BABY BOOMERS AND GENERATION X IN AUSTRALIA.

HEALTH DIFFERENCES AND THE INFLUENCE OF WORK AND WORKPLACE, WITH A FOCUS ON OBESITY.

A Thesis Submitted for Consideration for the Award of

DOCTOR OF PHILOSOPHY

By

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Abbreviations

ABS	Australian Bureau of Statistics
ANZSCO	Australia and New Zealand Standard Classification of Occupations
ARC	Australian Research Council
BMI	Body Mass Index
CATI	Computer Assisted Telephone Interview
CES-D	Centre for Epidemiological Studies Depression Scale
CHD	Coronary Heart Disease
COAG	Council of Australian Governments
CVD	Cardiovascular Disease
FAMAS	Florey Adelaide Male Ageing Study
GDP	Gross Domestic Product
HREC	Human Research Ethics Committee
K10	Kessler Psychological Distress Scale
NHS	National Health Survey
NILF	Not in the labour force
NOBLE	The Nutrition Obesity Biomedical Lifestyle and Environment Project
NWAHS	North West Adelaide Health Study
OECD	Organisation for Economic Co-operation and Development
OR	Odds Ratio
SES	Socioeconomic Status
WC	Waist Circumference
WHO	The World Health Organisation
WHR	Waist-Hip-Ratio
WWII	World War II

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Abstract

The increase in obesity prevalence seen in Australia since the 1970s and the rise in comorbid chronic conditions –particularly diabetes, pose a significant problem for society and government in terms of consequences for government spending on health, workforce participation, economic growth and quality of life.

Baby Boomers, born from 1946 to 1965 and Generation Xers born from 1966 to 1980 together form over half of Australia's total population and nearly 75% of the working population. Their continued health into older age is essential if the nation is to cope with the quadrupling of the 85 plus population by 2050[1].

This research explores generational differences in health status and the influence of work and workplace on health, irrespective of age. The aim of this is to highlight risk factors for the development of obesity and comorbid conditions, as well as specific groups that can be targeted by programs and policies to improve the health of Australia's population.

Using National Australian data, in Chapter 6 we explore the sociodemographic and health profile of Baby Boomers in 1989/90 and Generation X in 2007/08, in order to determine differences when the generations were of the same age of 25 to 44 years. This study illustrates that while Generation X are higher educated and have lower levels of smoking, they are also developing obesity and a higher prevalence of diabetes at an earlier age than their predecessors, and this may be reflected in their self-reported health status.

Chapter 7 explores generational differences in the association between job strain, occupation, psychological distress and the risk of overweight and obesity as defined by high waist circumference. Using data from two community based Adelaide cohort studies, this study provides evidence that for Generation Xers, work-related stress, occupation and psychological distress have significant relationships with unhealthy weight. The reasons for these generational differences require further exploration although it may reflect differing values, perceptions or lifecourse effects.

Chapter 8 examines the relationship between changes in employment status over time and the prevalence of Type 2 diabetes, depression, arthritis and obesity (BMI ≥ 30) with and without comorbidities at follow up. Generation X is compared to early (born 1946 to 1955) and late (born 1966 to 1980) Baby Boomers using data from a biomedical cohort study based in the North West suburbs of Adelaide, South Australia. Remaining unemployed and becoming unemployed is associated with the presence of chronic conditions. No generational differences were demonstrated in adjusted analyses.

These studies have identified that the younger generation is developing obesity and diabetes earlier in the lifecourse, highlighted generational differences in the relationship between work related factors and obesity and demonstrated that workforce exit and unemployment is related to the presence of obesity and common comorbidities. These findings have significant implications for healthy ageing, workforce participation, healthcare utilisation and costs into the future.

SECTION I

BACKGROUND & STUDY DESIGN

Chapter 1 INTRODUCTION

1.0 Introduction

Arguably one of the biggest challenges facing governments in Australia at this time is the ageing population and as a consequence, the higher rates of chronic disease and greater burden on the health system[1]. In 2012, the Baby Boomer cohort born from 1946 to 1965, made up 25.7% of the population and Generation X born from 1966 to 1980 formed 23.7% of the population[2]. Together, these generations form the working population of Australia[1] and their continued health into older age is essential if the nation is to cope with the doubling of the over 65 population by 2036[1, 3] and the quadrupling of the 85 plus population by 2050[1].

The pressures from the ageing population are not limited to increasing the burden on the health system. A projected reduction in working age Australians will slow economic growth[1] and affect the tax base needed to support the transformation of the aged care system necessary to accommodate the ageing Baby Boomer generation[4]. The contribution of chronic disease prevalence to these issues is becoming all too evident. Prevalence of obesity has nearly doubled since the 1980s[5] and as of 2012, 63.4% of the Australian population is overweight or obese[6]. The most common comorbidities of obesity include cardiovascular disease (CVD), which is the leading cause of death in Australia[5] and diabetes, predicted to become the leading cause of disease burden as well as the most costly by 2023[7]. Together, these chronic conditions severely impact on quality of life, workforce participation and overall, the ability to age healthily. The projected costs associated with the growing prevalence

of these chronic conditions and the consequences for workforce participation and workforce replacement as the Baby Boomers move into retirement are unsustainable.

These challenges have led to the present research that aims to explore the differences in health status and the influence of work and workplace on health in Baby Boomers and Generation X, as Australia's working generations. Following this, Chapters 2 to 4 discuss the background literature relevant to the current work and Chapter 5 reports on the overall study design and research questions. In Section II of this thesis these research questions are addressed. The initial study (Chapter 6) seeks to answer the question '*Are Baby Boomers healthier than Generation X, irrespective of age?*' The second study (Chapter 7) focusses on Job Strain and occupation to explore if the work and workplace, affects the health of the generations differently. The final study (Chapter 8) examines employment status over time and chronic conditions, to explore the relationship between economic inactivity and ill health in Baby Boomers and Generation X. The findings will highlight generational differences and factors that should be targeted in policy and program initiatives designed to reduce the burden of chronic disease, particularly obesity, on Australia's population.

Chapter 2 AUSTRALIA'S BABY BOOMERS AND GENERATION X

2.0 Australia's Baby Boomers and Generation X

2.1 A Generational perspective

Whilst some authors[8] have argued that the correct term to describe groups such as the Baby Boomers should be 'cohort', given that 'generation' is a term also used to allude to kinship relationships, this dissertation will adopt the term generation in the manner defined by Karl Mannheim in 1928: a particular age group that have shared common experiences within a given period[9].

An important question to be addressed before leaping into discussion presumptive of differing social identities, values and personal orientations is, what is it that makes a generation a generation, and why is this significant?

The late 1920s saw sociologist Karl Mannheim introduce the concept of 'generation'[9]. Mannheim defined a generation as a group of similar age that shared common experiences in their formative years[10]. The generation is imprinted with the primary social and political events that occurred during their youth and this shapes behaviours, perceptions, values, orientations and thoughts over the life course. These early life experiences form an individual's core view of the world and all subsequent experiences derive their meaning from this core[9-13]. Throughout their discussion of the 'theory of generations' Eyerman and Turner examine the model of 'generations' as a tool by which social stratification can be studied. They propose that Bourdieu's sociology of culture and theories of habitus and hexis provide a premise that accounts

for the collective dispositions and practices seen in a generation, and suggested generations are socially constructed by the conflict over limited resources within a given sphere[9]. A generation is defined as

> "a cohort of persons passing through time who come to share a common habitus, hexis and culture, a function of which is to provide them with a collective memory that serves to integrate the cohort over a finite period of time" p93[9].

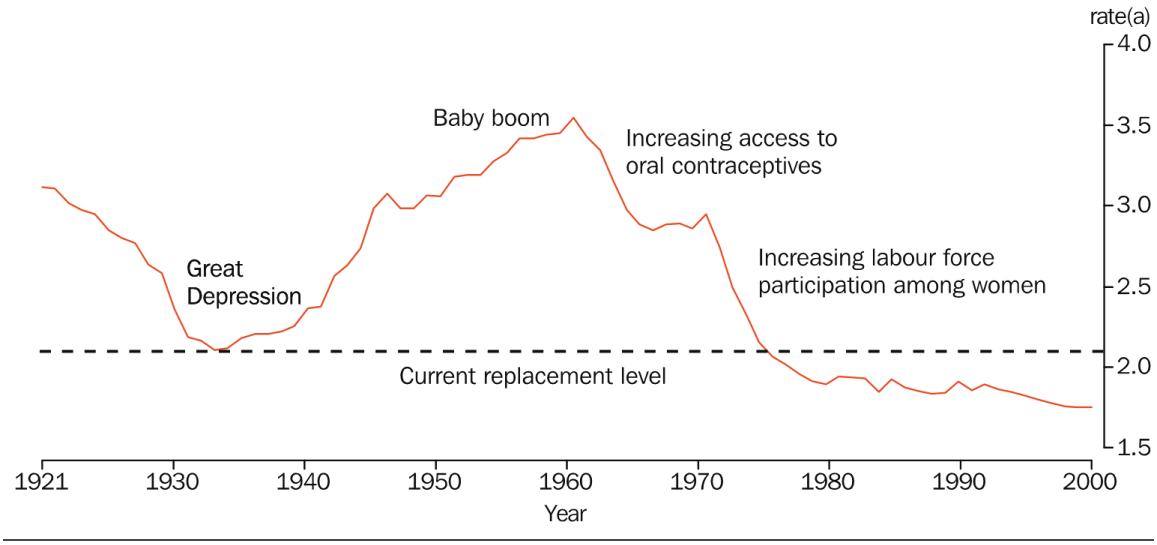
2.2 The History of Generations

2.2.1 A Demographic context

In Australia as elsewhere, there is little agreement regarding the definitive years of generations, other than that of the Baby Boomers[14]. The Baby Boomer generation, born from 1946 to 1965 were granted their moniker due to the post WWII rise in fertility rates or, aptly, the 'Baby Boom'[15]. During those years Australia saw a peak in population growth due to an increase in both births and migration[15].

The Australian population grew on average by 2.2% or 211,200 people per year between 1946 and 1965 compared to population growth of only 0.9% in the decades preceding the war[16]. The total fertility rate peaked at 3.5 in 1961[17] or in other words women during that period would on average, give birth to 3.5 babies in their lifetime if they conformed to the fertility rate of that year. The high rates of marriage and fertility were a natural follow-up to the disruption of relationships and child-bearing

experienced during the War[18, 19]. Figure 2.1 demonstrates the Total Fertility Rate in Australia from 1921 to the year 2000 with the Baby Boom highlighted.



(a) Babies per woman.

Source: Australian social trends ABS 2002 Page 12

Figure 2.1: Total Fertility Rate in Australia 1921-2000[20]

This increase in migration was the result of Australia's immigration policy following WWII, based on the belief that the population was not large enough to ensure national security or economic growth[17]. This was commonly known as the 'populate or perish' policy. Record levels of net migration were reached in 1949 and 1950[15].

The majority of migrants arrived from war-torn Europe as the White Australia Policy was still in place restricting the entrance of non-English speaking immigrants, while encouraging immigration from the United Kingdom and Ireland[16, 21]. However, following the war this policy was relaxed to allow the entry of other Europeans[22]. This resulted in increasing cultural diversity with immigrants born in Italy, Greece, Yugoslavia, Malta and Germany making up 34% of immigrants into Australia from 1961

to 1965[22]. The proportion of births in which one or both parents were born overseas increased from 14% in 1947 to 31% in 1965[17].

The initial split between the Baby Boomers and Generation X has been defined by the Australian Bureau of Statistics (ABS) by taking into account fertility rates and significant social and political events that have resulted in shared experiences[19]. The most significant change in birth rates can be seen in 1965 when fertility rates dropped again dropped below 3.0 for the first time since the beginning of the Baby Boom (see Figure 2.1). Due to this drop in fertility rates Generation X was also briefly referred to as the "Baby Bust" although an 'echo' of the fertility boom can be seen from 1970 to 1973, in which fertility rates rose to just under 3 before quickly declining once more[17]. Although this 'echo' resulted in the highest number of births in one year (276,400), this discrete rise pales in comparison to the previous Baby Boom. Both of these increases in fertility coincided with periods of strong economic growth and it is thought the continued prosperity seen throughout the 1950s was a significant cause of the continued high fertility rate[16]. By 1975 the youngest Generation Xers were being born when fertility rates had dropped below replacement level.

2.2.2 A Social and Political view

As Pilcher[11] notes, any investigation involving social generations needs to recognise and consider the social and historical factors that helped create the historical consciousness the generation carries with it[8]. In view of this, a discussion of these factors in relation to Baby Boomers and Generation X, follows.

The formative conditions that are said to have shaped the older generation arose largely out of the affluence of the post war boom[12]. This broadly included a rise in living standards involving improved nutrition, health, education, public health measures to develop sanitation and medical technology advances. Women in Australia experienced some of the most significant changes. During the mid 1960s effective contraception and access to abortion were introduced, women were allowed to continue working in the public sector once married and in 1969, women were granted 'equal pay for equal work'[15, 23]. These significant social changes are said to account for the decrease in fertility rate as this led to higher employment rates for women, in some instances delayed child-bearing and the changing pattern of the family structure. Mothers began to balance family and work[24] and the double income family was created[15]. The Family Law Act was passed in 1975 and this led divorce rates to rise significantly up until 1979. Economically, early Baby Boomers experienced high rates of employment while late Baby Boomers experienced lower employment due to the economic downturn of the late 80s and early 90s[19].

The majority of the literature on Generation X examines work-related characteristics and can be found in what could be termed 'pop' literature and as mentioned previously, there is little agreement on this generational definition. However, for this study we have defined Generation X as being born during the years 1966 to 1980 based on the previous discussion of birth rates as well as the shared social and political policies and events of their youth.

Generation X grew up with higher rates of divorce and separation following the introduction of the Family Law Act in 1975[19]. Subsequently, the family structure for Generation X was vastly different to that of the Baby Boomers[19]. Despite being the first generation forced to pay for higher education, they are still more educated than their predecessors, although the high unemployment during the early 1990s reflects the reduced work opportunities available when many were entering the workforce[19]. The workforce landscape also altered. Having observed their parents loyalty and dedication to organisations resulting in significant lay-offs during harsher economic times, Generation X is said to have developed a 'work to live' as opposed to a 'live to work' attitude[25, 26]. It has also been suggested that they view employment as necessary but precarious and expect to have multiple occupations in their working life[27]. Broad themes from workforce and management studies suggest that Generation X are more individualistic than Baby Boomers, valuing flexibility and independence while displaying more loyalty to individuals rather than organisations[26, 28].

In relation to this particular study, generational membership provides a unique way to predict and explain health status, health behaviours and health beliefs. Additionally, although broad generational themes can be identified, within a single generation it is possible there are multiple 'generational units' as a result of different experiences and responses to the same historical event[11] and diversity is likely to exist within, as well as between generations.

2.3 Socio-demographic characteristics

Analysis of the 2006 Australian census[29] presented in Table 2.1, demonstrates that nearly double the proportion of Baby Boomers reported being born in North-West Europe, reflecting the White Australia policy that encouraged only Anglo-Celtic migration until the 1970s[22]. Additionally, a greater proportion of Baby Boomers reported being born in Southern and Eastern Europe and this is most likely a result of the 'populate or perish' migration policy following WWII.

Baby Boomers are less formally educated with a much lower proportion completing a bachelor degree or higher compared to the national average, while Generation X have twice the national average of individuals with a University qualification. This is despite the government policy which from 1974 to 1989 abolished tuition fees and provided 'free' completely government funded, University education[30]. By the time Generation Xers were entering tertiary education, the Higher Education Contribution Scheme had been introduced and individuals once again had to contribute to the cost of tertiary education[30]. Wyn and Woodman suggest that Generation X triggered the beginning of a social norm which has resulted in many young people leaving school with a view to further education[27].

A greater proportion of Baby Boomers report providing unpaid assistance in a carers role or volunteering compared to Generation X. Approximately 80% of older Australians receive assistance from informal carers, often family, friends or

neighbours[4]. In 2006 Baby Boomers were aged 41 to 60 and that nearly 15% of them are reporting taking on a caring role is concerning given the negative effect unpaid care has on participation in paid employment[31], and the projected increase in caring needs due to the ageing population[3].

Examining the socioeconomic characteristics, it is apparent that there is a higher proportion of Baby Boomers who are managers and a lower proportion who are professionals or technicians and trades workers, compared to the younger generation. The differences in employment levels are fairly minor, although a higher proportion of Generation Xers reported looking for work compared to Baby Boomers who had a higher proportion classified as 'not in the labour force'. Related to employment level, distribution across income categories is largely even, other than a higher proportion of Baby Boomers earning $1-$399 weekly and a lower proportion of earning $1000-$1599 compared to the younger generation.

These socio-demographic differences highlight the greater ethnic diversity of Baby Boomers, the differences in formal education and in life stage, particularly in regards to caring responsibilities and participation in the labour force.

Table 2.1: Selected socio-demographic characteristics of Generation X, Baby Boomers and the total Australian population using 2006 Census data from the Australian Bureau of Statistics

	% **Generation X** (n= 4,163,834)	% **Baby Boomers** (n=5,397,474)	% **Aus Population** (n=19,855,287)
Sex			
Male	49.1	49.4	49.3
Female	50.9	50.6	50.6
Country of Birth (selected)			
North-West Europe	5.3	10.3	6.8
Southern and Eastern Europe	1.8	4.9	3.3
Oceania and Antarctica	72.8	66.3	73.4
Highest non-school qualification			
Certificate / Diploma	28.8	7.5	19.1
Bachelor degree or higher	24.4	4.8	12.5
Marital status			
Married (registered)	46.9	61.2	36.0
Married (de facto)	14.0	6.7	6.3
Not married	29.2	23.2	29.1
Carer status			
Provide unpaid assistance	8.4	14.2	8.1
Volunteer status			
Volunteer for organisation/group	16.3	21.2	14.4
Occupation			
Managers	9.6	11.4	6.1
Professionals	17.3	14.9	9.1
Technicians & Trades workers	11.1	9.1	6.6
Community & personal services	6.0	5.7	4.0
Clerical & administrative	11.2	11.4	6.9
Sales	5.4	4.9	4.5
Machinery operators & drivers	4.8	5.4	3.0
Labourers	6.4	7.1	4.8
Employment			
Employed full time	50.6	47.8	29.3
Employed part time	17.8	19.2	13.5
Employed away from work	4.7	4.2	3.0
Unemployed looking for work	3.6	0.8	2.5
Not in the labour force	17.2	20.7	26.5
Individual income (weekly)			
Negative income	0.4	0.5	0.4
$0	4.3	4.7	5.3
$1-$399	21.8	24.6	27.1
$400-$999	39.0	36.6	25.8
$1000-$1599	18.3	16.9	9.6
$1600+	8.1	9.4	4.8
Not stated	8.1	7.2	7.1

2.4 Health of the Generations

Baby Boomers are the first generation to grow up with advantages unseen in previous generations, such as modern medicine and increased access to education and health services, resulting in a significant increase in the standard of living[32]. Despite this, there are differing views as to whether they will progress to old age in a better or worse state than previous generations[33-35]. Research from the United States has presented conflicting results. A study by Weir found Baby Boomers have worse self-reported health than pre-Baby Boomers but objective measures showed their health to be the same[36]. In contrast to this, a report by the Institute of Medicine concluded disability rates are likely to increase as the Baby Boomers enter later life and the demographic distribution of America gets older[37]. Further, Martin et al. concluded that although mortality has dropped considerably, the rate of CVD, obesity, diabetes and lung disease had increased, suggesting the public health advances have not caused an increase in later life health, as could be expected[33]. Perhaps the most dire prediction coming out of the US, is of a decline in life expectancy due to the rise in obesity prevalence at a younger age[38], the complications that arise as a consequence and its life-shortening effects[38-41]. This is one of the most pressing health problems in the US and due to the higher prevalence of obesity in younger groups, serious consequences are expected in terms of morbidity and mortality[42, 43]. In the United Kingdom, Rice et al. reported a higher proportion of Baby Boomers had an illness or disability, multiple chronic conditions, diagnosed diabetes, diagnosed hypertension and a higher Body Mass Index (BMI) compared to the wartime cohort. They concluded that in spite of experiencing a higher quality of life compared to the former war-time generation,

Baby Boomers are ageing with overall worse health than expected and there are significant health issues to be addressed[32]. On a more positive note, research from the English Longitudinal Study of Ageing suggests retirement is an optimal time for interventions targeting risky health behaviours[44]. Specifically, it was found individuals were more likely to quit smoking whilst transitioning into retirement than before or after this time point[44]. This raises the possibility of dedicating interventions to a specific time point to increase success rates[45]. McMurdo argues ageing does not necessarily mean dependency or ill health[46] although the growing health problems associated with obesity and the associated cost would suggest otherwise[47].

In Australia the picture of Baby Boomer health is similar to that painted internationally, with significant concerns surrounding the ageing of this large cohort and the potential burden to the health system this presents[48]. Although life expectancy of the Baby Boomer generation has improved by four years for women and five for men since the early 1980s, this does not appear to have equated to improved quality of health over the same time period[35]. Research focussing on the Baby Boomer cohort in Australia posits that lifestyle changes seen over the past few decades may well outweigh the improvements seen in public health, medicine and overall quality of life, to cause an increase in morbidity largely attributed to the growing obesity prevalence[34]. South Australian research has demonstrated a rise in obesity among Baby Boomers between 2002 and 2007, with 65% of the cohort classified as overweight or obese using BMI[49]. The study highlights the importance of education, income, self-reported health status, physical activity and co-morbid

conditions such as diabetes, as precursors and potential consequences to developing obesity[49]. The research on the increasing prevalence of obesity in the Baby Boomer cohort[34, 49-52] suggests that if nothing is done to halt this then Australia will see rising rates of diabetes, sleep apnoea, knee replacements, bariatric band surgery[50], CVD, cancer and kidney disease[53].

Health research examining Generation X is much less common as the current spotlight centres on more immediate concerns surrounding the older generations. The latest report on Australia's Health from the Australian Institute of Health and Welfare illustrates that Baby Boomers and Generation X share the same risk factors of smoking, risky alcohol consumption and insufficient physical activity although the conditions contributing most to burden of disease differ[7]. Anxiety, depression, suicide, self-harm, substance abuse and traffic accidents feature prominently for the younger generation whereas older Baby Boomers are dealing with a greater burden from chronic diseases and cancer[7]. Unless the environment significantly changes then the greatest burden of disease for Generation X will alter over time to mirror that of the Baby Boomers. Research has also examined attitudes to work, generational differences in work ethic and the experience of the work environment[54-59]. Emerging themes from this research suggest ineffective communication in the workplace between generations, more negative workplace experiences and greater value placed on leisure time for Generation X[55, 57, 59].

The health differences demonstrated via inferences from current national research demonstrate a general consistent pattern with health issues associated with younger and older groups. However, it is also important to understand if there are differences between the generations in health status, irrespective of age or lifecourse stage. In other words, are there birth cohort differences, caused by factors other than age?

Chapter 3 OBESITY

3.0 What is Obesity?

Obesity is characterised by excess or abnormal fat that increases the risk of illness[60-62]. The development of obesity is a significant risk factor for multiple health problems including CVD, musculoskeletal conditions[63], type 2 diabetes[64], some cancers[65], disability[66], poor self-rated health[67-69], obstructive sleep apnoea[70], mental wellbeing[71, 72] and significantly affects overall health-related quality of life[73].

3.1 Measuring Obesity

3.1.1 Body Mass Index

The most common method of measuring obesity is the use of BMI due to the simplicity of a height and weight measurement, which is closely related to body fatness[61, 64, 74]. The BMI score is derived by dividing weight in kilograms, by height in metres[2 75]. The World Health Organisation(WHO) BMI classifications state that a BMI of ≥25.00 to 30.00 indicates 'pre-obese' or overweight and a BMI of ≥30.00 is indicative of obesity[62]. Table 3.1 demonstrates all BMI categories as defined by the WHO.

Table 3.1: **BMI Classification for Europid adults 18 years and over**

Classification	BMI (KG/m^2)	Risk of comorbidities
Underweight	<18.5	Low (increased risk of other clinical problems)
Normal weight	18.5 – 24.9	Average
Overweight	25.0 – 29.9	Increased
Obese[#]	≥30.0	Moderate to Very Severe

Source: WHO[74] [#]Obese categories collapsed

However, BMI fails to take into account fat distribution[76] and includes estimation of both fat mass and fat free mass in its calculation despite the opposing effects these have on health[77]. There are also issues in using BMI to define obesity in older populations as fat free mass decreases with age[78].

3.1.2 Waist Circumference and Waist-Hip-Ratio

In 1947 a French physician Jean Vague first noted that abdominal fat most commonly seen in men, was more likely to be associated with CVD and diabetes related complications[79, 80]. The two most common measurements of abdominal fat are the Waist-Hip-Ratio (WHR) and Waist Circumference (WC), both which are posited to more accurately predict diabetes and CVD risk compared to BMI[81-85].

WC is measured by placing a measuring tape at the point between the lowest rib and the top of the iliac crest at the end of normal respiration[86]. In 2008, an expert consultation was held by the WHO to explore the evidence base regarding WC cut-off's appropriate to the need for intervention[86]. The WC cut-off points most often used to define increased risk of metabolic complications are displayed in Table 3.2.

Table 3.2: WC classifications

WHO Cut-off points	Risk of metabolic complications
>94cm Males **>80cm Females**	Increased
>102cm Males **>88cm Females**	Substantially increased

Source: WHO, 2008 [86]

WHR is waist circumference divided by the hip circumference which is measured by circling a measuring tape around the widest point of the buttocks[86] and provides additional information about muscle mass[62]. While both WHR and WC provide measures of abdominal fat, WC is the more widely used given the comparative ease of measurement compared to WHR[86] and is the only measure of central obesity used in the present research.

It is proposed that excess abdominal fat is related to decreased glucose tolerance, reduced insulin sensitivity and unfavorable lipid profiles[86], key indicators of CVD risk. Accurate prediction of CVD risk and cardiometabolic risk factors is indispensable given that CVD is the number one cause of death in Australia[5] and globally[87]. However, individuals with excess abdominal fat may be demonstrating the accumulation of subcutaneous or visceral fat. Visceral fat has been shown to be associated with key metabolic abnormalities independent of the amount of subcutaneous fat[61, 88, 89] and is widely accepted as at the minimum, a marker and at the most a cause, of greatly increased risk of CVD and Type 2 diabetes[61]. Whilst WC is highly related to the accumulation of visceral fat using computed tomography in comparison to WHR and BMI[90] and associated metabolic markers of CVD or type 2 diabetes[91], it cannot by itself, distinguish visceral from subcutaneous adiposity[61]. Despite this, WC is superior to BMI in that it is unrelated to height[79, 85], it accounts for fat distribution, which has been shown to vary within a minor BMI range[76] and it predicts CVD[84, 85] and mortality[92] independent of BMI.

Both BMI and WC have been accepted as predictors of obesity related health risk, although both have limitations. The WHO suggests that BMI is appropriate for use as a predictor of disease risk or that WC or WHR could be used in conjunction with BMI[86].

3.2 Obesity and mortality

In attempting to discern the best population measure to identify those at highest risk of obesity comorbid conditions, it is important to consider the relationship between excess weight and mortality, as the ultimate consequence of unhealthy weight. A phenomenon termed the 'obesity paradox' has been proposed suggesting that in older age groups, overweight and moderate obesity confers a 'survival advantage'[93, 94].

Several large-scale projects have examined this seemingly counter-intuitive relationship. A recent review of the association between BMI and mortality by Flegal and colleagues showed that overweight was associated with lower mortality while grade 1 or 'mild' obesity (BMI 30.00-35.00) was not associated with excess mortality[95]. The authors therefore concluded that the driver of the relationship between obesity and excess mortality was higher levels of BMI of 35.00 or greater[95]. Pishcon and colleagues using the EPIC cohort data found that both general and abdominal adiposity, measured by BMI, WC or WHR, were all independently related to mortality risk[96]. However, they concluded that measuring both general fatness (BMI) and central adiposity (WC or WHR) provided the best prediction of mortality[96]. Criticisms of the Flegal meta-analysis make the point that their comparison group included smokers

and people with preexisting disease and therefore the risk of mortality in the comparison groups are underestimated[97].

A strong argument has been made that previous findings of an inverse association between weight and mortality are due to confounding by smoking status and preexisting disease as both factors influence premature mortality and weight. Leitzmann et al. found that abdominal fat mass measured by WC consistently related to death from multiple causes independent of BMI, while BMI demonstrated inconsistent associations[92]. From this they suggested that general fatness is not a consistent predictor of premature death[92]. This finding may be related to the potential confounding factor of smoking status, as other work has found that WC is associated with mortality risk independent of BMI, which may relate to the adverse fat storage profile often seen in smokers[96]. Examining a cohort aged 50 to 71 years old, Adams et al. found that when smokers and participants with preexisting disease were included in analysis then the obesity paradox persisted and overweight was not associated with risk of death in women and only weakly associated with death in men[78]. However, after restricting analysis to those who had never smoked and using mid-life BMI values to account for preexisting disease bias, they found that even modest increases in BMI increases the risk of death[98].

Acknowledging the potential bias, Berrington de Gonzalez and team aimed to estimate the mortality risk of overweight, obesity and morbid obesity without confounding from smoking or preexisting disease[99]. Using data from 19 prospective studies with a

median follow-up of ten years and restricting analysis to non-smokers and those who did not have diagnosed cancer or heart disease, they found that overweight, obesity and possible underweight was associated with an increase in all-cause mortality and that a BMI range of 20.00 to 24.90 illustrated the lowest mortality risk[99]. Masters, Powers and Link[100] further discussed the possibility that the obesity paradox has previously been found due to inadequate adjustment for birth cohort and age at interview, given that reductions in mortality are highly related to birth cohort. In a cross-sectional analysis of 19 waves of a US National survey they found that after adjustment for cohort and the interaction between obesity and age at survey, the association between BMI defined obesity and mortality grew stronger with severity of obesity and age[100].

The mass of evidence seems to suggest that in large population studies, BMI as a measure of general fatness and WC as a measure of abdominal obesity both predict health related risk and mortality with caveats. Use of WC confers advantage in terms of its relationship with visceral fat, although this is still not the perfect measure as it cannot discriminate between visceral and subcutaneous fat deposits.

3.3 What causes obesity?

While the causal pathway is generally accepted as an interaction between poor diet, low physical activity and an increase in sedentary time[101, 102] the sizeable increase in obesity prevalence that has occurred in almost all countries, has also been driven by

evolutionary changes and the complex interactions between genetic, biological, environmental and social factors.

In many countries, a small but chronic energy gap between intake and expenditure has been responsible for gradual weight gain that has propelled the increase in obesity[103]. Globally, food systems have altered over the past 50 years to the point where an abundance of energy-dense, cheap and palatable food is consistently available for consumption in a way that has never previously been experienced[104, 105]. Additionally, technological advances linked to reduced physical activity in relation to work, home and travel has resulted in reduced physical activity in developed countries[106].

3.3.1 Energy intake

The production and marketing of foods high in sugar, fat, salt and with flavour enhancers has been postulated as the primary driver of weight gain in developed countries[107, 108]. For the first time, food has been engineered to trigger a reward response exceeding that of traditional non-processed foods[109]. Volkow proposes food reward plays a critical role in the development of overweight and obesity and that highly palatable food trigger a response akin to drug addiction affecting self-control, promoting over-eating and reward response conditioning[110, 111]. There is overlap in the regions of the brain that respond to food and to drug intake[110, 112] and evidence from rat studies has shown intense sweetness consumed from sugars surpasses the reward induced by cocaine – a highly addictive drug, suggesting that highly sweetened beverages and foods may lead to a sugar addiction[113]. In the context of the

widespread availability of sweetened beverages, cheap, high fat and high sugar foods, the probability that conditioning of reward circuitry in the brain and subsequent behaviours akin to addiction are contributing to the obesity epidemic is of significant concern. Lustig, Schmidt and Brindis recently called for government regulation of sugar, arguing the addictive properties, the harm it confers on society and its widespread availability warrants intervention[114]. There is support for the theory of sugar and/or food addiction, although it has not yet been proven[112, 115]. However, others caution the link between food addiction and obesity, suggesting animal studies are not sufficient to prove this theory and endorsement may discriminate further against a group within society already in receipt of significant discrimination[116].

3.3.2 Energy expenditure

In terms of the reduction in energy expenditure, one contributor has been the reduction in work related physical activity[117-119]. Studies undertaken using national US data have shown that the prevalence of people working in occupations associated with high levels of physical activity has reduced by at least half since 1950[119]. Further, since the 1960s, daily occupation related energy expenditure in the US is estimated to have dropped by more than 100 calories (418 kilojoules)[117]. The reduction in occupational physical activity is of concern given that working in physically active occupations reduces the likelihood of developing obesity[120]. However, the obesity epidemic cannot purely be related to occupational related physical activity given the rise in prevalence has also been seen in children and other non-working populations[107]. An Australian study recently demonstrated that non-occupational

sedentary time has increased from 1997 to 2006 and 90% of leisure time is taken up with sedentary activity[121]. Related to this, sitting time has been highlighted as increasing the risk for many obesity related comorbidities[118, 122-124]. Prolonged sitting time has been shown to increase the risk of all-cause[122] and CVD related mortality[125], and is associated with diabetes and overall chronic disease status [124] independent of physical activity levels.

3.3.3 Genetics

Although both of these factors pertain to this core issue of chronic energy imbalance, genetic and evolutionary perspectives provide a further viewpoint on the causes of the obesity epidemic. While not within the scope of the present research, it is important to acknowledge the key role genes play in individual responses to the environment. It is estimated that up to 70% of differences in fat development within the same environment can be attributed to genetic variance[126, 127]. This should not be taken as an absolute but rather an acknowledgment some individuals will be in receipt of inherited genes that despite their best efforts, will result in the development of metabolic disease[127]. O'Rahilly speculates that eventually obesity will be considered as a neuro-behavioural disorder, as much of the identified genetic variance affects the regulation of food intake (satiation and appetite) and energy expenditure[128].

3.3.4 An evolutionary perspective

Pertinent observations have recently been made regarding the fact obesity is not a new condition and it is likely the most common comorbidities also existed in the

Neolithic era, as overeating was once a necessary defense against times of famine[129]. This is linked to the original evolutionary theory regarding the development of obesity. The thrifty gene hypothesis was proposed by Neel in the early 1960s and posited a genetically determined excessive insulin response to food ingestion promoted fat storage to provide for times of food scarcity[130]. Essentially, this theory proposes the earliest humans were predisposed to fat storage and overconsumption as a survival tool and this tendency to fat storage now confers significant risk of developing obesity. However, this theory does not explain how a significant proportion of individuals maintain normal weight[131]. Speakman suggests there would not have been sufficient levels of famine related mortality to encourage propagation of the thrifty gene and obesity would have been selected out due to natural predators[131]. Instead, he proposed that following the development of strategies to ward off predators, a genetic predisposition to obesity developed in the absence of selection and this mutation has spread as a result of random drift[131]. The random drift hypothesis explains why so many people maintain normal weight in the same environment where many do not.

3.3.5 Additional explanations

Other possible explanations for the rapid increase in obesity prevalence include exposure to synthetic chemicals with endocrine disrupting abilities often found in chemically contaminated food or food packaging, which have been linked to weight gain[132]. Decrease in sleep time and the increase in sleep disorders[133] have also been shown to increase the risk of hypertension, diabetes, stroke and obesity[134, 135].

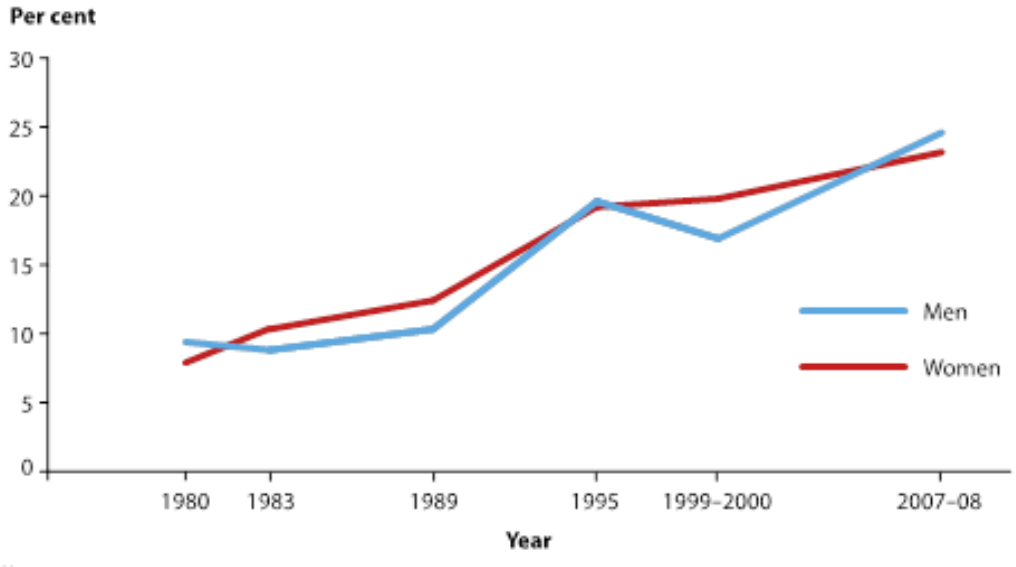
Technological advances in heating technology and clothing have also reduced the time humans spend in temperatures that require energy expenditure to maintain a stable internal body temperature[136, 137]. A significant amount of research has also been conducted into exposure to inadequate or inappropriate nutrition and other detrimental environmental exposures during critical early development periods and how this impacts on the development of early disease. Extensive evidence points to intra-uterine or early life exposures playing a central role in the risk of developing chronic disease through alteration in gene expression[138].

Within the community, obesity is often portrayed as individual (knowledge and behaviour) or environmental (external influences and resource availability), with responsibility in the first instance purely personal, whereas responsibility for the latter lies with the government, businesses and the wider community[139]. This research perceives obesity as being shaped by the factors previously discussed, that have altered the environment to one which requires minimum energy expenditure and high-fat, energy-dense foods are more available and affordable than the healthier alternative[139, 140]. In effect, human physiology and attitude to food has not changed in step with the environment. This has resulted in what has been termed the obesity pandemic[104].

3.4 Prevalence and costs

Compared to other OECD (Organisation for Economic Co-operation and Development) countries, Australia has one of the highest rates of obesity, with one in four Australian

adults obese in 2007/08[5]. Using measured data, 28.3% of the Australian adult population were obese in 2011-12 and 35.0% were overweight[6]. Similar figures are seen internationally. In the US 32.3% of adults over 20 years old were obese in 2004[40] and in England approximately 28% of adults were obese in 2007-2008[141]. Projections of obesity prevalence range from 33.9% for Australia in 2025[142] and for global adult obesity prevalence to reach 57.8% by 2030[143]. Furthermore, given that in 2007/08 40.0% to 47.0% of Generation X and Baby Boomer males and 26.5% to 34.7% of females were overweight, there is a considerable possibility that by 2025 obesity prevalence will be higher than currently projected[7]. Figure 3.1 illustrates the rise of obesity prevalence in Australia since 1980 and shows in recent times, men have overtaken women in terms of obesity prevalence[5].



Source: Australian Institute of Health and Welfare, Australia's Health 2012 [5]

Figure 3.1: Prevalence of obesity in Australia for 25 to 64 years olds, using measured height and weight, obesity defined as BMI≥30.

Access Economics released a report in 2008, asserting obesity cost Australia $8.3 billion in 2008 but if the net cost of wellbeing loss is added to this, it brings the total cost of obesity to $58.2 billion for 2008[144]. The latest intergenerational report from the Federal Treasurer predicts overall spending on health will increase from 4.0% of Gross Domestic Product (GDP) in 2010 to 7.1% of GDP in 2049[1]. By 2023, Type 2 diabetes, one of the most significant consequences of overweight and obesity[39], is predicted to become the leading cause of disease burden[7] and the cost of diabetes is projected to increase by 436% from $1.6 billion to $8.6 billion by 2033[1]. Increases are ordinarily expected over time but such a drastic rise poses a particular challenge to government as the number of working age people is projected to fall in line with the ageing population, from five in 2010, to less than three in 2050[1].

At the core of policy discourse surrounding the ageing generation is the idea it is not only demographic ageing that will influence labour force participation but also health[1, 145]. According to the 2008-2009 ABS Retirement survey, 29% of men and 19% of women reported the main reason they had ceased work was 'own sickness, injury or disability'[146]. The average age at which these people retire from the workforce is 54 years[146], a considerable time before qualification for the age pension of 65 years[147]. Taking all of these factors into account, it is obvious the benefits to reducing the incidence and prevalence of overweight and obesity would not just lie in the economic realm of reducing future health spending. There is also potential to increase and maintain labour force participation into the future[145], which in turn would affect economic growth and reduce the impact of the ageing population[1].

It is clear there is potential to moderate the effect of the ageing population through health improvement, with a particular focus on obesity. However, evidence based interventions at a population level are uncommon[148] and how to tackle this worldwide epidemic[71, 149] at a public health level is a divisive topic[50].

Two obvious pathways present themselves as opportunities to tackle the increase in obesity. The first path involves treating the clinical symptoms and individual causes of obesity and the second involves reversing the environmental changes seen over the past centuries[139, 150, 151] or in the least, the way in which individuals react to it. The situation thus far has only been addressed with reactionary measures. However, both research and policy agree the economic and health cost of this, should it continue, may become unsustainable[1, 152, 153] and interventions need to be instituted at a broad environmental level to have population effect. In recognition of this, the Federal Government formed a Standing Committee on 'Health and Ageing: an inquiry into obesity' in 2008[154] as well as the National Preventative Health Taskforce focussing on obesity, tobacco and alcohol[152]. Submissions to the standing committee argued for interventions ranging from behaviour modification, public education, weight loss and surgical interventions to tackling the availability of open space, access to public transport and suburb design[155]. However, there was a lack of discussion of the role social inequalities play in the development and maintenance of obesity, nor consideration of the idea interventions may only be taken up by the more advantaged - as has largely been the case with smoking[156].

Other research has proposed interventions at varying levels of government, including a greater emphasis on health when it comes to land use management, zoning and building design standards, as well as increasing walking opportunities and cycling lanes and paths[157]. Bond and colleagues have also suggested applying a tax to 'junk' food for similar reasons taxes have been raised on tobacco products and alcohol[158]. A US study estimated a 10% increase in soft drink price could reduce consumption by 8-10% and conversely, a 10% reduction in fruit and vegetable pricing could increase consumption by 7% and 5.8% respectively[159]. However, there are no suggestions as yet the Australian Government is receptive to this idea.

The prevalence of obesity has increased to an unsustainable level and the consequences for multiple aspects of the economy, society and individuals are vast. The central role of environmental changes in this epidemic raises the possibility younger birth cohorts, who have spent more time in this 'obeseogenic' environment, may reach a greater prevalence of obesity as they age than is currently being seen. Policy that addresses aspects of the environment encouraging reduced physical activity and increased food intake (i.e. bike paths, tax on sugar) coupled with programs to motivate attitude and behavioral change are imperative.

Chapter 4 WORK AND THE WORKPLACE

4.0 Work and the Workplace

4.1 An environment for intervention

A question of significant interest in this research is what environments exist that can be affected to alter the current pathway from environment, to obesity, to chronic disease. Consideration of the workplace as an intervention medium to reach the majority of the adult Australian population is reasonable, when it is evident that for many people, this is where they spend upwards of 50% of their time[101, 160].

In recent years there has been a respectable amount of funding invested in exploring the work environment as a pathway to health, be it good or poor health. A workshop into "preventing chronic disease in the workplace" convened by the National Institute of Health and the Centres for Disease Control and Prevention in the US[161] suggested several aspects of the workplace that may adversely affect health for the individual and potentially for the family. These included culture, policies, practices, hazardous exposures, psychological demands, job control, work schedule control, rewards, organisational justice, norms, social support and union status[161]. As of 2011, the Federal government announced $21.2 million in funding for South Australia under the new Healthy Workers Initiative to undertake workplace programs that encourage a healthier lifestyle with a view to prevent chronic disease and obesity[162]. This highlights that environment is comprised of more than just home and the workplace is a significant area that needs to be considered for research and interventions. There is a stark need to create an environment that encourages healthy eating and exercise

behaviours in a way that will eventually be accepted and supported by the community to see sustainable change in behaviour, attitudes, and level of overweight and obesity at the population level[139, 151]. The sticking point to all of this is the questions remaining about how best to change unhealthy decision making and attitudes in a way that is acceptable to the public and what it is exactly that should be targeted in policy.

Individual workplace interventions targeting diet or physical activity have been shown to have limited effectiveness after a systematic review by Le Maes and colleagues[163]. However, a recent workplace based intervention targeted at weight loss in male shift workers by Morgan et al. achieved clinically significant weight loss in the intervention group[160], which is of potential importance given shift work has emerged as one of the most significant factors that can negatively influence health when compared to normal daytime workers[160, 164]. Moreover, a meta-analysis conducted by Hutchinson and Wilson including 29 studies that conducted a workplace intervention with health as a main outcome measure, found most support for workplace interventions that used 'motivation enhancement' as the method for change, and that interventions that focussed only on a single behaviour (i.e. diet) had larger effect sizes than those that focussed on multiple behaviours or outcomes. However, lack of follow up meant change sustainability was not measured[165]. If we step out of the traditional view of individual behaviour and look to other contributing factors that may be creating an unhealthy workplace, it is apparent there are numerous pathways that may lead from the work environment to poor health outcomes. These include job control, sedentary time, subordination stress, peer or supervisory support or built environment and it is

extremely valuable to explore these additional avenues through which obesity and the development of chronic disease can be tackled.

4.2 Work related stress

In addition to intervention programs there has also been significant research linking psychosocial stress in the workplace to obesity and comorbid chronic conditions. This is in part due to the association between obesity and metabolic syndrome, CVD, Type 2 diabetes and the link between psychosocial stress and these same conditions[52, 166-169].

Perhaps one of the most prominent utilised theories of stress in the workplace is the Karasek demand-control model[170]. The theory hypothesises an individual working in a job which has high psychological demands and low control over those demands will experience job strain, which in turn leads to increased risk of ill-health [168, 171, 172]. A series of studies from the Whitehall II British civil servants cohort examined the link between the Karasek control-demand model across a number of different contexts. With three phases of data collection from 1985 to 1993 and 7,327 respondents participating in all three stages[173], these studies provide one of the most comprehensive assessments of the effect job control can have on health. Marmot and colleagues found support for the hypothesis that psychosocial work stress, in particular work control, is an important factor in the creation of the social inequalities seen in Coronary Heart Disease (CHD) incidence. They found having low control in the workplace contributed to the unequal distribution of CHD in both men and women[173].

Similarly, Kuper and Marmot investigated the full job strain model of demand and control and reported that job strain (high demands, low control), low decision latitude and high job demands were all associated with an increase in risk for CHD in the Whitehall II cohort[174]. A further investigation was undertaken into work stress and the metabolic syndrome, where chronic work stress was defined as three of more exposures to job strain over the period of the study. A dose-response relationship between work stress and metabolic syndrome was found for both males and females, although the number of females was very small. There was also a relationship between metabolic syndrome and unhealthy behaviours and both were more common in the lower employment grades raising more questions about health inequalities perpetuated through occupation class[166].

More recent examination of the Whitehall cohort with the aim of exploring the role of chronic stress in obesity by Brunner, Chandola and Marmot found that job strain over 19 years had a dose-response relationship with obesity defined by BMI (≥30 kg/m2) or waist circumference (>102cm in men >88cm in women) and this relationship persisted after controlling for alcohol, smoking, diet and physical activity[169]. Lallukka and colleagues hypothesised that workers attempt to compensate for high job strain and working overtime, with adverse health behaviours and analysed data from the London Whitehall II cohort and similar cohorts in Japan and Helsinki. In contrast to the previous findings that supported the link between working conditions and health, a relationship between obesity and working overtime was seen only in women in the London cohort while men in London with passive jobs (low control, low demand) were

more likely to have low physical activity. Job strain had a relationship with low physical activity in London men and Helsinki women. However, there was no strong evidence supporting the hypothesis the relationship between job strain and health might be mediated by obesity or health behaviours. Heraclides and colleagues reported that psychosocial work stress proved to be an independent predictor of type II diabetes in women after a 15 year follow up, irrespective of unhealthy behaviours, weight change and the resultant alteration of blood pressure, blood lipids and inflammation[168]. Findings from the Finnish Public Sector Study also provide support that job strain increases the likelihood of risky health behaviours[175] and that low job control and high strain are associated with a higher BMI[176] although the cohort was primarily women over 40.

Turning to Australian literature, a cross-sectional study among 1101 workers in Victoria concluded high psychological demand in men was associated with a higher BMI and after controlling for job stress measures in men, longer working hours were also associated with a higher BMI[171]. Psychosocial or other working conditions were not associated with BMI in women[171]. LaMontagne and colleagues using the same data from the Victorian Job Stress Survey, focussed on population attributable risk for depression and variation in job strain exposure[177]. They reported women were significantly more likely to experience job strain than men, and that job strain prevalence increased approximately 20% with each 'unit' of lowered skill level and conclude that job strain is a significant factor contributing to mental health inequality[177]. Using data from a cross sectional study of 40-44 year olds in Canberra

and Queenbeyan, D'Souza and colleagues examined the associations between job status, job strain, job insecurity and mental health[178]. Job strain was seen in around 23% of both low and high status worker while mid-status workers had the lowest proportion of workers experiencing job strain. Both job strain and job insecurity were significantly associated with mental health, irrespective of job status and high job strain was associated with depression and anxiety[178]. This is in contrast to the previously described studies, as high status workers were just as likely as low status workers to have poorer health outcomes, in part due to job strain.

The mass of evidence suggests conflicting support for the relationship between job strain, psychological work demands, job control, obesity and overall health. There is general theoretical agreement that stress at work caused by any of these factors may adversely affect health behaviours, thereby increasing the risk of chronic disease and further, it is plausible that increased levels of cortisol and adrenaline caused by chronic stress may impact on the development of obesity[166, 168, 169]. However, there is a lack of attention in data analysis that stress may cause weight gain or, weight loss[179], perhaps weight *change* should be considered as an unhealthy reaction to psychosocial stress at work.

The Australian studies highlight the important role mental health may be playing in mediating the relationship between work stress and overall health[177, 178], while the balance of evidence suggests that across a significant period of time, psychosocial work stress can have a significant impact on overall health. However, there is little

consideration in this work of generational differences in workplace experience and differences in work related influences on health. The majority of studies adjust for age, without acknowledging the likely heterogeneity in how different birth cohorts may be affected by factors such as work related stress.

4.3 Absenteeism and Presenteeism

Whilst much has been made of the potential decline in labour force participation in an absolute sense, there has been little political discourse in regards to absenteeism or presenteeism as significant factors that reduce work performance and labour force productivity, increasing the economic burden of chronic disease[172]. It is clear from this previous research that a further consequence of job strain may well be increased absence from work or, indeed, unproductive presence at work due to the effect it has on overall health. Absenteeism can also be conceptualised as an indicator of an individual's overall health, although the growing knowledge around presenteeism may challenge this perception. As job strain has a relationship with risky health behaviours[175], obesity[169, 176] and other chronic conditions such as CHD and metabolic syndrome, not to mention mental health problems, it stands to reason it may affect rates of both absenteeism and presenteeism.

In a Danish study, Hansen and Andersen consider what factors might influence the 'decision to turn up ill at work' and divide them into work-related factors, personal factors and attitudes[180]. They conclude that overall the most important factor involved in turning up at work ill was 'time pressure' theorising high workload may play a role in

presenteeism[180]. Studies conducted in Australia have demonstrated high job strain and active jobs (high demand, high control), psychological distress, as well as longer commuting time, are significantly associated with longer absenteeism over three years[172, 181]. There was also a negative relationship between long working hours and sick leave[172]. If long working hours exist due to a high or excessive workload, this raises the possibility the 'time pressure' discussed previously[180], may be the reason the ill individual does not take a whole day off work, despite the fact their health may be greatly reducing productivity at work. It is a distinct possibility that excessive workloads resulting in long work hours may be reducing overall workplace output or efficiency. Evidence in regards to work sector demonstrates those in the administration or retail sector were more likely to take long sick leave[172] although government employees have been demonstrated to be more likely to take short term sick leave[182]. Job insecurity has also been raised as a workplace factor that may influence sick leave or presenteeism. D'Souza et al. show respondents reporting high job insecurity or high workloads were significantly more likely to have long-term absences compared to those with low job insecurity[182]. However, when depression and anxiety were included in the model, they reduced the association between work demands and long-term absenteeism to non-significance suggesting mental health may explain the association between work conditions and long-term absence[182]. Holden and colleagues explored the number of health conditions associated with absenteeism or presenteeism[183]. They reported a greater number of conditions were associated with absenteeism although psychological distress, drug and alcohol problems, fatigue, work related injury and obesity demonstrated stronger positive

relationships with presenteeism than those conditions associated with staying at home, and propose mental health has a greater impact on both sick leave and presenteeism[183].

The effect of the ageing of Australia's population on the health system, the economy and society can be mitigated through improvements in health. This research will seek to identify behaviours, attitudes and environments that should come to the attention of health practitioners, health promoters and policy makers alike in the quest to reduce obesity and increase working life and health. The focus on both the Baby Boomers and Generation X allows this research to identify any differences between the groups that should be noted in terms of current and future interventions and preventative health strategies.

Chapter 5 STUDY DESIGN AND OBJECTIVES

5.0 Study Design and Objectives

Figure 5.1 presents the framework this research is based on. It encapsulates the proposal that work type or occupation, workplace and job specific characteristics such as work stress, may affect the likelihood of participation in risky health behaviours. This in turn has a relationship with the development of obesity and/or common comorbidities such as diabetes, depression, musculoskeletal conditions and cardiovascular disease, which affect overall health and may precipitate premature workforce exit and/or increased absences from work or a decrease in job performance.

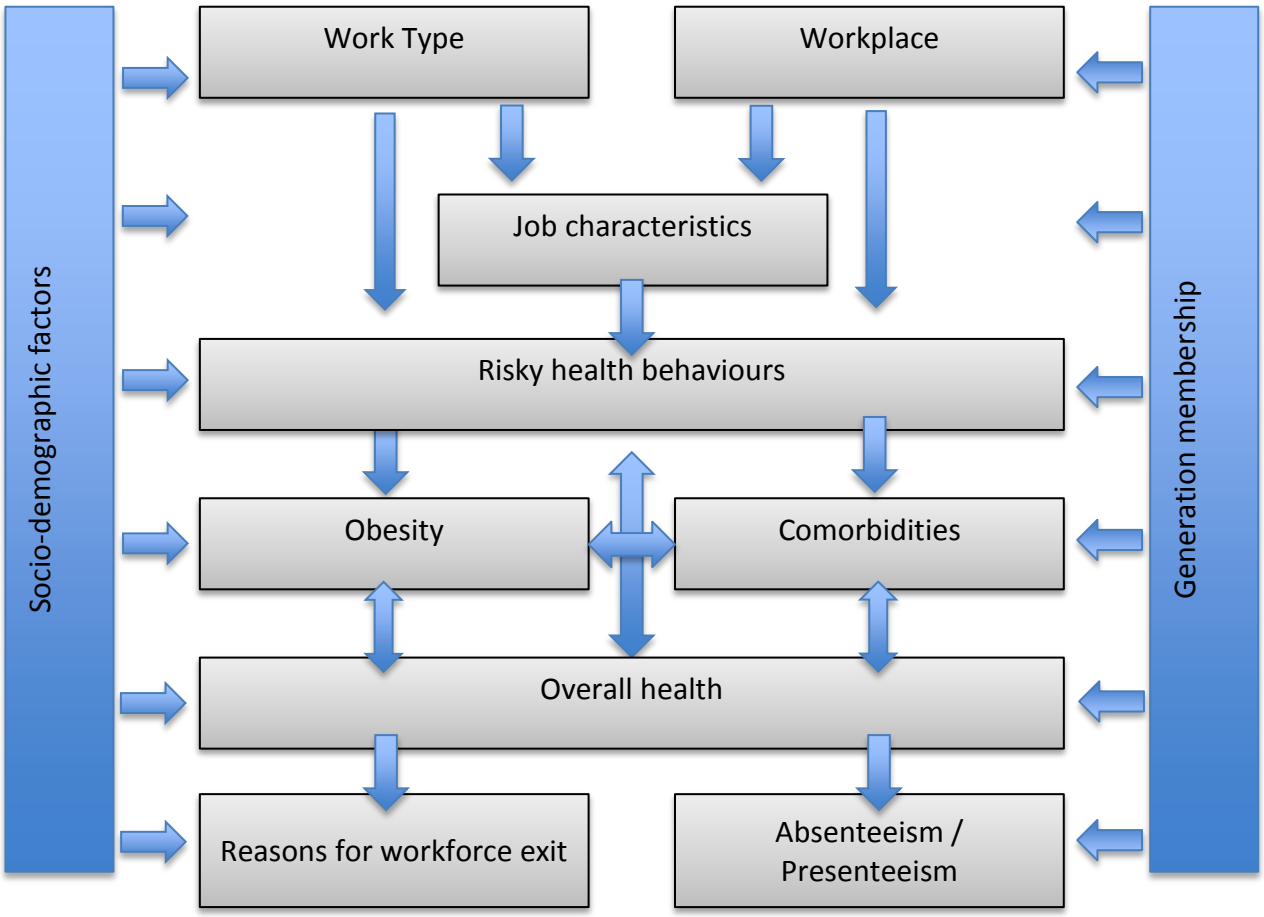


Figure 5.1: Framework exploring the inter-relationships between work and health related factors.

To investigate the generational differences in these relationships, multiple data sources have been utilised. The first study analyses the Australian National Health Survey (NHS), the second uses data from the Nutrition, Obesity Biomedical Lifestyle and Environment (NOBLE) II project and the third data from the North West Adelaide Health Study (NWAHS). The methodology of each study undertaken is explored within each study respectively so the following will describe additional information.

5.1 The National Health Survey

With the aim of obtaining nationally representative information on a range of health related indicators, the NHS has been conducted by the Australian Bureau of Statistics (ABS) seven times since the first survey in 1977/78.

The analysis undertaken for this study includes a comparison of the 1989/90 NHS with the 2007/08 NHS in order to compare Baby Boomers and Generation X when both generations were of the same age of 24 to 45 years.

The 1989/90 NHS was conducted under the *Census and Statistics Act 1905,* although willing participation of all respondents was sought. A multi-stage area sampling strategy was used to ensure equal probability of selection, although hospitals, nursing homes, boarding schools and military facilities were excluded from selection for the survey. To encourage respondent cooperation, public awareness media campaigns were undertaken prior to the survey commencing. A letter was initially sent to selected dwellings to inform them of their selection. Face to face interviews were

conducted to collect information on long-term medical conditions, medications, risky lifestyle behaviours as well as a specific set of questions assessing women's health and a range of socio-demographic information. A response rate of 96% was attained[184].

Data are weighted according to age, sex and area 'benchmarks' to ensure the population distribution in the sample matched that of the distribution within the respective areas. Expansion factors are also applied to the data to enable prevalence estimates for the total Australian population.

In 2007/08 15,792 houses were selected to participate, although this did not include very remote areas of Australia. (Non-private dwellings including hotel, boarding schools, hospitals, nursing homes and prisons were also not included in the survey.) A stratified multi-stage area sampling technique was employed to ensure all sections of the population considered with the scope of the survey were represented in the sample.

A letter was initially sent to selected households to inform them of their selection in the survey. Trained interviewers were used to collect information about one adult (18+) and one child in each household and parents or a guardian were asked to answer questions about children aged less than 15 years old. Five 'call-backs' were made to a dwelling before it was classified as 'non-contact'. All interviews were conducted face-to-face. Across Australia, 20,788 people participated and answered questions relating

to their (or their child's) health status and health-related behaviours. After sample loss a response rate of 90.6% was achieved.

Data are weighted to account for probability of selection and calibrated to "independent estimates of the population of interest" to ensure the sample estimates conform to population distribution.

The data are accessed from the ABS under its Universities Australia Agreement and is confidentialised. It is not possible to access all collected data at the desired level of detail due to concerns about potential re-identification of survey respondents. Of the data available from the 1989/90 and 2007/08 surveys we were able to match education attainment, employment, smoking status, BMI, physical activity levels, self-rated health and diabetes. All data were self-report. Further details on these variables can be found in Chapter 6 pp66-68.

5.2 The Nutrition Obesity Biomedical Lifestyle and Environment Project

Baby Boomers and Generation X members from two existing cohort studies were asked to partake in a telephone survey of work related issues as a part of the NOBLE II project in October 2011. For the purpose of this study, a Baby Boomer was defined as those born between 1 January 1946 and 31 December 1965 and Generation X was defined as those born between 1 January 1966 and 31 December 1980.

Participants were sourced from the NWAHS[185] and the Florey Adelaide Male Ageing Study (FAMAS)[186], both of which are population based biomedical studies of people living in the north-west suburbs of Adelaide, South Australia at the time of selection. An initial sample of 2350 Baby Boomers and Generation Xers was identified from the two cohort studies. Respondents were considered ineligible for the study if they had not worked in the past three years, as the majority of questions regarded work related factors.

A letter and an information sheet were sent to all selected participants introducing this study and informing them that they would receive a phone call within the time frame specified. The CATI (Computer Assisted Telephone Interview) system was used to conduct the interviews. This system allows immediate entry of data from the interviewer's questionnaire screen to the computer database.

A range of information was collected including respondents employment status, health related work influences such as job strain, work-life balance, supervisor and colleague support, occupation related physical activity, workplace policies, social networks and general health related questions as well as demographics not previously collected from the cohort studies or that needed to be updated.

A total of 1642 interviews were completed, resulting in an overall response rate of 87.5%. A breakdown of response rates by study can be found in Table 5.1.

Table 5.1: Breakdown of response rates by study for the NOBLE II project

	NWAHS		FAMAS		OVERALL	
	n	**%**	**n**	**%**	**n**	**%**
Initial eligible sample	1715		635		2350	
Not eligible to continue (not worked in last 3 years)	302	17.6	100	15.7	402	17.1
Unable to contact (modem, disconnected phone, respond not in area)	47	2.7	24	3.8	71	3.0
Eligible sample	**1366**	**79.7**	**511**	**80.5**	**1877**	**79.8**
Refusals	68	5.0	20	3.9	88	4.7
Non-contact after 15 attempts	91	6.7	18	3.5	109	5.8
Respondent unable to speak English	-	-	1	0.2	1	0.1
Incapacitated/ unable to be interviewed (ie too ill, hearing impaired)	1	0.1	3	0.6	4	0.2
Terminated interview	1	0.1	-	-	1	0.1
Respondent unavailable	20	1.5	11	2.2	31	1.7
Complete interviews	**1185**	**86.7**	**458**	**89.6**	**1642**	**87.5**

A flow chart depicting the cohort surveyed as a part of this study can be viewed on page 106 as a part of Section II, Chapter 7.

Data are weighted to the respondent's original probability of selection in the household and to age group and sex, as per the ABS 2009 Estimated Residential Population. Weighting was used to correct for the disproportionality of the sample with respect to the population of interest. The weights reflect unequal sample inclusion probabilities and compensate for differential non-response. The data were weighted using the ABS data so the health estimates calculated would be representative of the adult populations of the North West area of Adelaide.

Ethics approval for the survey of the existing NWAHS cohort was obtained from the Queen Elizabeth Hospital Human Research Ethics Committee (HREC) and ethics approval for the survey of the FAMAS cohort was granted by the Royal Adelaide Hospital HREC.

5.3 The North West Adelaide Health Study (NWAHS)

The NWAHS Study commenced in 1999 and is a representative longitudinal study of 4060 randomly selected adults aged 18 years and over at the time of recruitment from the north-west region of Adelaide, South Australia. At recruitment, 1,689 Baby Boomers and 818 respondents from Generation-X were part of the study.

Households in the north and western regions of Adelaide were eligible for selection if they had a telephone number listed in the Electronic White Pages. Businesses, institutions and residential care facility phone numbers were removed from the sample. Additional exclusions included those who could not communicate sufficiently with the telephone interviewer to answer initial recruitment questions, despite efforts to obtain family members who could translate[185].

Major stages of the study have been held approximately every four years and incorporated a telephone interview, self-completed questionnaire and biomedical examination at a clinic. As of 2011, there have been three stages of data collection. Of the initial sample of 10,096 selected in 1999, 18.6% were ineligible due to disconnected phone number, non-residential phone number, fax or modem

connections. From the eligible sample (n=8213), 215 (2.6%) people could not be contacted and 2148 (26.2%) refused to be interviewed. Of those interviewed (n=5850), 4056 attended the clinic for a biomedical examination resulting in a response rate of 69.3% for the clinic and 3622 respondents participated in the telephone follow up resulting in a 89.3% response rate for the interview. Stage 2 of the study was conducted from 2004 to 2006 and of the eligible sample, 79.0% of participants attended the clinic, 86.3% completed the CATI and 80.3% completed the self-report questionnaire. This resulted in an overall participation rate of 79.7%[185]. Stage 3 collected data from 2008 to 2010 using the same methods with 73.0% of eligible respondents responding to the CATI, 71.1% completing the self-report questionnaire and 67.0% attending the clinic[185].

Ethics approval for all stages of the NWAHS has been granted by the Queen Elizabeth Hospital HREC.

NWAHS data has been utilised in this research as part of a linked dataset with the NOBLE II data collection as well as for the third study (Page 107) as a stand-alone cohort.

5.4 The Florey Adelaide Male Ageing Study (FAMAS)

FAMAS commenced in 2002 as a longitudinal study assessing the "biomedical, socio-demographic, behavioural, physical and psychological interactions that contribute to the health and health-related behaviours of men"[186]. Overall, 1195 men aged 35 to 80

years were recruited from the north and west regions of Adelaide. All major stages of the study have included a self-completed questionnaire and a clinic examination. At the time of recruitment FAMAS contained 500 male Baby Boomers and 61 Generation Xers.

With a similar methodological design to the NWAHS, each phase of data collection has involved clinic assessment of a range of biomedical factors, with a CATI interview and annual self-completed questionnaires, as well as additional voluntary participation in various sub-studies undertaken with collaborators[187]. The study participants were recruited at random, based on Electronic White Pages listings with the prefix for the north or west suburbs of Adelaide. Selected households were sent an introductory letter accompanied by a brochure on the study. Following this a telephone call was made to the house and the last male aged between 35 to 80 years to have last had a birthday was invited to participate using CATI technology.

Major stages of the study have been undertaken in a phased fashion to accommodate funding availability. Of respondents who were eligible to participate, 71.7% agreed to be interviewed and 45.1% attended a clinic for Stage 1. Phase 1 (n=568) was undertaken from August 2002 until July 2003 and Phase 2 (n=627) from June 2004 to May 2005. Therefore stage 1 of data collection occurred from 2002-2005. Stage 2 was undertaken in a similar fashion from 2007 to 2010 and in total n=950 participants were interviewed or attended the clinic resulting in a follow-up participation rate of 76.6%[186, 187].

Ethics approval for all stages of the study was granted by the Royal Adelaide HREC. Further information on the study methodology and data collection is available elsewhere[186, 187].

FAMAS data has been utilised in this research as participants formed part of the NOBLE II cohort and data collected as a part of this study has been linked to the NOBLE II study. This is further explored in the methodology of Chapter 8.

5.5 Research Objectives

The aim of this research is to investigate the differences in health status and the influence of work and workplace on health in Baby Boomers and Generation X, as Australia's working generations. All analyses compare Baby Boomers and Generation X in order to untangle the relationship between generation membership, health status, health related behaviours and the influence of work.

The ensuing studies have been designed to answer the following questions;

1. *Are Baby Boomers healthier than Generation X, irrespective of age?*
2. *Does work and the workplace affect the health of the generations differently?*
3. *Does ill health have a relationship with workforce exit in Baby Boomers and Generation X and are there generational differences?*

SECTION II

RESEARCH RESULTS

Chapter 6 ARE BABY BOOMERS HEALTHIER THAN GENERATION X?

6.0 Statement of Authorship

Title of Paper: "Are Baby Boomers healthier than Generation X? A profile of Australia's working generations using National Health Survey data."

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Publication Details: Pilkington, R., Taylor, A., Hugo, G. & Wittert, G. 2014. Are Baby Boomers healthier than Generation X? A profile of Australia's working generations using National Health Survey data. PLOS One, 9(3): e93087. doi:10.1371/journal.pone.0093087.

Rhiannon Pilkington (Candidate)
Contribution: Conception and design, acquisition of data, data analysis, interpretation of results, drafting the article, critically revising and performing revisions.
I hereby certify that the statement of contribution is accurate and grant permission for the publication to be included in the candidate's thesis.

Signed **Date** 13/05/2014

Anne Taylor (Co-Author)
Contribution: Conception and design, interpretation of results and critical manuscript evaluation and editing.
I hereby certify that the statement of contribution is accurate and grant permission for the publication to be included in the candidate's thesis.

Signed **Date** 13/05/2014

Graeme Hugo (Co-Author)

Contribution: Conception and design, interpretation of results and critical manuscript evaluation and editing.

I hereby certify that the statement of contribution is accurate and grant permission for the publication to be included in the candidate's thesis.

Signed **Date** 13/05/2014

Gary Wittert (Co-Author)

Contribution: Conception and design, interpretation of results, critical manuscript evaluation and editing.

I hereby certify that the statement of contribution is accurate and grant permission for the publication to be included in the candidate's thesis.

Signed **Date** 13/05/2014

6.1 Chapter 6 Contextual Statement

In considering the concept that generational differences are shaped by distinctive formative experiences and that this may affect health related behaviours and the health status of the generations, it is essential to first consider the question; are there differences in the health of Australia's Baby Boomers and Generation Xers that are not attributable to age?

Although the majority of this research is undertaken on South Australian data, a national view of this question is warranted, given the potential implications of generational health differences not caused by age. The aim of this study was to isolate socio-demographic and health related differences associated with factors other than age. It is possible that results of the same-age comparison may be attributable to cohort or period effects, although the isolation of the difference in age-related health is viewed as most important.

The following chapter presents the results of an exploration of socio-demographic and health related differences of Baby Boomers and Generation Xers. This manuscript has been published by PLOS One as of the 27th of March, 2014 and has been re-formatted to meet the requirements of this thesis.

Are Baby Boomers healthier than Generation X? A profile of Australia's working generations using National Health Survey data.

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6.2 Abstract

Objective: To determine differences in sociodemographic and health related characteristics of Australian Baby Boomers and Generation X at the same relative age.

Methods: The 1989/90 National Health Survey (NHS) for Boomers (1946-1965) and the 2007/08 NHS for Generation Xers (1966-1980) was used to compare the cohorts at the same age of 25-44 years. Generational differences for males and females in education, employment, smoking, physical activity, Body Mass Index (BMI), self-rated health and diabetes were determined using Z tests. Prevalence estimates and p-values are reported. Logistic regression models examining overweight/obesity (BMI≥25) and diabetes prevalence as the dependent variables, with generation as the independent variable were adjusted for sex, age, education, physical activity, smoking and BMI (diabetes model only). Adjusted odds ratios (OR) and 95% confidence intervals are reported.

Results: At the same age, tertiary educational attainment was higher among Generation X males (27.6% vs. 15.2% p<0.001) and females (30.0% vs. 10.6% p<0.001). Boomer females had a higher rate of unemployment (5.6% vs. 2.5% p<0.001). Boomer males and females had a higher prevalence of 'excellent' self-reported health (35.9% vs. 21.8% p<0.001; 36.3% vs. 25.1% p<0.001) and smoking (36.3% vs. 30.4% p<0.001; 28.3% vs. 22.3% p<0.001). Generation X males (18.3% vs. 9.4% p<0.001) and females (12.7% vs. 10.4% p=0.015) demonstrated a higher prevalence of obesity (BMI>30).

There were no differences in physical activity. Modelling indicated that Generation X were more likely than Boomers to be overweight/obese (OR:2.09, 1.77-2.46) and have diabetes (OR:1.79, 1.47-2.18).

Conclusion: Self-rated health has deteriorated while obesity and diabetes prevalence has increased. This may impact on workforce participation and health care utilization in the future.

6.3 Introduction

Change in population size and composition, lower workforce participation, demographic ageing, an increase in life expectancy and a rise in chronic conditions are some of the key challenges facing developed countries into the next decades[1, 5, 142, 188-190]. The rise in chronic conditions is predicted to impact on workforce participation and health expenditure thereby reducing the tax-base, threatening economic growth and reducing the quality of life of those affected[35]. Baby Boomers comprise 25.3% and Generation X 21.1% of Australia's population respectively[2]. Given the size of these generations, their continued health into older age is essential to ensure the stability of Australia's workforce and economy[1]. Baby Boomers, so named following the post-World War II (WWII) rise in fertility were born from 1946 to 1965 (inclusive)[15]. They were aged from 47 to 66 years in 2012 and beginning to enter the retirement phase of life. Those in Generation X were born from 1966 to 1980 (inclusive) and were aged 32 to 46 years in 2012.

For Baby Boomers, the increase in life expectancy since the 1980s has not been matched by improved quality of life, possibly because of the concomitant increase in obesity[35] and associated chronic disease[34, 53, 103, 104]. In general, Baby Boomers have higher rates of many conditions such as arthritis, osteoporosis, circulatory conditions, overweight, obesity and high blood pressure while Generation X have a higher prevalence of smoking and anxiety, similar levels of psychological distress and better self-rated health[7, 191]. In Australia, as elsewhere, obesity is increasing in younger

generations[192] and therefore they may age with a greater burden of chronic disease and poorer quality of life than the generation before them.

The present study examines the health status of Baby Boomers and Generation X at the same age, using 1989/90 and 2007/08 National Health Survey data in order to examine generational differences, irrespective of age.

6.4 Methods

The National Health Survey (NHS) is a population survey designed and conducted in 1989/90, 1995, 2001, 2004/05 and 2007/08 by the Australian Bureau of Statistics (ABS), with the aim of obtaining information on a range of health related indicators. For this study, a comparison of the 1989/90 and the 2007/08 NHS is undertaken.

The NHS was in the field from August 2007 until July 2008. To account for seasonal variation in responses, interviewing times were randomly allocated to four periods. A total of 19,979 households were selected to participate. Following sample loss 17,426 households formed the active sample with a response rate of 90.6% or 15,792 households responding to the survey[184]. A letter and an information brochure, informing the dwelling of the upcoming survey and outlining their right to confidentiality were mailed to all dwellings with complete postal addresses available. Trained interviewers used Computer Assisted Interview technology to collect information about one adult (18 years+) and one child selected randomly from the household[184]. Missing data was not an issue for this analysis.

The 1989/90 NHS was conducted by the ABS from October 1989 to September 1990. A total of 22,200 households were selected at random across Australia. A letter and information brochure was posted to households informing them of their selection for the survey and that an interviewer would be in contact. Trained ABS interviewers interviewed persons aged 18 or older or from 15 to 17 years old with the consent of a parent or guardian, in the selected households. A response rate of 96% was attained[193].

Variables

Education attainment, employment and smoking status, BMI, physical activity levels, self-rated health and diabetes were able to be matched from the 2007/08 to the 1989/90 NHS, allowing a comparison between the generations. All data are self-report. Education, BMI, smoking and self-rated health were subject to minor recoding to ensure matching categories. Physical activity levels have been calculated by the authors and diabetes was established using differently coded variables. The employment variables did not need to be altered to match.

Education attainment was assessed by asking respondents to provide their current study or highest non-school qualification, if respondents had not completed high school or any qualifications post-high school, they were included in the category 'no non-school qualification'[184]. Respondents were classified as employed if they had a job in the week prior to the survey, unemployed if they were actively seeking work and

not in the labour force if they met neither of those conditions[184]. Smoking status (tobacco) was categorised into current smokers, ex-smokers if they had smoked at least 100 cigarettes or other at least 20 times and non-smokers if they did not meet this minimum criteria[184].

Physical activity was assessed by asking respondents how much time they had spent walking or doing moderate or vigorous exercise, in the two weeks prior to the survey. The 2007/08 NHS specifically excludes "household chores, gardening or yard work" in their questions on moderate on vigorous activity as types of exercise that could be considered which the 1989/90 survey does not do. However, this was not viewed as a significant barrier to matching the information although it is a potential limitation on comparison. Physical activity levels were defined using the 2008 ABS guidelines[184] and were calculated using the following formula: number of times activity undertaken (in last two weeks) x average time per session (minutes) x intensity. Intensity was defined as 3.5 for walking, 5.0 for moderate exercise and 7.5 for vigorous exercise. Respondents were grouped into four levels according to their score to correspond to sedentary (<100), low (100 to <1600), moderate (1600 to 3200 or >3200 but <2 hours of vigorous activity) and high (>3200 and >2 hours of vigorous activity) levels of physical activity[184].

Self-rated health status was determined by asking respondents if their health is excellent, very good, good, fair or poor[184]. Height and weight were self-report at the time of interview and BMI was defined using Quetelet's body mass index calculated as

weight in kg divided by height (m^2)[75]. Diabetes status was determined by asking respondents if they had ever been told by a doctor or a nurse that they have diabetes or high sugar levels in their blood or urine[184]. The variable available for the 2007/08 NHS is "Age first told had diabetes or high sugar levels" whilst the variable available from the 1989/90 NHS is "Whether suffers from diabetes or hyperglycaemia". All respondents who reported an age or indicated they suffered from diabetes or hyperglycemia were classified as having diabetes.

Analysis

The NHS uses a stratified, multi-staged, area sampling frame of private dwellings and in order to produce unbiased estimates, this sampling technique needs to be taken into account[194]. The sampling unit and stratification information is not included in the datasets released by the ABS, rather a class of techniques called 'replication methods' are used to estimate variances for the complex sample design and weighting procedure[184, 195]. The replicate weights are a series of variables that are calculated to account for the design features and their values are based on the sampling and stratification information[196].

Analysis of the NHS data was undertaken using the 2007/08 and 1989/90 Confidentialised Unit Record File[184, 193]. The 2007/08 file contains replicate weights; however the 1989/90 NHS is not released with the replicate weights. In order to ensure these files were comparable the Jackknife (JK-1) method was used to calculate replicate weights for the 1989/90 NHS using STATA IC 11[196]. JK-1 was the method

chosen as this is the method the ABS used for the 2007/08 calculation of replicate weights[184]. The ABS also supplies a person weight, which is adjusted to enable estimation of results for the total Australian population. For example, 20,788 persons were interviewed for the 2007/08 NHS although the data provides weighted population estimates with a total count of 20,643,100.

Applying both the person and replicate weights to the data, cross-tabulations were undertaken to estimate standard errors and proportions. The Z test was used in Microsoft Excel to produce p values adjusted for multiple comparisons using the Sidak method, to compare the variables between the generations for males and females (Table 6.1).

In 1989/90 Baby Boomers (1989/90 NHS n=5.3million) were aged 24/25 to 43/44 and in 2007/08 Generation Xers (2007/08 NHS n=5.9million) were 27/28 to 41/42 years of age. However, due to age only being available in pre-defined groupings, the generations are compared when they were both aged 25 to 44 years.

Logistic regression models were then conducted to adjust for sex, age (5 year groupings), education, smoking status, physical activity and BMI (diabetes model only) when examining the relationship between generation membership, diabetes and overweight/obesity in separate models, from 1989/90 and 2007/08. Table 6.2 presents results examining overweight/obesity using BMI as the dependant variable

and Table 6.3 presents results examining diabetes as the dependent variable, with generation as the independent variable for both analyses.

6.5 Results

Comparisons between generations of the same relative age using the 1989/90 and 2007/08 National Health Surveys

Education, employment, smoking, BMI, physical activity, self-rated health and diabetes prevalence were examined, by sex, when the generations are at the same relative age of 25-44 years (Table 6.1), using 1989/90 NHS data for Baby Boomers and 2007/08 NHS data for Generation X.

Males

Significantly higher proportions of Generation X males reported attaining a Bachelor degree or higher (27.6% vs 15.2% p<0.001), were classified as obese (18.3% vs 9.4% p<0.001), had a low level of physical activity (36.6% vs 31.6% p=0.002) and reported having diabetes (2.8% vs 1.0% p=0.001) as compared to Boomer males. As compared to Generation X males, a greater proportion of Baby Boomer males reported being employed (92.0% vs 89.7% p=0.024), a current smoker (36.3% vs 30.4% p<0.001) and having 'excellent' self-rated health (35.9% vs 21.8% p<0.001).

Females

Generation X females were significantly more likely to have achieved an education level of a Bachelor degree or higher (30.0% vs 10.6% p<0.001), report being employed

(75.2% vs 65.7% p<0.001), be classified as overweight (21.8% vs 17.6% p<0.001) or obese (12.7% vs 10.4% p=0.015) and report having diabetes (7.6% vs 2.9% p<0.001) compared to Boomer females. A higher proportion of Baby Boomer females reported not being in the labour force (28.7% vs 22.3% p<0.001), being a current smoker (28.3% vs 22.3% p<0.001) and having 'excellent' self-rated health (36.3% vs 25.1% p<0.001) compared to Generation X females. No differences were demonstrated in physical activity levels.

Multivariable analysis

Presented in Table 6.2, adjusted for sex, education, age, smoking status and physical activity level, Generation Xers had greater odds of being overweight or obese (OR: 2.09, CI95% 1.77-2.46) and presented in Table 6.3, adjusted for sex, education, age, smoking status, physical activity level and BMI, Generation X had greater odds of diabetes (OR: 1.79, CI95% 1.47-2.18) compared to Baby Boomers, when both generations were aged 25 to 44 years.

When the models were stratified by sex (not shown) the generational difference in diabetes persisted for both males and females in the unadjusted but not in the adjusted analysis. When age and education were included in the model, Generation X females no longer demonstrated greater odds of diabetes (OR: 2.25, CI95% 0.87-5.82) although the difference between Generation X and Boomers males remained significant (OR:1.74, CI95% 1.11-2.74). The generational difference in overweight and

obesity remained significant for males and females in unadjusted and adjusted stratified analysis.

6.6 Discussion

Compared at the same relative age of 25 to 44 years Generation X had a higher prevalence of obesity and diabetes compared to Boomers. This was independent of sex, age within that distribution, education, smoking status, physical activity and BMI (diabetes model only). Boomers also demonstrated better self-rated health at the same relative age, although this was unadjusted for demographic factors. This suggests that Generation X may be developing the lifestyle related conditions of obesity and diabetes sooner when compared to Baby Boomers.

When the sexes were examined separately, the prevalence of obesity was higher in males as compared to females although the prevalence of diabetes was lower. The difference in obesity prevalence is supported by figures from the Australian Institute of Health and Welfare which demonstrates that males in Australia have a higher prevalence of overweight and obesity compared to females[5]. Despite this, diabetes prevalence was lower in men compared to women, although Australian prevalence data from the ABS illustrates that diabetes prevalence is greater in men[197]. Population studies from England and the USA have demonstrated that prevalence of undiagnosed diabetes is higher in men than in women[198, 199] and a higher prevalence of undiagnosed diabetes among men in this sample may help explain this result although this cannot be confirmed.

When the regression model examining diabetes was stratified by sex and adjusted for age and education, Generation X females no longer had significantly greater odds of diabetes compared to Boomers of the same age. However, despite the non-significance of the result, the odds ratio increased and the confidence intervals widened, suggesting the reduction in sample size and the design effects from the complex sampling strategy the ABS employs, may have been responsible for altering this result for females.

This study adds to the growing evidence suggesting that successive cohorts are developing obesity and related chronic conditions earlier in the life course[38, 43, 51, 200, 201]. At the same relative age Baby Boomers in the USA[200] and the United Kingdom[32] have been shown to have a greater prevalence of obesity than the older generation (born 1926-1945), associated with more disability and chronic conditions, including diabetes and hypertension. Lee et al. conducted an age, period and birth cohort analysis of individuals in the USA from 1971-2006 and demonstrated that in younger cohorts, obesity is occurring earlier in the life course accompanied by the premature development of conditions such as type II diabetes and arthritis, usually considered to be diseases of ageing[43]. Furthermore, an Australian study examining age, period and cohort contributions to the prevalence of overweight and obesity concluded that more recently born cohorts are at greater risk of overweight[51].

That the younger generation were more likely to report worse self-rated health at the same age as Baby Boomers, may be linked to the significant increase in obesity. Previous studies have demonstrated that obesity, sedentary behaviour and stress are all related to poor self-rated health[67-69]. It could be theorised that this is due to comorbid conditions as opposed to weight, although research has demonstrated the association between obesity and self-rated health persists irrespective of chronic condition status[68, 69].

The physical activity and food environment has changed drastically over the past decades to one in which transport options encourage sedentary behaviour and food high in fat and sugar is often more readily available than a healthier alternative[114, 139, 140]. This may account for why the younger generation are developing an unhealthy weight at an earlier age. Alternative explanations for the cohort differences in obesity include the idea that psychosocial and socioeconomic stressors in early life may play a role in obesity development. The Boomer experience of post WWII prosperity may mean they experienced less psychosocial and socioeconomic stress compared to other generations[201, 202]. Keith et al. also explore the prospect that an increase in sleep debt, endocrine disruptors and maternal age at birthing are plausible contributors to the obesity epidemic[136].

Together, these generations form 76.7% of Australia's labour force[29] and there is potential for obesity related health-problems to propel an early workforce exit[49]. Should successive cohorts continue to develop what were once considered age related

conditions earlier, the consequences for healthcare costs will only increase further, at a younger age[203, 204].

Limitations

Due to the restrictions in the data granted from the ABS, we were not able to match the generational cohorts by exact birth years for the NHS analysis. Therefore, the ages the cohorts were compared at do not perfectly reflect the true birth years. Although the effect of this on observed generational differences is difficult to estimate, the balance of the age group is made up of the generations in question. We believe that this enables us to make inferences about generational differences although it would have been ideal to examine exact birth cohorts. Additionally, income and alcohol consumption could not be examined for the same age analysis due to significant alterations in the manner the survey assessed the variable. Self-report data was used to calculate BMI and this may have resulted in an underestimation of overweight and obesity, as individuals are prone to underestimate their weight and overestimate their height[205]. All other variables were also derived from self-reported information and this has inherent limitations in terms of potential for social desirability bias and issues with inaccurate recall. Physical activity in particular may be vulnerable to inaccuracies created by individual perception of what constitutes moderate or vigorous exercise[184]. Furthermore, the difference in the physical activity question specification for the 1989/90 and 2007/08 surveys may have affected responses to the questions and therefore this comparison should be interpreted with caution. Despite this, the generational perspective provides important insights into the development of health

in the cohorts across the time span and matches a large range of variables across the NHS surveys.

6.7 Conclusion

Generation X are becoming obese and developing a higher prevalence of diabetes at an earlier age than their predecessors and this may be reflected in their self-reported health status. The current study adds to previous research[38, 43, 51, 201], demonstrating successive generations are developing chronic conditions earlier. If this is to continue there will be significant implications for workforce capacity, health care utilisation and therefore health costs. There is a clear need for continued investment in preventative strategies targeting lifestyle chronic conditions, particularly programs and policies to tackle the increase in unhealthy weight at a population level.

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Table 6.1: A health profile of Generation X (aged 25-44 years) and Baby Boomers (aged 25-44 years) at the same age using 2007/08 NHS data and 1989/90 NHS data from the Australian Bureau of Statistics

	Males					Females				
	Generation X in 2007/08 (n=2,949,678)		Baby Boomers in 1989/90 (n=2,702,515)			Generation X in 2007/08 (n=2,972,344)		Baby Boomers in 1989/90 (n=2,658,560)		
	%	S.E.	%	S.E.		%	S.E.	%	S.E.	
Education#										
Bachelor degree or higher	27.6	0.009	15.2	0.013	***	30.0	0.009	10.6	0.009	**
Certificate/diploma/trade cert.	37.9	0.010	44.2	0.010	***	30.5	0.010	35.3	0.010	***
Other/certificate not defined	1.4	0.002	0.8	0.001		1.7	0.002	1.4	0.001	
No non-school qualification	33.1	0.010	39.7	0.009	***	37.9	0.011	52.6	0.015	***
Employment										
Employed	89.7	0.007	92.0	0.005	*	75.2	0.011	65.7	0.010	***
Unemployed	3.0	0.004	4.1	0.003	*	2.5	0.003	5.6	0.003	***
Not in labour force	7.3	0.006	3.8	0.003	***	22.3	0.012	28.7	0.009	***
Smoking										
Current smoker	30.4	0.009	36.3	0.007	***	22.3	0.008	28.3	0.006	***
Ex-Smoker	26.0	0.010	23.1	0.005	*	25.2	0.009	18.9	0.005	***
Never smoked	43.5	0.010	40.6	0.007		52.5	0.009	52.8	0.008	
BMI#										
Underweight (<18.50)	1.2	0.003	2.0	0.002		2.7	0.003	7.1	0.003	***
Normal weight (18.50 to <25.00)	33.2	0.010	52.8	0.008	***	45.1	0.011	64.9	0.009	***
Overweight (25.00 to <30.00)	37.3	0.010	35.8	0.007		21.8	0.009	17.6	0.006	***
Obese (>30.00)	18.3	0.008	9.4	0.005	***	12.7	0.006	10.4	0.005	***
Physical activity#										
Sedentary	32.1	0.010	34.9	0.011		33.2	0.010	35.6	0.011	
Low	36.6	0.013	31.6	0.007	**	43.0	0.010	39.0	0.008	*
Moderate	21.4	0.011	22.6	0.006		19.1	0.009	20.8	0.007	
High	9.9	0.008	10.9	0.005		4.7	0.004	4.6	0.003	
Self-rated health (SF36)										
Excellent	21.8	0.010	35.9	0.009	***	25.1	0.010	36.3	0.011	***
Very good/good	68.8	0.012	52.4	0.007	***	65.8	0.011	51.0	0.009	***
Fair	7.6	0.007	10.2	0.004	**	7.1	0.007	10.8	0.004	***
Poor	1.8	0.003	1.5	0.002		2.0	0.003	1.9	0.002	
Diabetes										
Yes	2.8	0.003	1.0	0.001	**	7.6	0.005	2.9	0.002	***
No	97.2	0.003	99.0	0.001	**	92.4	0.005	97.1	0.002	***

#NA or 'level not determined' categories not included

*p<0.05 ** p<0.01 ***p<0.001

Table 6.2: Logistic regression analysis of the association between overweight and obesity (BMI≥25.00) and generation membership of Generation X (aged 25-44 years 2007/08 NHS data) and Baby Boomers (aged 25-44 years 1989/90 NHS data) using data from the Australian Bureau of Statistics

	Model 1			Model 2 (adj. age, sex, education)			Model 3 (adj. age, sex, education, smoking, physical activity)		
Generation	OR	(95% CI)	p value	OR	(95% CI)	p value	OR	(95% CI)	p value
Baby Boomers	1.00	(ref)		1.00	(ref)		1.00	(ref)	
Generation X	**1.89**	**(1.72-2.09)**	**<0.001**	**2.10**	**(1.82-2.44)**	**<0.001**	**2.09**	**(1.77-2.46)**	**<0.001**

Table 6.3: Logistic regression analysis of the association between diabetes and generation membership of Generation X (aged 25-44 years 2007/08 NHS data) and Baby Boomers (aged 25-44 years 1989/90 NHS data) using data from the Australian Bureau of Statistics

	Model 1			Model 2 (adj. age, sex, education)			Model 3 (adj. age, sex, education, smoking, physical activity & BMI)		
	OR	(95% CI)	p value	OR	(95% CI)	p value	OR	(95% CI)	p value
Generation									
Baby Boomers	1.00	(ref)		1.00	(ref)		1.00	(ref)	
Generation X	**1.92**	**(1.60-2.29)**	**<0.001**	**2.05**	**(1.13-3.71)**	**0.019**	**1.79**	**(1.47-2.18)**	**<0.001**

Chapter 7 JOB STRAIN, OCCUPATION, PSYCHOLOGICAL DISTRESS AND RISK OF HIGH WAIST CIRCUMFERENCE

7.0 Statement of Authorship

Title of Paper: "Job strain, occupation, psychological distress and risk of high waist circumference in Baby Boomers and Generation X."

Publication status: Submitted to the American Journal of Public Health 26/3/14

Author Contributions

Rhiannon Pilkington (Candidate)
Contribution: Conception and design, acquisition of data, data analysis, interpretation of results, drafting the article, critically revising and performing revisions.
I hereby certify that the statement of contribution is accurate and grant permission for the publication to be included in the candidate's thesis.

Signed **Date** 13/05/2014

Anne Taylor (Co-Author)
Contribution: Acquisition of data, interpretation of results and critical manuscript evaluation and editing.
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7.1 Chapter 7 Contextual Statement

Having established that there are generational differences in health irrespective of age, the question regarding work related influences on health needed to be addressed.

The decision was made to examine the relationships between work related stress, psychological distress, occupation and obesity as defined by Waist Circumference for Baby Boomers and Generation X. This was based on the fact work related stress is the second greatest cause of workers compensation in Australia[206] and occupation provides an overview of specific job characteristics that may impact negatively on weight.

We utilised data from the NOBLE study to examine generational differences in work related influences on obesity and highlight specific groups that should be targeted in health promotion and obesity prevention policies and programs.

The following chapter has been submitted for publication with the American Journal of Preventive Medicine although it has not been accepted as of the 7th of May, 2014.

Job strain, occupation, psychological distress and risk of high waist circumference in Baby Boomers and Generation X.

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Chapter 8 EMPLOYMENT TRANSITIONS AND CHRONIC CONDITIONS IN BABY BOOMERS AND GENERATION X

8.0 Statement of Authorship

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Author Contributions

Rhiannon Pilkington (Candidate)
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Signed **Date** 13/05/2014

8.1 Chapter 8 Contextual Statement

The previous findings that Generation X are developing a greater prevalence of obesity and diabetes earlier in the life-course than Baby Boomers, coupled with the differential affects that work stress has on the generations, has led to consideration of the policy relevant consequences of these differences, in terms of workforce participation.

Part of the overarching framework for this research illustrated the relationships between work, obesity and comorbidities and the work related outcomes of absenteeism and presenteeism. These outcomes were conceptualised as policy relevant economic and productivity consequences of ill-health for businesses and for government. Although there were insufficient data on work absences to explore the relationship between health and absenteeism directly, the possibility of investigating the relationship between employment transitions and health presented itself as an alternative avenue to investigate policy and productivity relevant costs associated with chronic conditions.

The following chapter therefore focuses on the exploration of the relationships between generation membership and employment transitions with obesity and commonly associated comorbidities including diabetes, depression and arthritis.

Employment transitions and chronic conditions in Baby Boomers and Generation X: A South Australian cohort study

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8.2 Abstract

Objective: To investigate differences in the relationship between change in work status over time, and obesity and common comorbidities in Baby Boomers and Generation X.

Methods: This study uses data from n=312 Generation Xers (born 1966-1980), n=508 late Baby Boomers (born 1956-1965) and n=611 early Baby Boomers (born 1946-1955) who participated in stage 2 and 3 of the North West Adelaide Health Study in 2004 to 2006 and 2008 to 2010. Logistic regression was used to explore the relationships between sex, generation, employment transitions, Type 2 diabetes mellitus (T2DM), depression, arthritis and obesity (BMI ≥ 30) with and without comorbidities in separate models. Adjustment was made for a range of socio-demographic variables and physical activity.

Results: No relationships between generation and the chronic conditions were demonstrated in adjusted analyses. Not working at time 1 and 2 was associated with higher odds of T2DM (3.43, 1.88-6.27), depression (3.13, 2.05-4.79), arthritis (2.94, 1.98-4.38) and obesity with comorbidities (1.86, 1.30-2.65). Increased odds of T2DM (2.74, 1.37-5.47) and depression (2.99, 1.82-4.92) were illustrated in those who moved out of the labour force. Maintaining part-time work (1.79, 1.12-2.86) and moving from full to part-time work (2.26, 1.25-4.10) showed higher odds of depression, while moving from being out of the labour force into full-time work (3.36, 1.49-7.56) showed higher odds of arthritis.

Conclusion: Exiting or remaining out of the labour force is associated with the presence of T2DM, depression, arthritis and obesity without selected comorbidities. As this may have substantial consequences for workforce participation direction of causality requires further exploration.

8.3 Introduction

In Australia, there is a focus on increasing national productivity and workforce participation to foster economic growth over the coming decades[1, 188]. In order to achieve this, both increased and sustained workforce participation is required and it has been proposed that female and older worker participation in the workforce needs to increase drastically[188] and transitioning into retirement must be encouraged to increase part-time workforce participation[247].

The extent to which the increasing prevalence of obesity and associated comorbidities are barriers to ongoing workforce participation is unknown. However, there is evidence that poor health in general is associated with workforce exit. An Australia wide survey conducted in 2012-2013 demonstrated that of Australians who retired before 65 years of age (over 75% of all Australians), 53.4% of males and 32.7% of females reported 'sickness, injury or disability' as the reason they terminated their last job[248]. A recent prospective study showed that poor health increases the likelihood of labour force exit before reaching retirement age[230]. Additionally, previous research has also shown that exiting the labour force is associated with poor mental health[249, 250] and poor self-reported health[231, 251].

This study examines only Baby Boomers (born 1946 to 1965) and Generation X (born 1966 to 1980) as they form 77% of Australia's labour force[29] and the prevalence of overweight and obesity for these generations is 75% and 66% respectively[7]. We investigate the relationship between change in work status from time 1 and time 2

and obesity and common comorbidities (T2DM, depression, arthritis). Analysis utilises a South Australian cohort study limited to Baby Boomers and Generation Xers in order to explore generational differences within Australia's working population.

8.4 Methods

Data Source

The North West Adelaide Health Study (NWAHS) is a longitudinal cohort of 4056 randomly selected adults aged 18 years and over, who, at the time of recruitment lived in the northern or western regions of Adelaide[185]. These areas include approximately half of Adelaide's population and reflect the demographic profile of South Australia[223]. Households were selected using the electronic white pages and the last person aged 18 or over to have had a birthday was interviewed and invited to attend a hospital based clinic for a biomedical examination[223]. Telephone interviews are undertaken by professional interviewers, accredited under the International Standard for Market Opinion and Social Research.

As of 2014, there have been three stages of data collection all involving a clinic assessment, telephone interview and a self-report questionnaire. From the eligible sample selected in 1999 (n=8213), 5850 were initially interviewed and 4056 attended the clinic for a biomedical examination resulting in a response rate of 69.4% for the clinic. Further, 3622 respondents participated in the telephone follow up resulting in a 91.7% response rate for the interview. Stage 2 of the study was conducted from 2004 to 2006. Of the eligible sample, 79.0% of participants attended the clinic, 86.3%

completed the CATI and 80.3% completed the self-report questionnaire. This resulted in an overall participation rate of 79.7%[185]. Stage 3 collected data from 2008 to 2010 using the same methods with 73.0% of eligible respondents responding to the CATI, 71.1% completing the self-report questionnaire and 67.0% attending the clinic. A total of 2871 participants were interviewed or attended the clinic. Every effort is made to ensure the participants are contacted in the same order as previous stages to maintain the four year follow up period[223].

Sample

The present analysis uses clinic and self-reported data from stage 2 and 3 of the cohort study including only Baby Boomers (born 1946-1965) and Generation Xers (born 1966-1980) who had data available for both stage 2 and stage 3 of the cohort study (n=1431). The older generation has been split into early (1946 to 1955) and late (1956 to 1965) Baby Boomers in recognition of within generational differences, given the size and age range of the cohort. Stage 2 is also referred to as Time 1 and Stage 3 as Time 2.

Ethics approval for each stage of data collection was obtained from the Queen Elizabeth Hospital Human Research Ethics Committee. Further details of the study can be found in previously published work[185, 223].

Variables

The prevalence of diabetes at stage 3 was defined as clinic-measured fasting plasma glucose level of at least 7.0mmol/L, or those who self-reported being told by a doctor they had diabetes.

Depression was defined as a score of 16 or higher on the Centre for Epidemiological Studies Depression Scale (CES-D)[252]. Respondents answered 20 questions in relation to symptoms associated with depression at stage 3 of the study.

The prevalence of arthritis at stage 3 was obtained from self-report response to a telephone interview. Respondents were asked if they had osteoarthritis, rheumatoid arthritis, another form of arthritis or if they did not know what type they had. A 'yes' to any of these questions was classified as 'arthritis'.

Obesity was defined using the Body Mass Index (BMI) score derived from height and weight measurements taken in the clinic at Stage 3[223]. A BMI of ≥30.00 (weight kg/(height m^2)) was classified as obese as per the World Health Organisation's recommendations[62].

Changes in work status were derived from self-reported work status at stage 2 and 3. Respondents were categorised into one of eight categories:

1) Stable full time work;
2) Stable part time work;
3) Stable not in the labour force;

4) Not in the labour force to part time;
5) Not in the labour force to full time;
6) From part to full time;
7) From full to part time; and
8) Employment to not in the labour force.

Not in the labour force (NILF) includes respondents who reported work status as home duties, retired, unemployed, student, unable to work or volunteer.

Weight gain was derived by using clinic-measured body weight in kilograms, to calculate percentage weight gain from stage 2 to 3. Percentage weight change was dichotomised into weight increase of ≥5% of body weight.

Physical activity levels of sedentary, low, moderate and high at Stage 2 were determined from a self-report questionnaire which asked about the amount and time spent walking, or undertaking moderate or vigorous activity within the last two weeks. Physical activity levels were defined using the formula "*e * t * i*" where *e* was number of times spent walking or undertaking moderate of vigorous activity, *t* was the average amount of time spent on each session and *i* was the weighted intensity score for type of exercise (3.5 for walking, 5.0 for moderate exercise and 7.5 for vigorous exercise). A sedentary level of activity equated to a score of less than 100, including a score of 0, low activity a score of 100 to less than 1600, moderate activity a score of 1600 to 3200 or more than 3200 but with less than two hours of vigorous exercise and a high level of activity was classified as a score of at least 3200 with two or more hours of vigorous

activity[223]. These questions were also used in the 2001 and 2004 Australian National Health Survey and coding followed the same methodology[253].

Sex was self-reported at Stage 1 of the study and marital status, education level and household income are included from self-report data at Stage 2. The Generation groups were categorised according to self-reported date of birth.

Statistical analysis

Binary logistic regression was conducted to analyse the relationships between sex, generation membership, employment transitions (stage 2 to 3) and weight gain (stage 2 to 3) with the prevalence of T2DM, depression, arthritis and obesity with and without comorbidities at stage 3, in respective models. IBM SPSS Version 19.0 was used for all analyses.

8.5 Results

Table 8.1 demonstrates the characteristics of the sample by generation and shows that overall the study population consisted of 53.5% females, 42.7% early Baby Boomers and 45.2% of all respondents remained in stable full time work over the four years between stages. Late Baby Boomers were most likely to have remained in stable full time work (41.4%) while early Baby Boomers were most likely to have stayed out of the labour force (70.3%) over the duration of the study compared to the other generational groups. The highest proportion of those with T2DM, depression, arthritis and obesity were early Baby Boomers (62.0%; 44.7%; 65.7%; 45.8%), while the highest

proportion of respondents with obesity and no comorbid diabetes, depression or arthritis were late Baby Boomers (41.9%).

Unadjusted and adjusted multivariable analysis of the relationships between sex, generation membership, employment transitions, weight gain and T2DM, depression and arthritis prevalence at stage 3, are displayed in Table 8.2 and 8.3. Table 8.4 presents associations with obesity and obesity excluding comorbid cases with T2DM, depression or arthritis.

Type 2 Diabetes Mellitus

Adjusted results illustrated females had a lower likelihood of having T2DM (OR 0.54 CI95% 0.34-0.85). Respondents who were stable NILF (OR 3.43 CI95% 1.88-6.27) or moved from being employed to NILF (OR 2.74 CI95% 1.37-5.47) were more likely to have T2DM. In the unadjusted model, both early (OR 3.79 CI95% 1.68-8.55) and late (OR 3.06 CI95% 1.32-7.09) Baby Boomers had a greater likelihood of having T2DM although this result attenuated once socio-demographics and year of birth were included in the model. There was no relationship between weight gain and T2DM.

Depression

Stable part-time work (OR 1.79 CI95% 1.12-2.86), stable NILF (OR 3.13 CI95% 2.05-4.79), moving from full to part-time work (OR2.26 CI 95% 1.25-4.10) or from employment to NILF (OR 2.99 CI95% 1.82-4.92) had greater odds of depressive

symptoms. Weight gain of at least 5% also demonstrated greater likelihood of depressive symptoms (OR 1.40 CI95% 1.05-1.88).

There was no significant relationship between sex and depressive symptoms. Early Baby Boomers (OR 2.77 CI95% 1.02-7.55) had greater odds of depressive symptoms.

Arthritis

Respondents who were stable NILF (OR 2.94 CI95% 1.98-4.38) or moving from NILF into full-time work (OR 3.36 CI95% 1.49-7.56) were more likely to have arthritis. The unadjusted model showed that early (OR 5.00 CI95% 3.25-7.70) and late Baby Boomers (OR 2.04 CI95% 1.29-3.23) as well as those who moved from employment to NILF (OR 1.89 CI95% 1.17-3.05) showed an increased likelihood of having arthritis although these results did not persist in the adjusted model.

Obesity

Separate models were undertaken to explore the relationships between sex, generation, employment transitions and weight gain with obesity with comorbidities and obesity without selected comorbidities. Both analyses are presented in Table 8.4.

Respondents who were stable NILF (OR 1.86 CI95% 1.30-2.65) and those who had gained ≥5% of their body weight (OR 2.11 CI95% 1.66-2.68) had greater odds of BMI defined obesity. In unadjusted analyses early (OR 1.44 CI95% 1.06-1.97) and late Baby Boomers (OR 1.42 CI95% 1.04-1.93) were more likely to be obese.

After exclusion of those classified as obese with comorbid T2DM, arthritis or depression (n=289) weight gain was significantly associated with obesity (OR 1.72 CI95% 1.28-2.32) in adjusted analyses. There were no relationships between sex, generation membership or employment transition with the prevalence of obesity without comorbidities.

8.6 Discussion

The main finding of this study of Baby Boomers and Generation Xers in South Australia, demonstrates that not participating in the labour force is positively associated with the presence of T2DM, depression, arthritis and obesity. Additionally, moving from employment to out of the labour force is associated with T2DM and depression. Generational differences were shown in the unadjusted analyses of relationships with T2DM, arthritis and obesity. These findings suggest workforce exit or not being in the labour force may be related to the presence of chronic conditions.

This provides support for the theory that the increasing prevalence of obesity[142] and associated comorbidities may constitute a substantial barrier to working life. While the majority of previous research has focused on the relationship between health and work status at a single point in time, of those studies examining change in work status, there is support for our main finding that not working or moving out of the labour force is related to ill health[231, 249]. Ki et al. show that transitions from employment into unemployment and inactivity (defined as withdrawal from the workforce) over a one-

year period, were affected by self-reported general health, using data from the British Household Panel Survey 1991 to 2007[231]. Another study using the same survey data from 1991 to 1998 found that becoming unemployed was associated with an increase in psychological distress[249].

Research demonstrating negative changes in employment status are associated with risky health behaviours such as decreased sleep and physical activity, as well as increased alcohol consumption, are suggestive of a pathway from unemployment to chronic conditions caused by unhealthy behaviours[254]. Alternatively, work or the workplace may impact negatively on health in a way that promotes the development of obesity and comorbid conditions. Au and colleagues have recently demonstrated in a longitudinal cohort of Australian women, that stable full-time work[255] and longer work hours[256] have a positive relationship with weight gain. This highlights a further possibility that chronic conditions operate as health selection factors out of the workforce.

Research into the relationships between work and chronic conditions suggest possible explanations for the relationships seen in the current study [230, 251, 257, 258] . Analysis of 2003 national self-report data from the Australian Bureau of Statistics has shown 45.6% of workforce exit before age 65 was due to a chronic health condition[251] and ill health has been shown to increase the risk of labour force exit in a prospective study on Dutch workers with a ten-year follow-up period[230]. T2DM prevalence and related factors such as side effects from diabetic medications have been shown to increase

levels of absenteeism and work impairment, reducing productivity and affecting the probability of employment[257, 258]. Studies by Robroek and colleagues have also demonstrated obesity is associated with the duration and likelihood of taking sick leave[259], of exiting the workforce with a disability pension[260] and that poor health plays a role in labour force exit[261]. A relationship between economic inactivity and depression has also been demonstrated, although direction of causation remains unclear, as there is evidence for depression preceding unemployment and vice versa[262]. Weight gain was also associated with increased odds of depression in the present study, which is possibly a result of the bi-directional relationship between obesity and depression[244].

The associations between employment transitions and arthritis may seem contradictory as both stable NILF and moving from NILF to full-time work demonstrated around three times greater odds of having arthritis. It may be that the association of workforce re-entry with arthritis is the result of temporary work loss associated with disease characteristics[263], although this cannot be confirmed in the current study. Further, the number of cases in this category is quite small so this result should be interpreted with caution. Australian estimates suggest the risk of being out of the labour force is three times higher for those with arthritis[251] and labour force participation rates are significantly lower in people with rheumatoid arthritis compared to the general population[264]. However, in this study we cannot confirm type of arthritis.

Weight gain and stable NILF were both factors that had increased odds of obesity. Once respondents with obesity and the comorbidities of T2DM, depression or arthritis were excluded from analysis, this relationship did not persist and only weight gain was significantly associated with obesity. This highlights the possibility that obesity related chronic conditions may have a mediating role in the relationship between obesity and workforce participation, although obesity may be the initial causal factor.

Differences by generation membership were demonstrated with unadjusted analysis showing that both early and late Baby Boomers were more likely to be obese and have arthritis and diabetes. That these differences did not persist after the addition of a range of covariates to the model suggests these factors may mediate the relationship between generation membership and chronic condition prevalence. The descriptive statistics demonstrate late Baby Boomers are more likely to be obese without comorbidities compared to the early Baby Boomers, suggesting that the length of time at an unhealthy weight may relate to the development of comorbidities.

Investigations into the effect unemployment has on health have shown unemployment or being economically inactive is related to an increased risk of all-cause mortality[265, 266] and poor psychological and physical health[191, 250]. However, there is no examination of pre-existing health conditions operating as a selection factor into unemployment. It is possible mortality risk increases with unemployment because poor-health has forced workforce exit. As Ki notes, health is a necessary precondition for economic activity[231].

The exact timing of these transitions within the four year period is unknown and therefore the precise temporal association between the employment transitions and chronic conditions is unable to be established. We also would have liked to include cardiovascular disease in this study. However, the low prevalence of CVD meant this was not possible. It also cannot be ignored a significant proportion of the sample (39.5%) had to be excluded due to missing data. Loss to follow-up in cohort studies is a widespread issue, although it is encouraging previous work has demonstrated that only minimal bias results from participant loss[267, 268] and does not necessarily affect analysis of causal associations[269]. The relatively small sample size also places limitations on potential generalisability. It would be ideal for the longitudinal relationship between chronic condition diagnosis and employment transitions to be examined in a larger cohort of Australian workers. Additionally, investigation of change in work status and incidence of chronic conditions will enable temporal order to established. The present study did not have a large enough sample to examine incidence. However, the in-clinic measured height and weight and diabetes diagnosis are all significant strengths of the study.

Although we cannot ascribe causation, possible implications of these findings include the potential for the rise in chronic conditions to affect future workforce participation as ill-health may force early workforce exit.

8.7 Conclusion

This study raises to possibility that the increase in obesity prevalence and comorbid conditions may affect workforce participation. Premature workforce exit affects both individual savings for retirement and national productivity levels and comes at a significant personal cost to the individual[270-272]. With the recent increase in the pension qualification in Australia from age 65 to 67[133], the need to create preconditions for healthy ageing are more relevant than ever. The institution of workplace policies that accommodates increased flexibility to enable longer working life despite ill-health would benefit the economy and the individual. Additionally, policy and program efforts to halt and reduce the continuing rise in chronic conditions, particularly obesity, need to be ramped up if they are to improve the health and working life of the ageing Baby Boomer generation.

Table 8.1: Characteristics of participants by generation group

	Generation X 1966-1980 N=312			Late Baby Boomers 1956-1965 N=508			Early Baby Boomers 1946-1965 N=611				
	n	%	(95% CI)	n	%	(95% CI)	n	%	(95% CI)	Total n	%
Sex											
Male	160	24.1	(21.0 - 27.5)	229	34.4	(30.9 - 38.1)	276	41.5	(37.8 - 45.3)	665	100.0
Female	152	19.8	(17.2 - 22.8)	279	36.4	(33.1 - 39.9)	335	43.7	(40.3 - 47.3)	766	100.0
Employment transition (T2 to T3)^											
Stable full time work	161	24.9	(21.7 - 28.4)	268	41.4	(37.7 - 45.3)	218	33.7	(30.2 - 37.4)	647	100.0
Stable part time work	37	20.8	(15.5 - 27.3)	72	40.4	(33.5 - 47.8)	69	38.8	(31.9 - 46.1)	178	100.0
Stable NILF	26	12.4	(8.6 - 17.6)	36	17.2	(12.7 - 22.9)	147	70.3	(63.8 - 76.1)	209	100.0
NILF to part time	11	26.8	(15.7 - 41.9)	18	43.9	(29.9 - 59.0)	12	29.3	(17.6 - 44.5)	41	100.0
NILF to full time	12	34.3	(20.8 - 50.8)	15	42.9	(28.0 - 59.1)	8	22.9	(12.1 - 39.0)	35	100.0
From full to part time	20	20.0	(13.3 - 28.9)	47	47.0	(37.5 - 56.7)	33	33.0	(24.6 - 42.7)	100	100.0
From part to full time	17	22.1	(14.3 - 32.5)	19	24.7	(16.4 - 35.4)	41	53.2	(42.2 - 64.0)	77	100.0
Employment to NILF	15	13.4	(8.3 - 20.9)	25	22.3	(15.6 - 30.9)	72	64.3	(55.1 - 72.6)	112	100.0
Weight gain (T2 to T3)^											
Have not gained 5%	210	20.8	(18.4 - 23.4)	348	34.5	(31.6 - 37.5)	451	44.7	(41.7 - 47.8)	1009	100.0
Gained ≥5% weight	102	24.2	(20.3 - 28.5)	160	37.9	(33.4 - 42.6)	160	37.9	(33.4 - 42.6)	422	100.0
Diabetes^											
No	305	22.9	(20.7 - 25.2)	477	35.8	(33.3 - 38.5)	549	41.2	(38.6 - 43.9)	1331	100.0
Yes	7	7.0	(3.4 - 13.7)	31	31.0	(22.8 - 40.6)	62	62.0	(52.2 - 70.9)	100	100.0
Depression^											
No	250	21.9	(19.6 - 24.4)	410	35.9	(33.2 - 38.8)	481	42.2	(39.3 - 45.0)	1141	100.0
Yes	56	21.1	(16.6 - 26.3)	91	34.2	(28.8 - 40.1)	119	44.7	(38.9 - 50.7)	266	100.0

NILF: Not in the labour force; GX: Generation X; BB: Baby Boomer ^ Missing not displayed

Table 8.1: Characteristics of participants by generation group continued

	Generation X 1966-1980			Late Baby Boomers 1956-1965			Early Baby Boomers 1946-1965				
	n	%	(95% CI)	n	%	(95% CI)	n	%	(95% CI)	Total n	%
Arthritis											
No	268	26.4	(23.8 - 29.2)	398	39.3	(36.3 - 42.3)	348	34.3	(31.5 - 37.3)	1014	100.0
Yes	29	8.7	(6.2 - 12.3)	85	25.6	(21.2 - 30.6)	218	65.7	(60.4 - 70.6)	332	100.0
Obesity											
No	221	24.0	(21.3 - 26.8)	323	35.0	(32.0 - 38.2)	378	41.0	(37.9 - 44.2)	922	100.0
Yes BMI ≥30.00	91	17.9	(14.8 - 21.4)	185	36.3	(32.3 - 40.6)	233	45.8	(41.5 - 50.1)	509	100.0
Obesity no diabetes, depression, arthritis											
No	252	21.3	(19.0 - 23.7)	405	34.2	(31.5 - 36.9)	528	44.6	(41.7 - 47.4)	1185	100.0
Yes	60	24.4	(19.4 - 30.1)	103	41.9	(35.9 - 48.1)	83	33.7	(28.1 - 39.9)	246	100.0

Table 8.2: Multivariable associations of sex, generation, employment transition and weight gain with unadjusted and adjusted analysis of the prevalence of diabetes and depression at T3

	Diabetes			Diabetes adjusted^			Depression			Depression adjusted^		
	OR	**(95% CI)**	**P**	**OR**	**(95% CI)**	**P**	**OR**	**(95% CI)**	**P**	**OR**	**(95% CI)**	**P**
Sex												
Male	1.00			1.00			1.00			1.00		
Female	**0.57**	**(0.36-0.89)**	**0.014**	**0.54**	**(0.34-0.85)**	**0.008**	1.03	(0.76-1.41)	0.831	1.02	(0.75-1.39)	0.881
Generation												
GX 1966-1980	1.00			1.00			1.00			1.00		
BB 1956-1965	**3.06**	**(1.32-7.09)**	**0.009**	1.49	(0.47-4.77)	0.500	1.01	(0.69-1.47)	0.967	1.86	(0.99-3.48)	0.053
BB 1946-1955	**3.79**	**(1.68-8.55)**	**0.001**	1.02	(0.18-5.83)	0.983	0.90	(0.62-1.3)	0.575	2.77	(1.02-7.55)	0.046
Employment transition (T2 to T3)												
Stable full time work	1.00			1.00			1.00			1.00		
Stable part time work	0.61	(0.20-1.82)	0.375	0.60	(0.20-1.80)	0.360	**1.82**	**(1.14-2.90)**	**0.012**	**1.79**	**(1.12-2.86)**	**0.015**
Stable NILF	**3.98**	**(2.22-7.14)**	**<0.001**	**3.43**	**(1.88-6.27)**	**<0.001**	**2.88**	**(1.89-4.37)**	**<0.001**	**3.13**	**(2.05-4.79)**	**<0.001**
NILF to part time	2.04	(0.58-7.18)	0.268	1.91	(0.54-6.80)	0.315	1.53	(0.67-3.50)	0.310	1.59	(0.70-3.65)	0.270
NILF to full time	0.76	(0.10-5.82)	0.793	0.73	(0.10-5.66)	0.767	1.10	(0.41-2.94)	0.844	1.10	(0.41-2.96)	0.852
From full to part time	2.01	(0.88-4.59)	0.098	1.99	(0.87-4.56)	0.105	1.55	(0.88-2.71)	0.128	1.55	(0.89-2.73)	0.125
From part to full time	0.57	(0.13-2.45)	0.448	0.57	(0.13-2.47)	0.454	**2.20**	**(1.22-3.98)**	**0.009**	**2.26**	**(1.25-4.10)**	**0.007**
Employment to NILF	**3.00**	**(1.52-5.93)**	**0.002**	**2.74**	**(1.37-5.47)**	**0.004**	**2.74**	**(1.68-4.47)**	**<0.001**	**2.99**	**(1.82-4.92)**	**<0.001**
Weight gain (T2 to T3)												
Have not gained 5%	1.00			1.00			1.00			1.00		
Gained ≥5% weight	1.01	(0.63-1.62)	0.961	1.02	(0.63-1.64)	0.944	**1.43**	**(1.07-1.91)**	**0.014**	**1.40**	**(1.05-1.88)**	**0.023**

^Baseline household income, education, physical activity level, marital status and year of birth included in the model
NILF: Not in the labour force; GX: Generation X; BB: Baby Boomer

Table 8.3: Multivariable associations of sex, generation, employment transition and weight gain with unadjusted and adjusted analysis of the prevalence of arthritis at T3

	Arthritis			Arthritis adjusted^		
	OR	**(95% CI)**	**P**	**OR**	**(95% CI)**	**P**
Sex						
Male	1.00			1.00		
Female	1.29	(0.96-1.74)	0.089	1.26	(0.93-1.71)	0.129
Generation						
GX 1966-1980	1.00			1.00		
BB 1956-1965	**2.04**	**(1.29-3.23)**	**0.002**	0.57	(0.29-1.12)	0.103
BB 1946-1955	**5.00**	**(3.25-7.7)**	**<0.001**	0.47	(0.17-1.31)	0.149
Employment transition (T2 to T3)						
Stable full time work	1.00			1.00		
Stable part time work	1.20	(0.75-1.90)	0.448	1.25	(0.79-2)	0.343
Stable NILF	**3.43**	**(2.34-5.04)**	**<0.001**	**2.94**	**(1.98-4.38)**	**<0.001**
NILF to part time	1.40	(0.63-3.12)	0.414	1.33	(0.59-3.01)	0.494
NILF to full time	**3.11**	**(1.41-6.87)**	**0.005**	**3.36**	**(1.49-7.56)**	**0.003**
From full to part time	1.21	(0.69-2.11)	0.500	1.21	(0.69-2.11)	0.507
From part to full time	1.16	(0.62-2.16)	0.646	1.17	(0.62-2.18)	0.633
Employment to NILF	**1.89**	**(1.17-3.05)**	**0.009**	1.61	(0.98-2.62)	0.058
Weight gain (T2 to T3)						
Have not gained 5%	1.00			1.00		
Gained ≥5% body weight	1.00	(0.74-1.34)	0.993	1.06	(0.79-1.44)	0.690

^Baseline household income, education, physical activity level, marital status and year of birth included in the model

NILF: Not in the labour force; GX: Generation X; BB: Baby Boomer

Table 8.4: Multivariable associations of sex, generation, employment transition and weight gain with unadjusted and adjusted analysis of the prevalence of obesity and obesity excluding cases with comorbid diabetes, depression or arthritis at T3

	Obesity			Obesity adjusted^			Obesity no comorbidities			Obesity no comorbidities adjusted^		
	OR	**(95% CI)**	**P**	**OR**	**(95% CI)**	**P**	**OR**	**(95% CI)**	**P**	**OR**	**(95% CI)**	**P**
Sex												
Male	1.00			1.00			1.00			1.00		
Female	0.82	(0.64-1.06)	0.128	0.82	(0.64-1.06)	0.124	0.78	(0.57-1.07)	0.125	0.79	(0.58-1.09)	0.150
Generation												
GX 1966-1980	1.00			1.00			1.00			1.00		
BB 1956-1965	**1.44**	**(1.06-1.97)**	**0.021**	1.24	(0.75-2.06)	0.406	1.09	(0.76-1.56)	0.650	0.99	(0.54-1.82)	0.971
BB 1946-1955	**1.42**	**(1.04-1.93)**	**0.026**	1.06	(0.47-2.38)	0.895	0.74	(0.51-1.07)	0.112	0.62	(0.23-1.69)	0.351
Employment transition (T2 to T3)												
Stable full time work	1.00			1.00			1.00			1.00		
Stable part time work	1.07	(0.73-1.58)	0.727	1.07	(0.73-1.58)	0.727	0.77	(0.47-1.26)	0.305	0.66	(0.40-1.08)	0.099
Stable NILF	**1.93**	**(1.36-2.74)**	**<0.001**	**1.88**	**(1.32-2.69)**	**<0.001**	0.70	(0.43-1.14)	0.153	0.85	(0.38-1.94)	0.702
NILF to part time	1.35	(0.69-2.63)	0.377	1.35	(0.69-2.62)	0.384	0.90	(0.40-2.04)	0.801	0.60	(0.22-1.66)	0.329
NILF to full time	0.89	(0.41-1.91)	0.764	0.85	(0.39-1.85)	0.691	0.66	(0.25-1.74)	0.399	0.75	(0.42-1.35)	0.344
From full to part time	1.08	(0.68-1.71)	0.744	1.07	(0.67-1.69)	0.780	0.77	(0.43-1.37)	0.375	0.53	(0.25-1.15)	0.107
From part to full time	0.94	(0.55-1.60)	0.822	0.96	(0.56-1.63)	0.868	0.52	(0.24-1.12)	0.096	0.74	(0.42-1.33)	0.320
Employment to NILF	1.51	(0.98-2.31)	0.059	1.48	(0.97-2.28)	0.072	0.77	(0.43-1.37)	0.367	0.66	(0.40-1.08)	0.099
Weight gain (T2 to T3)												
Have not gained 5%	1.00			1.00			1.00			1.00		
Gained ≥5% weight	**2.08**	**(1.64-2.64)**	**<0.001**	**2.10**	**(1.65-2.67)**	**<0.001**	**1.71**	**(1.28-2.30)**	**<0.001**	**1.71**	**(1.27-2.29)**	**<0.001**

^Baseline household income, education, physical activity level, marital status and year of birth included in the model NILF: Not in the labour force; GX: Generation X; BB: Baby Boomer

SECTION III

DISCUSSION

Chapter 9 DISCUSSION, FUTURE DIRECTIONS AND CONCLUSIONS

9.0 Discussion

In this thesis I have explored and demonstrated generational differences in health status, the effect work related factors have on obesity and the relationship between economic inactivity and workforce exit with health. In sum, Generation X have reached a higher prevalence of obesity and diabetes with lower self-rated health and demonstrate a greater likelihood of WC defined obesity if working in the community and personal services sector or in a low strain, passive or high strain job compared to Baby Boomers. Furthermore, staying out of, or exiting the labour force is strongly related to the prevalence of diabetes, depression, arthritis and obesity.

The implications for these findings revolve around four specific themes; capacity for healthy ageing, social inequalities of health as well as workforce participation and supply.

9.1 Healthy ageing?

As life expectancy in Australia has increased, so too has the number of years spent in retirement. Life expectancy in Australia (excluding Aboriginal and Torres Strait Islanders) is among the highest in the world[273]. It is estimated that as of 2009, the oldest Baby Boomers (born 1946-48) had gained approximately 17 years in additional life expectancy[273], while late Baby Boomers (born 1965) are estimated to have gained approximately 45 years of additional life expectancy[15] from when they were born.

The increase in life expectancy can be partly attributed to improved living standards and medical advances[23]. Higher levels of education and the halving of smoking rates from 30% in 1985 to 15% in 2010[5] are also important contributors. The decline in lung cancer incidence in males, circulatory disease deaths and stroke mortality seen over the past decades has been largely attributed to this decrease in smoking[5]. The first study in this thesis demonstrates that at the same age, 15.2% and 10.6% of male and female Baby Boomers had attained a Bachelor degree or higher education, while 27.6% and 30.0% of Generation X males and females respectively had achieved the same. Prevalence of current smoking in the generations dropped from 36.3% to 30.4% in Baby Boomer and Generation X males while in females it dropped from 28.3% to 22.3%. However, despite these results illustrating the drop in smoking prevalence and the increase in education attainment, there is every probability the rise in overweight and obesity is offsetting these successes.

Over the same period that smoking has decreased, obesity and overweight has more than doubled in the adult population. The 1980 Australian NHS showed the prevalence of overweight and obesity among adults was 26.7%[274], while the most recent National survey from 2011 has demonstrated a prevalence of 63.4%[6]. Subsequently, there is also evidence the greatest contributors to burden of disease in Australia are changing. In 2003, the greatest contributor to disease burden in Australia was tobacco smoking, followed by high blood pressure and overweight/obesity[275]. As of 2006 high BMI was the leading independent contributor to burden of disease in Western Australia[276] and by 2010 high BMI was demonstrated to be the leading risk factor for Australasia[277].

Although Australian-specific burden of disease has not been estimated recently, we would infer from these trends overweight and obesity is now the largest, preventable contributor to the burden of disease in Australia.

Related to this, healthy life expectancy has not increased at the same rate as absolute life expectancy. Recent estimates from the 2010 Global Burden of Disease Study[278] show healthy life expectancy in Australia is 68.4 and 71.8 years for males and females respectively, while absolute life expectancy is 79.2 and 83.8 years[278]. Given that overweight and obesity may be the largest contributor to burden of disease in Australia, it is reasonable to suggest this may be the most significant barrier to healthy ageing, given the potential effect on quality of life[73]. Obesity can affect quality of life through the previously mentioned avenues involving the development of comorbid conditions such as diabetes[279], depression[72], musculoskeletal conditions and CVD[280] and also increases the risk of falls in the elderly[281]. Additionally, the lifespan of someone who is severely obese is around eight to 10 years shorter than someone of normal BMI, which is similar to the years of life lost by smokers[282]. Estimates suggest 57.9% of Australian's aged 60 years and over are living with two or more chronic conditions[283]. The prevalence of obesity in Generation X in 2008 of 18.3% for males and 12.7% for females as demonstrated in study one, does not bode well for future development of comorbid conditions. A recent study supports this, demonstrating younger Australians are also at significant risk of compromised quality of life as 32.1% of those aged 40 to 59, are also living with multi-morbidity[283].

The consequences of overweight and obesity in terms of disease burden, which in turn compromises capacity for healthy ageing, may have overshadowed the benefits that have arisen as a result of decreased smoking and increased levels of education. Absolute life expectancy is lengthening but healthy life expectancy is not. The first study has demonstrated the increase in obesity is not solely the result of an ageing demographic but that the environment and cohort specific characteristics have also played a role. If these results extrapolate to future generations, serious structural changes to the environment will need to be considered.

9.2 Widening the 'gap' - Obesity related social inequalities

Socioeconomic and demographic factors have been included in all studies in this thesis, however, the relationship between obesity and social inequality has not been explored. A serious concern is that the increase in overweight and obesity is being seen disproportionately in the most disadvantaged sectors of society. Theoretically, there is potential for this to widen the gap between the least and most disadvantaged.

Although the high prevalence of overweight and obesity means that different social groups are all affected to varying extents, existing evidence has demonstrated the highest BMI's are more likely to exist within the lowest educated and poorest sections of society[284-286]. A recent review of the relationship between education attainment and obesity found that an inverse association between education and obesity is more likely in high income countries, although effect size differs by sex[287]. The same can be said for the relationship between socioeconomic status (SES) and obesity, though the

inverse relationship is much stronger among women[288]. Australian data has shown obesity is much more prevalent among people living in the most disadvantaged areas and that fall within the lowest SES quintile[5]. While these associations are consistent and strong, they do not address the question of causality. Prospective studies have found that low education and SES predict weight gain over time[289, 290]. However, there is also evidence overweight and obesity affect education achievement and likelihood of marriage, as well as household income from a study following a group of 16 to 24 year olds over nine years from 1981[291].

Stigma can be conceptualised as the development and propagation of stereotypes, status degradation and discrimination[292]. Obesity and overweight are both highly stigmatised conditions[293], a social consequence of excess weight that can lead to poor health outcomes[292]. Blaming obesity on individual characteristics is a major source of stigma and discrimination[294]. There is evidence stigma can cause social isolation, participation in risky health behaviours such as smoking and alcohol consumption[295], negative self-perception[296, 297] and stress[292]. Studies examining American attitudes to obesity have shown obesity was most often attributed to lack of willpower[298, 299] and insufficient exercise[299]. The consequences of weight-related stigma are at least partially responsible for the disadvantage gradient seen in the occurrence of overweight and obesity and a strong contributor to the perpetuation of inequality[300]. The media also plays an important role in shaping perception of social issues, with research demonstrating most television media covering obesity portrays it as the result of individual action centered mostly on diet[301]. Further, there is evidence that

TV shows such as *The Biggest Loser* reinforce concepts of individual control and blame, perpetuating 'anti-fat' attitudes[302, 303]. Despite the negative effect stigma has on individuals, there has been little consideration of this as a causal factor that should be treated with similar importance as nutrition and physical activity.

Further potential for widening inequality can be seen in the financial consequences of obesity related discrimination. A German study has demonstrated wage and job attainment discrimination negatively impacts upon obese females[304]. A longitudinal American study also showed obese individuals experience a persistent wage disadvantage of up to 6.3%, independent of health limitations[305]. This is also supported by analysis of the European SHARE data, which illustrated obesity is associated with higher unemployment and 10% less salary, although the earning result was only seen in females[306]. The effect of BMI on occupational attainment has also been demonstrated to be significant in females only[307]. As these relationships have been shown to be stronger or exist only in females suggests that females are more vulnerable to weight related financial disadvantage and discrimination. Obesity may also act as a health selector out of the workforce[230, 261], which could impact on further weight gain, given the relationship between unemployment, financial resources, depression and weight[308, 309].

Environmental characteristics have also been demonstrated to influence health with a social disadvantage gradient as the effect of the built environment on obesity risk is more likely to be seen in disadvantaged areas[310]. Disadvantaged neighbourhoods are

more likely to have reduced access to supermarkets, open green spaces and safe places to exercise[311]. They are often characterised by fewer opportunities to participate in physical activity due to lack of facilities[312], lower levels of physical activity[313] and reduced access to healthy food outlets[314]. Possibly reflecting this, groups of higher socioeconomic disadvantage have also been shown to consume less fruit and vegetables[315].

Stigma, the associated discrimination and unhealthy surroundings are all factors that combine to perpetuate a cycle of disadvantage related to obesity. Built environment influences on health including land-mix, healthy food supply and availability of facilities that promote physical activity can be altered through local and state government regulation and intervention[316]. The vulnerability to discrimination in the workforce seen particularly in obese women, needs to be addressed through education and policy in the first instance with the potential for legislation. The culture of individual blame for obesity and resultant stigma particularly, needs to be addressed.

9.3 Workforce participation and supply

A core policy question for all levels of Australian government is 'How can we improve workforce participation, keep Baby Boomers in the workforce longer and prevent health related workforce exit in the younger generations?'

From the research presented in this thesis, there is support for the hypothesis that work and the workplace is affecting the health of the generations differently. Evidence presented that the workplace is affecting the likelihood of overweight and obese through job strain, occupation and psychological distress in the younger generation suggests avenues of prevention within the workplace still need to be pursued. That Generation X is reaching a higher prevalence of obesity and diabetes earlier in life, and chronic conditions are strongly associated with workforce exit, also calls for prevention strategies to be married with management strategies, to promote longer working life in the high proportion of individuals already managing chronic conditions.

Possible consequences for these findings exist in terms of workforce participation and supply. In the short to medium-term there is the possibility the younger generation will exit the workforce for health related reasons, earlier than their predecessors. Following this, a worse-case scenario could manifest into significant workforce supply shortages, propelled by the increase in what are largely preventable chronic conditions.

As of 2013, there is considerable evidence demonstrating workforce exit can be propelled by health related factors. A comprehensive overview of the retirement intentions and status of the Australian population is provided by an ABS survey conducted from July 2012 to June 2013 with 8,300 Australian residents aged 15 or over[248]. Of Baby Boomers aged 55 to 64 in 2012/13, the average age of intended retirement was 65.6 for males and 64.8 for females. This compares to an actual

average retirement age for those aged 45 years and over of 58.5 years for men and 50 years of age for women. Of those who retired before 65 years of age (over 75% of all retirees), 53.4% of males and 32.7% of females reported their 'own sickness, injury or disability' as the reason for terminating their last job[248]. However, a more recent picture of those who had retired since 2007/08 illustrated the average age of actual retirement for men was 63.3 years and 59.6 years for women, demonstrating later retirement ages in more recent cohorts. In 2011, only 61.1% of 55 to 64 year olds were employed in Australia[317]. Although this is the highest proportion of workforce participation seen in this age cohort, there is substantial capacity for improvement. Moreover, comparable countries such as New Zealand demonstrate significantly higher participation rates among 60 to 64 year olds (78.9%) and Australia is lagging behind other OECD countries with female participation rates of over 55 year olds[318]. This, coupled with the high proportion of health propelled workforce exit, points to the significant capacity to increase working life by improving health and workforce ability to retain workers who are managing their health conditions.

As previously discussed, premature retirement affects personal financial resources and national productivity levels[270-272]. Prior to workforce exit, the effect of chronic disease on productivity is also significant. The 2004/05 National Health Survey assessed days away from work as a result of illness[319]. During the fortnight prior to the survey, males and females with one chronic disease averaged 0.55 and 0.41 days away respectively. Of those with three or more chronic conditions, males had two days off work while females had less than one day off work within the previous fortnight[319]. This translates

to approximately 500,000 days lost per fortnight. Access Economics estimates productivity costs related to obesity incorporating the flow-on affects due to comorbid diabetes, CVD, osteoarthritis and cancer at $3.6 billion in 2008[271]. Although no sex differences exist in the present research to support this, the sex differences in the absenteeism rates suggest females respond differently and perhaps manage multi-morbidity better than males. This is particularly interesting given the stronger relationships between weight and discrimination seen in women as discussed earlier[304, 306, 307].

Multiple policy driven changes have been instituted to promote and encourage an increased working life[317]. In 2009 a 'work bonus' was introduced to allow pensioners to continue receiving a proportion of their pension if they returned to part-time work. Related to this, retirees can also now receive all of their superannuation and work full-time if they wish[247]. The eligibility criterion for the disability pension has also been tightened to align with a substantial reduction in working capacity. Importantly, in 2011 an Age Discrimination Commissioner was appointed to identify barriers to mature worker employment and how to remove them[320]. Incentives have also been introduced to encourage employers to hire and retain older workers[317]. Further to this, increasing the pension eligibility age to 67 years by 2023 and raising the age at which superannuation can be accessed without severe tax penalties to 60 by 2025 will influence financial-based retirement decisions. To increase self-funding of retirement the compulsory superannuation contribution will gradually be raised from 9 to 12% by 2019[247]. All of these changes have been designed to increase capacity for self-funded

retirement and encourage greater participation in the workforce for older Australians in a relatively short time frame.

Work has been conducted proposing why mature age workforce participation will continue to rise and common themes include the move away from manual work, the increase in levels of education which is highly correlated with workforce participation, and the increasing health of successive cohorts will positively impact on participation rates[247, 318]. Health is acknowledged to be the most important contributor to workforce participation in older age groups[247, 318]. Heady and colleagues propose that if population health is improved based on estimates of increased life expectancy, then participation rates will increase for all older (55+) age groups by at least 2%[247]. However, whilst the increasing level of education is supported by the current research, the supposition that successive cohorts will be healthier than previous cohorts is not.

In terms of increasing population health, the National Partnership Agreement on Preventive Health has been created by the Council of Australian Government (COAG) to coordinate targeted interventions designed to address the rising prevalence of chronic conditions[321]. In terms of preventing early workforce exit due to ill-health $216.8 million in funding has been allocated to the state and territory governments to fund the implementation of health promotion in workplaces[321]. The focus of these interventions are to address overweight and obesity, physical activity, smoking, nutrition and alcohol abuse. The South Australian initiative is focusing on implementing programs through a top-down approach with industry, associations or

unions leading the implementation of policies and programs designed to create a health promoting culture[322]. Progress, reach and effect of this program have yet to be evaluated so unfortunately, there is little information about the success of the initiative thus far, although as the aims are for long-term sustainable change it may be some years until this can be detected. However, in relation to the current research it is apparent there are generational differences in how work affects health. Although we can only theorise as to the causal mechanisms involved in the differences seen in the relationships between job strain, occupation and obesity seen in the second study, it highlights the need to consider these differences in workplace promotion and programs aimed at improving health. Also, given that all forms of job strain bar active jobs (high demands, high control) demonstrated greater odds of obesity, that this initiative is not targeting mental health including work stress, is concerning. In addition, the third study of this thesis demonstrates the strong relationship between workforce exit or economic activity with chronic conditions and this highlights that for many Baby Boomers who are already out of the workforce, this initiative will have no effect.

9.4 Limitations

There are a number of factors that were not within the scope of the present research, which could be examined to further elaborate on the relationships between work and health. Health behaviours were only included in analyses as potential confounders, not as potential outcomes of work-related factors that may lead to obesity. However, previous exploration of the effect of work on health related behaviours has shown only partial and inconsistent support for the association between psychosocial work

factors and risky health behaviours such as smoking, low physical activity and poor nutrition[175, 208, 212, 323]. Additionally, there are a multitude of work-related factors that may influence health, including the location and size of the workplace, workplace policies, management and co-worker support, hours worked, commuting time and job security, that were unable to be examined. Many of these factors will constitute the basis of future exploration into the influences of work on health. Despite this, a strength of this research is the multi-faceted view of obesity in Baby Boomers and Generation X. Use of multiple data sources has allowed investigation into the health related generational differences at a national level, followed by a closer examination of work related influences on obesity and the associations between employment transitions and health. This has provided an overview of generational differences and illustrated groups that should be targeted in work-related health promotion and programs, as well as highlighted the potential productivity and workforce participation costs of chronic conditions.

9.5 Future directions

Future directions for research focusing on the health of Baby Boomers and Generation X and work related factors include extending the work of the first study to compare Baby Boomers and Generation X with Generation Y, to determine if the successive cohort or environment effect of a higher prevalence of chronic conditions earlier, is continuing.

There is also a need to elucidate the causal pathways that resulted in the differential effects of work and workplace on the health of the generations. We theorised that the effect of occupation and job strain categories on WC defined obesity may reflect differences in perceptions of the workplace, or lifecourse differences in the potential effect of work and workplace on weight. Examination of this relationship in a larger longitudinal sample with additional information to understand why work and the workplace might affect the respective generation's health differently would enable tailoring of workplace health promotion campaigns and programs.

An exploration of the reasons behind employment transitions across the generations would allow differentiation of voluntary and involuntary transitions, which may be related to carer responsibilities, ill-health or labour market forces. This would help target policies towards specific causes of workforce exit.

Additionally, whilst not within the scope of the current work, the ageing of the Baby Boomers is going to force structural changes to the aged care system due to the size of the generation. Expectations of aged care are also expected to differ given the uniqueness of the Baby Boomer generation and their desire for independence[4]. Research exploring future expectations and perceptions of needs will allow proactive changes to be made as aged care services grow.

Future research could also examine the uptake of workplace health programs and interventions and how this differs by generation to allow better targeting of programs.

Related to this, an investigation into the sex differences demonstrated in absenteeism rates for people with multimorbidity may highlight avenues to reduce the impact chronic conditions have on productivity.

9.6 Conclusion

The causal factors involved in the increasing prevalence of obesity as discussed, are extremely complex. This thesis has demonstrated cohort, environment and work related influences. Overall it appears if obesity continues to rise in prevalence earlier in the lifecourse the consequences for health, workforce participation and economic growth will become untenable. Importantly, there are opportunities to affect change. Workplace focused interventions provide a key opportunity to improve adult health and thereby workforce participation, although generational differences in the work experience should be taken into account. Moreover, a focus on management of workers with chronic conditions and increased flexibility may prevent workforce exit due to ill-health. There is a clear need for management to accompany prevention efforts, as it is unlikely current efforts will reduce the high prevalence of chronic conditions to such an extent that it no longer affects productivity. Furthermore, efforts must be made to reduce the stigma associated with excess weight and to address the potential for widening inequalities caused by this epidemic.

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