuring the health of its staff given the complexity of the industry. As one participant stated:

> *"Do I think that the workplace has a role to play in supporting health behaviours and behaviour change? I think especially in this industry."*

All participants commented that shift length was a major barrier to maintaining a healthy lifestyle and managing weight. Sites in which employees worked 12 hour shifts found it particularly hard to find the time and energy to devote to exercise or prepare a healthy meal, and ensure that they receive the optimal amount of sleep for that day. In addition, the mine sites where focus groups were conducted were located a distance from the town or city where many employees chose to live. This added

additional time to a work day, as often the travel commute was 1-2 hours each way from their home to site. As one participant stated:

> *"Shifts make it very difficult. Most of us travel an hour or over an hour to get to work. So by the time you get to work – you get up, get in the car, drive to work, work all day, get back in the car and drive home – you're looking at 7:30am and then 7:30pm and there's no time to do anything. I mean some people try and whack something in but there's no time to do anything. You're uncomfortable or you haven't eaten and then it's really difficult to do that. Likewise in the morning, then you're running yourself short on sleep because that's only like six hours, so that's difficult.*

Another participant added:

> *"If you're getting home at 8:00pm at night and you have to get up at 03:20am the next morning, people don't feel like cooking a big beautiful vegetable meal that late at night, they just want to go to bed. On your off days you're not going to sit there and cook all day and throw it in the freezer, you want time off."*

Roster systems were also identified as a challenge for employees. A number of participants commented that it is hard to sustain participation in team sports and other group exercise activities outside of work with rotating shifts and varying rosters.

Maintaining a regular meal pattern alongside shift changes (e.g. night shift) also presented barriers to healthy eating. One participant stated:

> *"I think there are a lot of people who genuinely want to make a change but look sometimes you get into that rut of shift work and that rut of well I have to eat now or otherwise I'm not going to get a chance to eat, and you make poor choices about what you eat and where you have to eat it. Then you're tired overnight so you're looking for sugar to keep yourself awake."*

Another participant added:

> *"You need to juggle the eating around to fit in with your shifts, so you try to normalise it as much as you can and eat when you would normally eat, but that's quite difficult when you're normally sleeping or working when you would normally eat. You're a bit all over the place and then there's that fatigue element that starts to come into the whole shift work thing."*

Fatigue and lack of energy was also a factor, which presented a challenge to shift workers, with employees having reduced energy to exercise. One participant stated:

> ***"****Well I'm on 5/8's nights, so Sunday night I've got to come into work. To try and sleep Sunday before you come in is impossible, so you don't. So I stay up all day Sunday, work Sunday night and I don't go to bed until Monday morning. Thursday (night) is my last shift, so I knock off here at 7:00am and then I stay up all day so that I can sleep Friday night. So I miss out on two sleeps a week."*

The sedentary nature of some job roles was also raised as an issue. Whilst employees in some roles such as maintenance were on their feet most of the shift, other job roles were much more sedentary in nature with limited breaks or opportunity to exercise on the job. As one participant stated:

"Then there's the isolation at work, it's sedentary and you're put into a position out in the pit and look that's just part of the job. You're in the pit and you don't have any access at all to go for a walk, I mean you could walk around the crib part area but that's all that you can really do. So the only opportunity that you have to do any physical exercise is after work, and when I'm talking after work I mean on your days off."

All the identified opportunities to exercise on the job were self-directed. One participant commented that some of the staff at his mine site walk to the gate and back during one of their breaks, as this is their only opportunity to exercise during a work day.

Meal breaks also varied from site to site, with little or no enforcement of a compulsory break. Some sites allowed staff to combine their two-scheduled shift breaks into one so that they could have a longer break in the middle of the day. Some staff indicated that they did not take a break at all throughout their shift. Access to healthy food options at work was also limited and no sites in this sample had access to a canteen. One participant stated:

"A site this size should have a canteen or something that provides fresh meals that could be accessed over 24 hours. Fresh, healthy meals."

Vending machines provided some meal options, but mostly unhealthy options.

4.3.2 RESOURCES

All participants felt that resources for health and wellness were more readily available during the mining 'boom' time of approximately 4-5 years ago and that wellness initiatives had not been reinstated to the same levels despite the mining sectors recovery. All participants were unanimous that after the downturn, gym membership subsidies were changed without employee consultation from multiple fitness options (including local pools), and replaced with substandard gym choices. Participants commented that the limited choice of gyms available under the new subsidy scheme often meant additional travel time to reach a member gym (up to 30 minutes each way), or that no member gyms were available in their local area. Gym subsidies could also once be utilised by family members, however the current subsidy program does not extend to family members, nor contract employees. One employee stated:

"I would like the contractor companies to get on board in facilitating free memberships or subsidised memberships….. it would see great benefit to their employees and employees here on site to have access to gym membership to encourage participation."

Some sites also used to offer a monetary value for the employee to put toward a physical fitness option such as sports club membership or purchase of a pushbike for those not interested in the gym; however, this is no longer an option.

In relation to food resources, participants also felt that variety of food options had decreased at staff quarterly BBQ's due to funding cuts. Previously they had seen dietitians visit and cook healthy and nutritious burgers instead of just bacon, eggs and sausages. Other healthier options such as salads or gluten free food were also rarely available.

Participants felt that education resources had also been reduced or staff were unaware of what health resources were available to them. One participant commented:

> *"We used to have people that would go into the work processing areas and have a look at our range of movements and the work that we did and recommend programs to suit to help with posture."*

Whilst Doctors, nurses and physios were available on site, they were not utilised for promoting healthy activities, but rather dealt with the treatment of work-related injuries and rehabilitation.

Where participants commented that organisational financial investment in health initiatives had improved or was well supported, they all indicated that the problem lied in the ongoing maintenance of the intervention, specifically the lack of dedicated health and safety resources to sustain the program and employee motivation.

> *"If we were to come in and say (to management) we're going to do this, they would support us, but it all just falls over when the six weeks is up and you have to keep going yourself. The company puts everything in place to an extent, but then it comes down to the person getting out there."*

According to participants, challenges were a successful way to engage participants in wellness initiatives and were successful at achieving individual results (e.g. weight loss). Each focus group site had at one time conducted a competition or challenge to lose weight, for example a Biggest Loser competition; the ClickFit online health program; or use of InBody Body Composition Analyser.

The ClickFit program went for six weeks and contained educational material on exercise, diet and portion size, and lifestyle. After a six-week challenge however, individuals were responsible for their own weight maintenance and participants noted that employees who lost weight during the challenge were likely to gain weight again when the challenge was completed.

> *"I think one of the winners they've almost put all that weight back on. The hard thing about any of that sort of thing is to really change your lifestyle and to sustain it. See for them the goal was to actually win the prize rather than change your lifestyle, but sometimes it's good to actually have those as a kick-start with changing your lifestyle."*

One exception of a healthy weight initiative that has remained ongoing has been the use of the InBody Body Composition Analyser, which measures fat and muscle and where it is located in the body. One site trialled this as a six month pilot, but the machine has now remained onsite for over two years as a motivational tool educating employees on the health benefits of not just losing weight, but providing them with an overall picture of health. One participant stated:

> *"We did a six week rapid challenge so that was to get people started on their journey. We gave everyone health cards and they made commitments to themselves. We encouraged people to make it really simple.*

The obvious difference in the success of this initiative has been the sites commitment to resources and keeping participants motivated. Promoting health and supporting a healthy workforce was very much on the agenda at this mine site and driven by the entire Occupational Health and Safety

Committee. Staff were also educated on the results of their scans. This gave them a tangible measure and drove them to not only better their results for next time, but created a healthy competition between employees. One participant commented:

> *"When you've got a family history of heart disease and its showing the visceral fat (on the scan result), that really encouraged me to keep on top of stuff like that, rather than just your weight. For me it's more about my health, not so much my weight."*

Zero smoking onsite is an example of a healthy initiative that has been successfully adopted across all sites. Organisations gave employees six months notice of the change and provided monetary assistance for smokers to quit and put the money towards an intervention of their choice (e.g. nicotine patches, hypnosis etc.). Participants were of the understanding that the zero smoking policy was introduced as a safety measure, as opposed to a health initiative and it was regulated and embedded into company health and safety policy.

4.3.3 CULTURE

A number of factors emerged from the focus groups in relation to workplace culture, particularly lack of staff consultation, the workplace focus on mining production, and issues associated with 'macho' culture.

Participants strongly expressed that staff were rarely consulted on matters relating to health and safety in the workplace, and that decisions and initiatives were made by "corporate" (upper management) without wider consultation with employees. Most wellness initiatives trialled on site were either industry driven, determined by upper management or the Occupational Health and Safety Committee. The majority of focus group participants said that staff had not been consulted on what healthy initiatives they would like to see in the workplace, what initiatives they thought would work and what strategies would encourage employee uptake.

There was also a feeling amongst staff that workplace culture was predominantly 'production driven' and concerned with meeting quotas and improving efficiency, rather than focused on fostering a productive and healthy workforce.

> *"It's not about me and my personal lifestyle choices, it's about us meeting their (the workplace) requirements under their statutory obligations… so ticking boxes primarily."*

One site however approached their healthy weight initiative in a more strategic way and achieved greater uptake from participants:

> *"We had an initiative where we did it strategically to get the most engagement out of it. We gave everyone a half hour off shift to take part. Basically we were bringing work groups through one at a time regardless if people wanted to participate or not and what we found was that peer encouragement engaged some of those who were apprehensive about it at the start."*

They also created personal health cards where individuals wrote simple messages that encouraged them to make small changes to their habits and lifestyle. The site found this was a really motivational way to encourage active involvement, as goals were personal, achievable and not too overwhelming.

The majority of participants agreed that it would be helpful to have something written into workplace policy about supporting healthy eating or living, however they don't want the messaging to be dictated to them – *"you should eat this, do this, do this, and have them push it down your throat… people will go nup, I'll do what I want because they get their back up."* Employees felt that change needs to be led by employees, not dictated from above. One participant phrased it as follows:

> *"Rather than dictate more terms employees have to adhere to, angle it so that it is written into policy that we have these options available and this is what we'd like to do to help support you with a healthy lifestyle."*

There was also a strong sense that there is a 'macho' culture in mining where peer pressure is significant. When participants were asked if it would be viewed negatively if they ate an apple instead of a bacon and egg roll they responded:

> *"Bloody oath. Same as if I have a bottle of water instead of a beer on the way home…. When you're in a (car) crew and you say you're not getting a beer, they'll still go in and bring you a beer and then you'll have it sitting in your lap and you'll be like oh right-o and you'll have it."*

Whilst there was an understanding among participants that the workplace can't control lifestyle choices outside work (e.g. diet, exercise and alcohol use), there was consensus that behaviour change could be influenced in the workplace with those in management positions leading by example and supporting employees to make healthy lifestyle choices. Furthermore, it was identified that the younger staff seemed more engaged, open-minded and aware of health and therefore encouraged their peers to join in workplace health programs.

4.3.4 EDUCATION AND TRAINING

Participants identified that health topics were discussed more frequently at training days, however there were a number of challenges identified.

Time dedicated to health education and training is limited. With rosters and shift rotations, as well as pre-shift meetings only being 5-10 minutes in length, little time is available to present health-related topics. Training days only take place once a quarter and typically on a day when the crew would have a rostered day off. One participant stated:

> *"The training day only takes place once a quarter on what would typically be a rostered day off for that crew, so it's an additional compulsory amount of work or attendance so there's pressure to keep the presentation real and relevant. Then there's also mandatory stuff that we have to cover like going through certain procedures, as well as trying to make it interesting for others. So it's just a balance to try and get through a really long day."*

Participants also stated that the delivery of health messaging was not always appropriate to encourage understanding or engagement. The mine "*just sort of say you shouldn't drink, you shouldn't smoke and you should eat healthy. Well what is healthy eating? You sort of have to explain that."*

Participants suggested that health education needs to be presented in more attention grabbing ways such as through videos or real life examples and statistics that they can relate to.

Monthly Toolbox Talks represent an opportunity to provide health education, however participants felt that when health is discussed, the topics were limited to a focus on fatigue-related talks. Several participants expressed that more education on general aspects of health, exercise, mental health, nutrition, meal portion size, food groups and alcohol use, would be of benefit. One participant stated:

> *"People don't necessarily make the connection about fitness, or diet or long term health consequences. We need to know not just what to eat, but when to eat, sleep, that sort of thing. People aren't sure what is actually healthy and how to incorporate food items into their everyday like what sort of snacks they can easily pack for breaks…. There is no (understanding of the) connection between diet and fatigue."*

One mine introduced monthly health topics at Toolbox Talks as a way of sharing a variety of health information without becoming monotonous in their training. Topics varied in content but covered items such as weight loss, skin cancer checks, mental health and sugar content in drinks.

4.3.5 FIT FOR WORK

Each site maintained a 'Fit for work' policy which meant employees were not under the effect of fatigue, alcohol and/or other drugs, and were medically fit to carry out their specific role each shift. There were however a number of variables across sites in relation to this policy.

Mine sites are legislated by fatigue policy which allows employees to take regular breaks, however there is no enforcement of this with some staff combining their two scheduled shift breaks into one so that they can have a longer break in the middle of the day, and some staff not taking a break at all throughout their shift. Some sites were well supported and allowed stretch breaks as needed and not just during allotted times. For example:

> *"We have a fatigue policy that if you are feeling tired, then you put your hand up and you don't have to wait for crib. You tell the supervisors that you're feeling fatigued and they'll arrange for you to pull up and have a break and they give you like 20 minutes or something and then they'll come back and see how you're going and if you're ok to return to work."*

Other sites however felt that fatigue and stretch breaks used to be widely accepted; however, emphasis on production has limited employee's ability to take regular breaks.

Employees are also subject to periodic and random drug testing at work, as well as periodic medical testing (pre-employment, then every three years or more frequently if identified as at risk). Participants identified that weight gain is a common problem and health surveillance is insufficient to address the issue of overweight and obesity. Where a workplace environment requires heavy lifting, fitting into certain sized holes or weight allowances of seats in some machinery, the risk of injury is increased. As one participant stated, you might meet the statutory obligations having completed a medical test, but:

> *"How can someone be fit for work if they're 170kg."*

Some participants felt that it was the company's responsibility to monitor and manage staff health to ensure they are entirely fit for work. There was some suggestion that there needs to be more scope to the periodic medical testing, which also includes being fit to perform your job role. Without further

regulation, participants felt that employees have little motivation to be fit beyond the current 'Fit for work' guidelines:

> *"There needs to be another section (on the Coal Services Health medical) where it says you fit into the hole for the job that you've got. That includes your health, fitness, weight and all of that sort of thing. Until that's initiated, that's the only thing that's going to drive people…. Otherwise they say nah, it doesn't matter."*

> *"I think a lot of people struggle with identifying what the real reward is.... What are we trying to achieve? Are we trying to achieve people losing weight? Or are we trying to achieve people being fit and strong? Because they are very different."*

5 DISCUSSION

5.1 PREVALENCE OF OVERWEIGHT AND OBESITY

Seven per cent (7.0%) of the total health burden in Australia is due to overweight and obesity (44). It is also a significant issue for the NSW coal mining industry, with almost half the workforce identified as overweight and a further quarter obese; putting a large proportion (74.49%) of the NSW coal mining workforce at risk. Whilst the proportion of males who are overweight or obese in the NSW mining sector is only slightly higher than the Australian General Population (71.0%) (45), the mining industry overall has the highest proportion of overweight and obese employees of all employed Australians (46). It has been estimated that by 2020 around 14.0% of disease burden due to overweight and obesity could be avoided if everyone in the population at risk reduced their BMI by 1 (i.e. equivalent to around 3 kg in a person of average height (44). Even if the current rises in overweight and obesity in the population were halted by people just maintaining their current weight, an estimated 6.3% of future disease burden due to overweight and obesity could be avoided.

Males experience a greater proportion of disease burden due to overweight and obesity then females and risk levels increase with age. Older males aged 55-64 are more likely to carry excess body weight, with 82.0% of the Australian General Population identified as overweight or obese (45). Similarly, in the NSW coal mining sector, 80.0% of males aged 50-59 years, and 81.0% aged over 60 years, were found to be overweight or obese. Our findings showed that study participants aged 40-49 and 50-59 years and characterised as overweight and/or obese, were most at risk of increased BP, high-risk alcohol use and increased psychological distress.

High BP is a risk factor for chronic diseases including heart failure, chronic kidney disease and stroke. In the Australian General Population, the proportion of men with high BP is slightly higher than for women (35.0% and 32.0% respectively) and increased with age (47). In our study, overweight and obese males aged 40-49 and 50-59 years had significantly higher BP rates: elevated BP (50.0%), Stage 1 (51.0%) or Stage 2 (44.0%). Participants in the same age category were also more likely to have moderate or high cardiac risk levels, meaning the risk of them getting heart disease, stroke or blood vessel disease over the next five years (48) was either moderate (84.0%) or high (80.0%). Carrying excess body fat has serious health implications and increases the likelihood of other chronic diseases such as Type 2 diabetes, osteoarthritis and some types of cancer such as bowel cancer (44, 49).

Excessive alcohol consumption is consistently related to weight gain and is a major risk factor for a variety of health problems, including liver, cardiac and mental health problems (45, 50). In our study, overweight and obese males were more likely to consume alcohol at risky or hazardous levels (47.0% and 33.0% respectively). Of even more concern however, was that 51.0% of overweight males, and a further 28.0% of obese males were identified at high risk of alcohol dependence. Males of working age have among the highest rates of alcohol use in the Australian community and the results in the Australian coal industry are even higher (35). Substance abuse disorders are one of the three most common mental health problems; hence, it is not surprising that a similar number of overweight coal miners in this study were identified as having high or very high risk of psychological distress (45.0%). The factors associated with psychological distress are an interplay of personal, social and environmental characteristics such as those in the workplace (35).

Workplace and employment characteristics provide potentially modifiable factors that may be a focus for interventions that aim to reduce the risk of overweight and obesity and their associated related problems.

5.2 WELLNESS INITIATIVES

Our study identified a variety of workplace wellness initiatives have been trialled across the NSW coal mining sector and whilst our results showed some anecdotal evidence of the benefits of the various programs, very few initiatives have been measured, evaluated or sustained. Additionally, a number of challenges due to the complexity of the nature of the mining sector have been identified as barriers to managing overweight and obesity.

Our findings were consistent across both the online survey responses and the focus group discussions about the types of workplace wellness initiatives trialled. Weight loss challenges, consultations with health experts such as nutritionists, subsidised gym memberships, smoking cessation programs and health education sessions, had been tried most commonly across sites. A quarter of the participants of the online survey indicated wellness programs had been measured, however when explored further, some programs had only been measured against participation rates in initiatives, or as individual weight loss results, and not against organisational return on investment. Without adequate reporting, management have therefore been unable to measure impact, and as a result this has threatened the sustainability of the wellness programs that had been trialled. Return on investment is used to value the efficiency of a financial investment and in workplace health programs, as a metric to determine the benefit of program outcomes over the cost of delivering such programs, enabling management to value, in dollar terms, certain parameters such as employee health status, corporate culture, morale, absenteeism, productivity and injury costs (51). Although the task of determining return on investment requires some economic complexity, the cost-benefit analysis of workplace health programs is consequently tangible and may encourage an organisation to support longer term investment in wellness with an approach that enhances sustainability (51).

One of the key findings of this study was that little consultation occurred with employees about the introduction of new workplace wellness initiatives, nor were any needs assessments with employees conducted prior to implementation. Research shows however, that facilitating factors of workplace program uptake include effective communication within the workplace and involving employees in program design and implementation (34). Higher levels of consultation are more likely to lead to activities or programs being developed that are of interest and relevance, and therefore more likely

to lead to higher rates of participation (34).

It is also shown that employees who believe their organisation places a high priority on worker health and has the support of their managers to participate in wellness initiatives, are more likely to take part in workplace health programs. For example, where managers and direct supervisors ideally lead by example, or support their employees to participate in initiatives during work time, this has been shown to be associated with a higher likelihood of participation in physical activity programs (34). This is important to highlight, as the findings of our study seemed to suggest a mismatch between management and employee health values. Results of the online survey indicate that managers encourage a culture of health through leadership commitment and behaviours at work, however focus group discussions implied current organisation values in terms of health and wellbeing were not represented in their managers or the organisation's actions.

There exists obvious challenges in providing access to programs across complex worksites where shift work and irregular work patterns exist, such is the case for the coal mining industry. Research shows that shift or rotational workers can be at heightened risk of poor health and health behaviours compared with those who work normal daytime hours (34, 52-54). The connection between shift-work and cardiovascular disease (CVD) is also suggestive but not conclusive. Changes in circadian rhythm, social disruption and behavioural changes have been suggested as possible pathways linking shiftwork to increased risk of CVD (52). Other work-related factors that have been implicated as potentially increasing the risk of a cardiovascular event include exposure to chemicals, environmental tobacco smoke, noise and psychosocial factors including low job control (52).

Physical inactivity also acts as a barrier to managing overweight and obesity in the workplace. Physical inactivity has increased in the workplace as job roles have changed from manual labour to predominately inactive tasks. A rise in the levels of automation and the number of labour-saving devices has resulted in more people working in sedentary roles (55). Sedentary work, low physical job demand, or their combination, has been shown to increase the risk of obesity, particularly in male employees that work more than 40 hours per week (56), with many coal mine employees fitting into this category.

Poor nutrition also acts as a barrier and in our study, a lack of healthy food options and unhealthy food vending machines at the work site were identified as barriers to overweight and obesity. Employees without healthy food options near or at the workplace have been found to consume a smaller amount of fruit and vegetables per day (55).

The combination of sedentary behaviour and easy access to nutrient-poor food therefore compounds the risk of overweight and obesity. These findings highlight the challenges of working difficult hours and the responsibility of the workplace to provide physical activity and nutrition programs to support employees health.

5.3 IMPLICATIONS FOR INDUSTRY

Workplace and employment characteristics suggest potentially modifiable factors that may guide interventions, which aim to reduce the risk of overweight and obesity in the workplace. There have been many studies conducted over the past three decades reporting on the design and implementation elements of effective workplace health promotion programs (34, 39, 55, 57) . They

have all concluded that best-practice programs include: building a culture of workplace health through leadership support and employee input, providing sufficient education and training, ensuring adequate resources and regularly measuring and evaluating programs.

5.3.1 EMPLOYEE CONSULTATION

Involving employees in the early stages of developing a workplace wellness intervention is critical to establishing buy-in for programs. The most significant way to do this is through the establishment of a culture of health within the organisation. A culture of health can be defined as a workplace that places value on, and is conducive to, employee health and wellbeing (57). Evidence suggests that various interventions will have limited impact unless they are part of an overall culture.

In our study focus group participants unanimously confirmed that being included in the decision-making process in relation to wellness interventions was inadequate. Actively engaging employees in the process of shaping and building wellness offerings, as well as setting goals and objectives, can ensure that programs more appropriately meet the needs of the individuals most likely to participate (57). There are many examples of wellness programs established in contentious workplace environments where workers have little control over tasks and job demands, which show low employee engagement rates and worker resentment (57). Involving employees in day-to-day decisions about health initiatives is also critical to establish and build staff trust. In order to do this effectively, employees need to be engaged in transparent communications about the programs purpose and the rationale underlying the actions. Having employees involved in decision-making processes also allows the opportunity to develop peer support processes, which assist in engaging employees in health program uptake. It has been proven that peer support in health initiatives encourages motivation, enhances competition and enforces accountability (57).

Creating cultures of health also involves leaders practicing health behaviours, encouraging employees to incorporate healthy activities into their workday, and implementing health promoting policies and practices into the organisation. This can be achieved when leaders and managers consistently communicate health messages that show they value the health and wellbeing of their employees. Effective communications must also be tailored and targeted, as employees needs vary by age, gender, education and job type. Tailoring health promotion means providing needed services and communicating those services in relevant and engaging ways (57).

5.3.2 HEALTH LITERACY AND EDUCATION

Australians are encouraged to actively participate in maintaining their health, and health literacy levels can influence how much and how effectively people do this. In 2009 the Australian Bureau of Statistics reported that only 41.0% of adult Australians had a level of health literacy that would allow them to meet the complex demands of everyday life (47). A person's health literacy can be influenced by their cultural beliefs, language, education, income and health status. Low levels of health literacy have been linked to higher rates of hospitalisation, increased incidence of chronic conditions and limited effective self-management (58).

In our study it became evident during the focus group discussions that there was a general lack of basic knowledge about good health habits including a how to prepare healthy meals, what a standard

drink size was, how to manage stress, fatigue and sleep, benefits of physical activity and the nature and causes of disease.

Raising health literacy, particularly in males, presents numerous challenges, mostly because of the cultural and social environments which influence men's health behaviours and men's resistance to seek preventative health advice or self-management services (58). Whilst it is important to avoid simplistic explanations that apportion responsibility to the individual, it is vital that men are provided with access to information and education about health, as well as encouraged to make earlier, more appropriate use of primary health services (58). The workplace offers this opportunity, to deliver innovative approaches to providing resources and developing skills that can be used at the employees discretion to help improve their health and wellbeing, particularly those most at risk of poor health outcomes. A study of Australian miners recently published in the journal of *Safety and Health at Work*, found that employees at risk of developing obesity-related chronic illnesses (based on high BMI) were more likely to report preference for weight management assistance than lower risk employees (46). Miners in that study (aged between 17-73) wanted assistance to reach a healthy weight, however they did not feel confident in modifying their eating behaviours or identifying sufficient physical activities for reaching a healthy weight (46). This suggests there is a need for the workplace to support employees to achieve a healthy lifestyle and increase the likelihood of better weight management.

5.3.3 HEALTH RESOURCES

Implementing health promoting policies and practices and creating a healthy work environment requires allocating sufficient resources for programs to be sustained over long periods of time. Our study found that a number of qualified health resources are accessible on site including Nurses and Physiotherapists, as well as access to external resources such as Doctors and Dietitians. However despite these immediate health resources at hand, the primary responsibility of the workplace wellness programs appeared to rest with the Occupational Health and Safety Managers. Many of these individuals do not have health qualifications, nor the time to adequately monitor the programs put in place and rely solely on statistics such as workplace injury numbers for evaluation. Health is the predominant value of Doctors, Nurses and allied health professionals, therefore it makes obvious sense to utilise their skills to support the Occupational Health and Safety Manager to action and evaluate health programs, as well as embed a culture of health into organisational policy. The role of health care professionals in the workplace is constantly evolving and adapting to individuals' health needs, as well as legislative requirments. Having a workplace model where interprofessional education is optimised, allows for these healthcare professionals to share experiences that uses a common language (59). Setting up a Committee or expanding memberships of current ones to include health staff, provides an opportunity to draw on their expertise and utilise their leadership to support workplace wellness programs.

Pre-employment and periodic medical testing data as conducted as part of employment for coal mine employees is also a resource that is potentially being insufficiently, or under-utilised. Traditionally, *fitness for work* focuses solely on the identification of pre-existing medical conditions and the resultant risk of injury, and has since expanded to testing employees for drug and alcohol intoxication and excessive fatigue (39). However, a broader and longer term view which considers how much an employees capacities match the demands of their job role, and how their health and fitness status changes over time and impacts their capacity to physically adapt to keep up with work demands, may

be beneficial. Although legislation under Order 43 required that mine sites, in collaboration with a medical Doctor, increase health surveillance if an employee was identified as weighing >130kg, employees do not appear to be aware of this process and few at risk employees identified being under medical management plans to lose weight. Mechanisation and changes to some work methods has resulted in an increase in the sedentary nature of some job tasks, however many mining tasks remain physically demanding, hence health surveillance at more regular intervals to also assess where employee capacity levels may be declining or at risk, may be also warranted.

Sufficient resources are also required for ongoing sustainability of programs. In our study many participants pronounced that when downturns were apparent across the industry, the wellness budget was reduced or ceased at their site. Research suggests however that the most successful workplace programs ensure that the wellness budget is never threatened, even during economic downturns, which proves managements' commitment to the health of its staff and further assists with employee engagement levels in programs (57). Literature also suggests that costs exceed benefits unless programs are sustained for a minimum of 3-5 years (39), therefore having a short-term or temporary focus on health programs is not cost-effective. Ongoing commitment must also provide for employee incentives to participate in wellness initiatives, which is something the participants of our study highlighted was important for their engagement in health initiatives.

5.3.4 RESHAPE AND SUSTAINABLE FRAMEWORK

A workplace wellness and health culture entrenched into an organisation's policies, procedures, infrastructure and leadership style, signals to employees the high value the organisation places on the health and wellbeing of its staff.

There is no one-size-fits-all approach to a successful workplace wellness program. Programs must be tailored to employee's health needs, as well as the organisation and the mine sites unique culture. Evidence suggests that a strategic and long term approach to workplace wellness is much better at yielding population health improvements and cost saving benefits when compared with programs that are composed of random and often unrelated activities (57). More importantly, supporting health includes not only a physical environment that helps employees make healthy choices, but a full integration of health into the way an organisation operates. Reviews of successful health promotion programs point to the paramount importance of sustained support from management, as well as worker involvement in the design and execution of such programs (39).

The RESHAPE framework is an example of an intervention that aims to assist the workplace to embed an organisational framework, which establishes a sustainable approach to the management of overweight and obesity. Health promotion initiatives and the direct short-term outcomes of such programs are not effective at implementing long-term change. Whilst changes to the physical environment such as providing access to healthy food offerings, fitness facilities and regular stretch and fatigue breaks are important to address individual health measures, a whole of organisation approach is required. An example of the application of this would be building health culture into the performance objectives of all staff including senior leaders down to line employees, which set individualised health promoting goals, but at the same time account for a percentage of the workers overall performance evaluation (57).

The RESHAPE framework was conceived by a subcommittee of the NSW Minerals Council, which developed a framework for a coordinated plan of action for mining operations to engage in industry-wide change in order to prevent and manage obesity. The RESHAPE framework details the steps that mining operations can take to address the problem of overweight and obesity in the workplace. This involves an evaluation of all aspects of the organisation including a review of leadership styles and commitment levels, job design processes, work scheduling, work processes, production processes and all aspects which allow the organisation to develop a more holistic and sustained approach to the health of its workforce. The process requires continual improvement, which is based on leadership commitment, employee engagement and ongoing evaluation.

5.4 STRENGTHS AND LIMITATIONS OF THE STUDY

This study is one of the first to explore the prevalence of overweight and obesity in the NSW coal mining population and the workplace wellness initiatives trialled within the NSW Coal mining industry. This study was completed in several parts, with one component utilising existing data from Coal Services Health pre-employment and periodic medical assessments of 10,869 employees who worked within the NSW coal industry in open cut and underground mines between the years 2012-2014. Our findings are therefore representative of coal mine workers in NSW and may have similarities to other male-dominated occupations within NSW and Australia more widely.

Comparisons with other population figures is not straightforward, as contemporary data from representative groups of individuals in similar age, gender and employment type would be required to draw firm conclusions about whether mining itself is associated with higher rates of obesity. Where comparisons have been made to the Australian General Population, factors associated with overweight and obesity have been hypothesised to reflect results based on similar occupations and a male-dominated workforce. It is also acknowledged that factors, which impact on the health of the mining community, such as global mining boom and busts, are significant issues, which potentially impact individual health outcomes, and results may be difficult to capture.

To investigate the workplace wellness initiatives that have been trialled within NSW coal mines, an online survey was conducted with Managers and health and safety personnel. The response rate to online surveys is usually low (around 33.0%) (60), hence 52.0% response rate for an online survey is acknowledged as good. Whilst it should be noted that there may be some volunteer bias with those individuals interested in the topic of the study more likely to respond, there was representation from both open cut and underground mines, which does suggest results can be generalisable to the situation in coal mines across NSW more broadly. The survey was purposely brief to encourage completion, however due to the type and nature of responses and the relatively small sample size of 68, only descriptive statistics could be completed.

Ten mines sites initially expressed interest in being part of the focus groups, with the Occupational Health and Safety Committee's confirming the commitment of mining company management and local management, at a site level. The logistics of conducting the focus group in collaboration with the mine sites regular Occupational Health and Safety Committee meetings however meant that only five focus groups could be completed. Nonetheless, data redundancy was reached within these five focus groups with consistent themes being raised across the mine sites.

5.5 CONCLUSION

The findings from this study support the importance of a focus on the management of overweight and obesity in the mining industry, as it is for all workplaces and communities across Australia. Overweight and obesity problems are significant among NSW coal mining employees with rates of overweight and obesity at least equivalent, and in some instances higher, than comparable populations. The prevalence of the impact of this problem also extends to increased blood pressure, increased cardiac risk and significant rates of alcohol use and psychological distress.

Numerous wellness initiatives had been trialled across NSW mine sites and a number of factors emerged as barriers or enablers to the successful health outcomes of the programs. It was also clear that existing programs had not been evaluated and measured after implementation, hence results and return on investment were difficult to quantify.

Whilst is it clear that mining organisations recognise it is in their best interests to keep their workers healthy, engaged and productive, obesity is a complex issue and our findings also indicate the interplay of personal health and social factors, alongside work characteristics, as potential contributors to the issue and difficulties to address.

Nonetheless, the findings of this study provide opportunities and guidance for workplace interventions which encompass prevention and health promotion, early intervention and sustainability of programs by: Establishing a workplace health culture which is inclusive of employees; enhancing employee health literacy levels; ensuring sufficient resources are allocated for health programs; and utilising a framework such as the NSW Blueprint for the management of Overweight and Obesity in the NSW Mining Industry, or RESHAPE to embed health into organisational policy. Workplace health programs, which recognise the importance of these strategies, can contribute significantly to the health and wellbeing of its workforce, particularly if they are implemented and properly evaluated.

Given the health, social and economic benefits derived from health and wellness programs, the workplace provides a unique opportunity to both recognise and promote effective response to overweight and obesity. Building a culture of health means integrating health into each and every way the organisation operates and requires sustained effort on a number of fronts. It is essential that management develop an environment where employees are actively included in decisions that shape health promotion efforts and ensure sufficient resources are invested in this important area of health and safety.

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