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A U S T R A L I A

**Alcohol consumption by reproductive-aged women:
patterns, predictors, social and health consequences**

(A prospective birth-cohort study of women and their offspring)

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Abstract

Despite the existence of a number of studies which examine the levels and the patterns of alcohol consumption by women, relatively little is known about the patterns of women's alcohol consumption over their reproductive life course. Research involving women's use of alcohol has tended to focus on identifying the patterns of drinking behaviour among adolescent, middle-aged and older women or even among those in clinical samples rather than women of reproductive age in a community-based sample. The reproductive period is a critical time associated with major transitions in women's lives. To bridge the gaps, this thesis is conducted addressing three research aims:

- Aim 1:** To explore how the patterns of alcohol consumption by women of reproductive age change over their life course.
- Aim 2:** To determine why the patterns of alcohol consumption among women change over time.
- Aim 3:** To investigate the social and health consequences for mothers and their offspring associated with the patterns of alcohol consumption by women over the reproductive life course.

Data were taken from the Mater-University of Queensland Study of Pregnancy (MUSP), a prospective pre-birth cohort study which began in 1981 in Brisbane, Australia. The MUSP comprised of 6753 women who gave birth to a live singleton child at the baseline survey. Women and their children were initially assessed five times up to 21 years post-birth. Since then there have been additional follow-ups of the mothers at 27 years and their children at 30 years. At each survey, respondents completed a series of self-report questionnaires, which included a structured mental illness questionnaire (the CIDI) at 21 years and afterward. The current study uses women's alcohol consumption measured from baseline up to the 21-year follow-up; predictor variables are measured at the baseline survey; covariate variables are measured at both the baseline and every measurement period, and variables assessing outcomes are measured at the 27-year follow-up. Offspring's outcomes are measured at both 21 years and 30 years.

A number of statistical analyses were undertaken to identify trajectories of alcohol consumption, estimate the prospective association between various baseline predictors and these trajectories as well as between the drinking trajectories and later life-course

outcomes. Additional analyses were undertaken to account for attrition. Sensitivity analyses were applied to confirm the results of the main analyses.

The thesis findings showed that women can be categorised into three alcohol-consumption trajectories (abstainers/minimal consumption, light consumption, and heavy consumption). These describe the short-term changes of women's drinking behaviour from prenatal to postnatal period. The heavy consumption group includes those who drink heavily at pre-pregnancy and after the delivery during the breastfeeding period.

In regard to long-term patterns of alcohol consumption, I identified four distinct trajectories of alcohol consumption by women over their reproductive life course. These drinking trajectories were abstainers, low-stable drinkers, moderate-escalating drinkers, and heavy-escalating drinkers. These four trajectories exhibited evidence of a high level of stability over time for abstainers and low-stable drinkers, but patterns of alcohol consumption changed for moderate and heavy-escalating drinkers. Although Australia is described as a high alcohol-consumption country, this finding suggests the diverse patterns of drinking among women over the long term with about 70% abstaining and having low-stable consumption, 25% having moderate-escalating consumption, and only 5% having heavy-escalating consumption. Pattern of alcohol consumption among the heavy-escalating group changed over time. Women in this group consumed an average of almost two standard glasses a day at pre-pregnancy. They kept drinking, averaging 1.4 standard drinks per day during pregnancy and delivery, then sharply escalated their alcohol consumption from a moderate level (1.5 standard drinks per day at Year 5) to a heavy level (2.4 standard drinks per day at Year 14 and 21).

I found that membership of the abstaining trajectory is predicted by lower family income, being married, and high frequency of church attendance; while membership of the heavier-escalating trajectory is associated with women who were not currently married, never went to church and had unhealthy lifestyle behaviour.

In relation to the life-course outcomes, I found that a maternal trajectory of moderate-escalating alcohol consumption is an independent predictor of an alcohol use disorder in the offspring's lifetime at 21 years and offspring's problem-gambling behaviour at 30 years after adjustment for a range of potential confounders. The associations differ by sex of a child. The findings also show that women with higher alcohol-consumption trajectories over a 21 year period may experience adverse outcomes—particularly in relation to their marital relationship, reproductive health and general wellbeing at 27 years.

This study makes a number of important contributions to the existing body of work related to the patterns, predictors and consequences of alcohol consumption over women's reproductive life course. The main findings are an exemplar of Weber's ideal types that best fits to the life course analytical framework employed in this study. This study also strengthens evidence for related prevention and intervention programs.

Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

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1. **Tran, N.T.**, Najman, J.M., and Hayatbakhsh, R. (2014). Predictors of maternal drinking trajectories before and after pregnancy: evidence from a longitudinal study. *Australian and New Zealand Journal of Obstetrics and Gynaecology*. Volume 55, Issue 2, pages 123-130. DOI: 10.1111/ajo.12294
2. **Tran, N.T.**, Williams, G.M., Alati, R., and Najman, J.M. (2015). Trajectories and predictors of alcohol consumption over 21 years of mothers's reproductive life course. *Social Science Medicine-Population Health*, Volume 1, pages 40-47. DOI: <http://dx.doi.org/10.1016/j.ssmph.2015.11.002>

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Statement of parts of the thesis submitted to qualify for the award of another degree

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List of Abbreviations

ALSWH	Australian Longitudinal Study of Women's Health
AUD	Alcohol use disorder
CIDI	Composite International Diagnostic Interview
CPGI	Canadian Problem Gambling Index
DSM	Diagnostic and Statistical Manual of Mental Disorders
DSSI	Delusions-Symptoms-States Inventory
ICD	International Statistical Classification of Diseases and Related Health Problems
MI	Multiple Imputation
MUSP	Mater-University of Queensland Study of Pregnancy
NDSHS	Australian National Drug Strategy Household Surveys
WHO	World Health Organisation
YSR	Youth Self-Report

Chapter 1: INTRODUCTION

1.1 Rationale

Alcohol has been an important part of Australian culture since the time of colonisation in 1788 (Fitzgerald et al., 2009; Hall & Hunter, 1995; Room, 1988). During this time, drinking by men has been interpreted as a symbol of masculinity, strength, self-control, non-conformity, and willingness to take a risk (Gotoh, 1994; Herd, 1997; Lyons & Willott, 2008; McDonald, 1994); while drinking by women has tended to be associated with a lack of femininity, conflict of social roles and family responsibilities, and loss of sexual inhibitions (Blume, 1997; Herd, 1997; Warner, 1997). The women's liberation movement in Australia and other countries in Europe and in the United States in the early 1970s contributed to dramatic changes in Australian culture with new social values, expectations and aspirations for women as well as social attitudes toward women (Pocock, 2003; Roche & Deehan, 2002; Strachan, 2010; Summers, 1994). As a result, alcohol consumption by women has changed particularly for younger women (Hall & Hunter, 1995; Roche & Deehan, 2002; Summers, 1994). It has been suggested that the perceptions of the acceptability of women consuming alcohol and becoming intoxicated has also significantly changed (Schmidt, 2014). Drinking alcohol has become a more accepted component of women's lifestyles (Roche et al., 2007).

Following the social movements in the decade of the 1970s, there were increased efforts to identify the levels and patterns of alcohol consumption by women. Cross-sectional studies pointed to a growing number of women consuming alcohol; and consumption patterns of the young female population did change over time (Hajema et al., 1997). In cross-sectional studies, the common approach is to examine patterns of women's alcohol consumption by comparing different age groups at one-time point. This method provides limited information about how a person's alcohol consumption may change over time. Cross-sectional studies can identify average developmental trends in alcohol use but they are not able to adequately capture the changes in drinking behaviour over time (Fillmore et al., 1997; Maggs & Schulenberg, 2004).

In contrast to cross-sectional studies, longitudinal studies with repeated measures of alcohol consumption allow researchers to examine how women's drinking behaviour

changes over their life course by using advanced statistical technique such as latent class growth analysis (Nagin, 2005; Nagin & Odgers, 2010b) and growth mixture analysis (Muthén & Asparouhov, 2002; Muthén & Muthén, 2000; Muthén & Muthén, 2012; Weden & Miles, 2011). Recent longitudinal studies have reported four and up to six distinct drinking patterns, including non-drinkers, declining consumption, increased consumption, stable consumption and a curvilinear consumption (Bobo & Greek, 2011; Bobo et al., 2010; Brennan et al., 2011; Cerda et al., 2008; Cook et al., 2013; Gee et al., 2007; Platt et al., 2010; Powers & Young, 2008). The research to date has tended to focus on identifying patterns of alcohol consumption among mid-aged and older women or female adolescents rather than women who are in the reproductive age range (Brennan et al., 2011; Platt et al., 2010; Powers & Young, 2008). These studies have also limited their investigation by the length of time for each follow-up, normally from 5 to 10 or 12 years in length (Cook et al., 2013; Kreager et al., 2010; Laborde & Mair, 2012; Thundal et al., 2000). Generally, there is not much attention paid to addressing the development trajectory of maternal alcohol consumption of reproductive-aged women over their reproductive life course.

In addition to identifying drinking trajectories over the life course, it has been suggested that researchers should determine risk factors that predict and alter trajectories (Elder & Giele, 2009; Hutchison, 2005; Maggs & Schulenberg, 2004). Moreover, it is argued that by examining trajectories of alcohol consumption, researchers can better understand and predict whether women will experience positive and negative consequences of their drinking in the long term (Britton et al., 2015; Hill et al., 2000; Lanza et al., 2013; Maggs & Schulenberg, 2004; Petras & Masyn, 2010).

The present study is of interest because it: (i) increases knowledge about women's alcohol-consumption patterns over their reproductive life course; (ii) compare the patterns of alcohol consumption among Australian women to those in other countries; and (iii) identifies the social and health consequences of different drinking trajectories for women and for their child. Specifically, this research addresses the following questions: How does alcohol consumption by reproductive-aged women change over time? Does women's socio-economic status, life events, or mental health problems lead to changes in her pattern of alcohol consumption? What are the health and social consequences associated with particular drinking patterns for women who consume alcohol and what are the consequences of these patterns of consumption for their child?

1.2 Thesis outline

This thesis is divided into nine chapters. Chapter 1 provides the rationale of the current study by outlining the current gaps and the need for research on alcohol consumption by women over the life course.

In Chapter 2, I review the literature relevant to the research topic. In the first section, I review the history of alcohol consumption by women in Australia from the colonisation of Australia, marked by the arrival of the first fleet in 1788, up to the present time. In the next three sections, I review current cross-sectional and longitudinal research on how alcohol consumption by women changes over the life course; why the patterns of women's alcohol consumption change over time; and what social and health consequences of mothers and their offspring are associated with these alcohol consumption changes. In the last section, I present research aims and my study objectives.

In Chapter 3, I begin by introducing a life-course perspective as a research paradigm to further understand the developmental course of women's drinking behavior over the reproductive life course. In this study I examine trajectories of women's alcohol consumption over the reproductive life course, the predictors and consequences associated with membership of these trajectories are also of interest under the life-course paradigm. Subsequent sections provide a detailed description of the Mater-University of Queensland Study of Pregnancy (MUSP), a birth cohort study used for this thesis; the measure of variables; and the statistical methodologies employed.

Chapters four through to eight contain manuscripts published by or submitted to international peer-reviewed journals. These chapters comprise the results section. In Chapter 4 and 5, I explore the short-- term (prenatal to postnatal period) and long-term (over 21 years) trajectories of alcohol consumption by women. In these chapters I also examine factors associated with membership of each trajectory. Chapter 4 was published in the Australian and New Zealand Journal of Obstetrics and Gynaecology; while Chapter 5 was published in the Social Science Medicine – Population Health Journal. The last three results chapters are devoted to the social and health consequences associated with membership of the trajectories. I examined the impact of maternal alcohol consumption trajectories on offspring's alcohol use disorder at 21 years in Chapter 6, and presented the association between maternal alcohol consumption trajectories and young adult offspring's problem gambling at 30 years in Chapter 7. In Chapter 8 I describe the associations

between womens' drinking trajectories and marital relationship, reproductive health, and subjective well-being at 27 years.

In the final chapter I review and integrate the main findings of the study, showing how they are relevant to my conclusions. The strengths, limitations, implications of the key findings, and suggestions for further research are also included in this chapter.

Due to the nature of thesis by publication, all manuscripts within the thesis contain a literature review, methods section and a discussion. Despite efforts to reduce the repetition of materials, some redundancy between results chapters (chapters four through to eight) and other chapters is inevitable.

Chapter 2: LITERATURE REVIEW

Much of the literature concerned with alcohol use and misuse has focused for understandable reasons on male drinking. There is also a less prolific and somewhat diverse literature that examines alcohol consumption by females. It may well be that, as gender differences are addressed in society, alcohol consumption by females will be of increasing interest and concern. This chapter provides a summary of topics considered to be most relevant to alcohol consumption by women not only in Australia but also in other developed countries. It begins with a brief introduction discussing the historical use of alcohol by women in Australia, followed by a description of the patterns of alcohol consumption in both cross-sectional and longitudinal studies. Factors associated with the patterns of women's alcohol consumption are then described. Finally, social and health consequences of alcohol use by women will be discussed.

2.1 Alcohol consumption by women in Australian history

In Australia, the study of alcohol consumption by women has an interesting historical basis. Women's alcohol consumption is generally accepted in similar terms to male's alcohol consumption but there has been a long journey from a male-dominated society to a more egalitarian one, related possibly to changes in women's social position in the family and society.

Alcohol has been an important part of Australian culture since the time of colonisation, marked by the arrival of the first fleet in 1788 (Fitzgerald et al., 2009; Hall & Hunter, 1995; Room, 1988). According to Lewis (1992), the author of a *Rum State*, when convicts arrived, they brought with them a drinking culture from Britain where alcoholic spirits (e.g. distilled alcohol) were served as a food and source of nutrition. Alcohol consumption at that time was sharply differentiated by gender (Fitzgerald et al., 2009; Hall & Hunter, 1995; Roche et al., 2007). Drinking was common among males because this group comprised male soldiers, jailers and convicts who accounted for a large proportion of the existing society (Hall & Hunter, 1995; Powell, 1988). Additionally, cultural and social norms in this period regulated drinking behaviours for males and females. Drinking by men was seen as a symbol of masculine traits, strength, self-control, non-conformity, and

willingness to take a risk (Gotoh, 1994; Herd, 1997; Lyons & Willott, 2008; McDonald, 1994); while drinking by women was associated with a lack of femininity, conflict of social roles and family responsibilities, and loss of sexual inhibitions (Blume, 1997; Herd, 1997; Warner, 1997).

Australia gradually became a settled, urbanised, and family-oriented society from the 1850s and by the 1940s could be characterised as an industrialised society (Room, 1988). In Australia, alcohol consumption by women has dramatically changed since the early 1970s, reflecting the impact of the women's liberation movement (Hall & Hunter, 1995; Roche & Deehan, 2002; Summers, 1994). Like the United States and other Western countries, the movement in Australia contributed to dramatic changes in women's lives. Women attained a greater right to work outside the home and many became economically independent (Schmidt, 2014). For example, many women of the 1950s only worked until they married; after that they were home-makers and were responsible for the care of their husband and children (Strachan, 2010; Summers, 1994). In this period, social attitudes discouraged married women from working. This was despite the finding that a majority of people supported childless wives entering the work force (Murphy, 2000). The female labour-force participation rate in the 1960s was about one in four women (Sheridan & Stretton, 2004). The dominant ideology and belief that women's primary place was in the home started changing from the early 1970s, reflected in an increased rate of female labour-force participation to 38.6% (Strachan, 2010). The 1970s were also marked by changes in Australian culture with new social values, expectations and aspirations for women, as well as social attitudes toward women (Pocock, 2003; Roche & Deehan, 2002; Strachan, 2010; Summers, 1994). As a result, perceptions about the acceptability of women consuming alcohol and becoming intoxicated also significantly changed (Schmidt, 2014). As Roche et al. (2007) have stated, drinking is no longer bound to the public realm of the drinking hotel but has multiplied into diverse areas including the private sphere; and it has become an important part of women's lifestyles.

Today, the average alcohol consumption per person (15 years old and over; including recorded and unrecorded) in Australia is about 12.2 litres of pure alcohol per year (WHO, 2014). Females over 15 years old in Australia consume about 7.2 litres per person per year of alcohol (WHO, 2014). We know that the pattern of alcohol consumption in Australian history has followed a v-shaped curve beginning at 13.6 litres per year in the 1830s. It decreased to 5.8 litres in the 1930s, then declined to the lowest point of 2.5 litres during the Great Depression. The consumption of alcohol climbed back to its high point of

13.1 litres in the 1980s (Hall & Hunter, 1995; Room, 1988). There is a need to know more about how the patterns of women's alcohol consumption may have changed over time.

2.2 How alcohol consumption by women changed over time

Prior to the 1970s, in comparison with men, research on women's alcohol consumption received little attention. However, after the 1970s, there were increased efforts to identify the levels and patterns of alcohol consumption by women. Studies in Australia and overseas suggest that women's use of alcohol has substantially changed (Corti & Ibrahim, 1990; Fleming, 1996; Wilsnack et al., 1984a). In the following section I examine how alcohol consumption by women has changed over time. The sections which follow will present the changes in women's alcohol consumption as reflected in both cross-sectional and longitudinal studies.

2.2.1 Changing patterns of alcohol consumption in cross-sectional studies

In 1977, about 49% of female adults in Australia consumed alcohol (Australian Bureau of Statistics, 1997). However, the proportion of women who reported consuming alcohol increased to 67% in 1983 (McNair, 1993) and to 87% in 1994 (Fleming, 1996). Since then, there have been a number of cross-sectional studies examining the patterns of women's alcohol consumption (Bungey & Winter, 1986; Corti & Ibrahim, 1990; Fleming, 1996; Jonas et al., 2000). These studies have usually involved comparisons of alcohol consumption by different age groups to describe the prevalence of levels and patterns of women's alcohol consumption. Although there are limitations which qualify the findings in some instances, most studies generally agree on the following:

First, alcohol consumption by women increased in the period 1977–85 (Australian Bureau of Statistics, 1997; Corti & Ibrahim, 1990); after that, consumption patterns were mostly stable except for some variation in the proportion of abstainers and those consuming alcohol daily. Corti and Ibrahim (1990) conducted three cross-sectional studies of the general population in New South Wales, South Australia and Western Australia in the period 1977–85. They reported that there was a slight increase in alcohol consumption by women; although, the general level of alcohol consumption declined over this period. Corti and Ibrahim's results were consistent with data from the Australian Bureau of Statistics in South Australia in 1983, which showed that there had been a significant

increase in alcohol consumption by women. Specifically, compared with data in 1977, the survey in 1988 reported a growing proportion of women who consumed at moderate and heavy levels (Bungey & Winter, 1986). The increase in alcohol consumption by women over this period is consistent with the data for that time period in the United States (Wilsnack et al., 1984b). The increase in women's alcohol consumption is possibly due to alcohol consumption by women becoming publicly accepted in the 1970s, and may also reflect the stability in men's drinking globally (Neve et al., 1993).

More recently, the patterns of alcohol consumption by women has been captured by the Australian National Drug Strategy Household Surveys (NDSHS). The NDSHS is a large scale cross-sectional survey of people aged 14 years or older that commenced in 1995. The available data from 2004 to 2013 describes the proportion of women drinking according to the following categories: daily, weekly, less than weekly, ex-drinker (has consumed at least a full serve of alcohol, but not in the previous 12 months), and never drink. In general, women's drinking status remained largely unchanged except for the abstainers and weekly alcohol-consumption groups (Australian Institute of Health and Welfare, 2011). The NDSHS shows the proportion of women who consumed alcohol daily increased from 11.6% to 15.8 in nearly 10 years, from 2004 to 2013. In contrast to an escalation of the abstainer group, the weekly alcohol-consumption group reduced their proportion from 5.8% in 2004 to 4.6% in 2013 (Australian Institute of Health and Welfare, 2011). The earlier findings from NDSHS are also consistent with the trends seen elsewhere (Wilsnack et al., 1984a).

Second, there have been a growing number of women consuming alcohol, but the pattern of women's use of alcohol has varied according to age group. Studies in Australia have found that there was a significant increase in alcohol consumption among younger women aged 18–24 years (Bungey & Winter, 1986; Clemens et al., 2007; Corti & Ibrahim, 1990; Roche & Deehan, 2002). Women in this age group have also consumed more alcohol (hazardous levels) than women in other age groups. A recent national survey of alcohol and drug use confirmed these findings, showing female drinkers aged 14–29 years were consuming alcohol at greater levels of risk than older women (Australian Institute of Health and Welfare, 2008, 2011).

Numerous cross-sectional studies in Australia have consistently found that middle-aged and older-aged women tend to reduce their alcohol consumption with increasing age (Australian Institute of Health and Welfare, 2011; Breslow et al., 2003; Roche & Deehan,

2002). Studies in the United States and European countries align with these findings that high levels of drinking are common in younger women, but alcohol consumption levels decline in middle and old age, partly reflecting changes in lifestyle, adverse health among the elderly, a lower tolerance to alcohol, or a belief that abstinence improves health (Adams et al., 1990; Bjørk et al., 2008; Hajema et al., 1997; Stall, 1987; Wilsnack et al., 2009; Wilsnack, 2012). However, some cross-sectional studies also suggest that, for some countries where the drinking culture is associated with higher status or seniority, the drinking pattern did not alter with age. In this case, alcohol consumption by older women is higher than by younger women (Geels et al., 2013; Wilsnack et al., 2009; Wilsnack, 2012).

National data from Australia shows that the level of alcohol consumption increased in the period 1977–85; after that, the patterns of consumption were mostly stable except for variations in the abstainers and daily-consumption groups. Younger women are found to drink less frequently but they consume more per occasion, normally at risky levels. Middle-aged and older women tend to drink alcohol more frequently but they drink at lower levels.

It is clear that in cross-sectional studies, the common approach is to examine patterns of women's alcohol consumption by comparing different age groups at one time point. This method provides limited information about how a person's alcohol consumption may change over time. Cross-sectional studies can identify average developmental trends in alcohol use, but they are less effective at predicting a person's drinking trajectory over their life course (Maggs & Schulenberg, 2004).

2.2.2 Changing patterns of alcohol consumption by women in longitudinal studies

In contrast to cross-sectional studies, longitudinal studies can track people over a lengthy time period. Thus using a longitudinal study design allows researchers to examine how women's drinking behaviours change over a life course. Current longitudinal studies of women's alcohol consumption have tended to explore (i) short patterns of drinking behaviour, from the prenatal to postnatal period; or (ii) long patterns of drinking behaviour across women's life course.

Many studies of women's alcohol consumption have focused primarily on short-term changes by pregnant women (Ethen et al., 2009; Maloney et al., 2011; Nykjaer et al., 2013; Osterman, 2011). These studies suggest that women reduce or stop their alcohol consumption when they are pregnant. After the birth of their babies, many women return to drinking at levels they had before pregnancy (Giglia & Binns, 2007; Maloney et al.,

2011). Women with the highest levels of alcohol consumption before pregnancy are those who tend to have the greatest reduction in consumption during pregnancy, and consume the most postpartum (Alvik et al., 2006; Fried et al., 1985). For example, in a followed-up survey of 587 pregnant women in Perth, Australia between 2002 and 2003, Giglia and Binns (2007) found that 32% of women stopped consuming alcohol while 35% of women still consumed alcohol during pregnancy. This proportion increased to 46.7%, 47.4%, and 42.3% at four, six, and 12 months postpartum, respectively. Research on alcohol consumption among pregnant women in Oslo, Norway also reported that 80% of women used alcohol six months after delivery, and among these women half were abstinent in the six months prior to pregnancy. Those drinking at the highest level of alcohol before pregnancy consumed the most after pregnancy but they also were the ones who reduced their consumption the most (Alvik et al., 2006).

It is likely that women reduce their alcohol consumption when they find out they are pregnant, in part reflecting concerns about a child's health associated with maternal drinking in pregnancy. It is also likely that many women return to drinking in the belief that postnatal alcohol consumption is relatively safe or it constitutes a form of self-medication to relieve stress resulting from caring for children and coping with the changes in social relationships (Budescu et al., 2011; Ethen et al., 2009; Laborde & Mair, 2012; Osterman, 2011; Plant, 2008).

In addition to identifying the short-term patterns of alcohol consumption associated with pregnancy, researchers have also spent much effort to examine long-term patterns of alcohol consumption across women's life course. Indeed, the pattern of maternal alcohol consumption over the reproductive life course is greatly understudied. Research involving women's use of alcohol has tended to focus on short periods of their lives, generally during pregnancy (Anderson et al., 2013; Liu et al., 2014; Maloney et al., 2011) or old age (Brennan et al., 2011; Molander et al., 2010), with little interest in the maternal reproductive life course. The reproductive life course stage for women involves a period of relatively good health but with numerous competing commitments. Childrearing may be the central activity during this period but the formation and maintenance of a dyadic partnership, the initiation and development of a career, the maintenance and enhancement of social networks, and major transitions involving the death of parents, marital breakdown, and the growing independence of children are all characteristic exposures during the reproductive life course (Evans, 1985; Mishra et al., 2010; Neve et al., 2000).

Most longitudinal studies that have examined alcohol consumption by middle-aged and older women have identified stable and changing patterns of consumption. For example, the Australian Longitudinal Study of Women's Health (ALSWH) examined longitudinal changes in alcohol consumption across three age groups (18–23, 45–50, and 70–75 years-old). The ALSWH reported that women aged 45–50 and 70–75 years did not change their alcohol consumption levels over 5 to 7 years while those in the younger age group, 18–23 years old, were more likely to decrease their consumption (Clemens et al., 2007; Young et al., 2005). This result was consistent with other published reports (Harford, 1993; Perreira & Sloan, 2001). Other longitudinal population-based studies of women aged 18–26 years also found that drinking behaviour among these women peaked at age 21 years then declined (Bachman et al., 2002; Ham & Hope, 2003; Roche et al., 2007; Staff et al., 2010). However, there remained a small minority of women whose consumption increased markedly after the age of 21 years (Casswell et al., 2002).

Despite methodological differences and some differences in findings, consistent patterns of alcohol consumption by women have been identified. Studies have reported from four and up to five distinct alcohol-consumption patterns, including abstinence, declined, increased, stable, and curvilinear (Bobo & Greek, 2011; Bobo et al., 2010; Brennan et al., 2011; Cerda et al., 2008; Cook et al., 2013; Gee et al., 2007; Platt et al., 2010; Powers & Young, 2008). In examining alcohol consumption among elderly people in Japan from 1987 to 1999, Gee and colleagues (2007) identified four drinking trajectories, namely abstainers, declining consumption, stable consumption, and a curvilinear pattern of consumption. Cook et al. (2013) also found that longitudinal data obtained from 1996 to 2006 on HIV affected women showed that over ten years, four drinking trajectories existed among the sample: abstainers, stable consumption, declining consumption, and a curvilinear pattern of consumption. Presumably the duration of time between recruitment and follow-up will impact on the number and types of trajectories which are identified.

Depending on the definition of levels of alcohol consumption used in different studies, estimates of the proportion of women in the abstaining or non-drinker trajectory group range from 14.0 % to 45.3 %; the proportion in the occasional or steady drinkers group range from 20.7 % to 39.4 %; the proportion in the increasing consumption group range from 2.2 % to 5.1 %; the proportion in the declining consumption group range from 6.0 % to 18.4 %; the proportion in the moderate consumption group range from 24.2 % to 51 %; and the proportion in the curvilinear pattern of consumption group is about 13.7% (Bobo et

al., 2010; Brennan et al., 2011; Cerda et al., 2008; Gee et al., 2007; Powers & Young, 2008).

Results from longitudinal studies (Brennan et al., 2011; Clemens et al., 2007; Hajema et al., 1997; Keyes, Li, et al., 2011; Molander et al., 2010; Moore et al., 2005; Shaw et al., 2011) have confirmed the findings from cross-sectional studies, namely that alcohol consumption among women declines by age. It is often assumed that alcohol consumption declines in later life, but the evidence for this assumption is based primarily on averaged group changes (Brennan et al., 2010). Longitudinal studies of women's alcohol consumption conducted in Sweden and in the United States have found a decrease in alcohol consumption, especially a decline in heavy drinking with advancing age (Harford, 1993; Thundal et al., 2000). In contrast, several longitudinal population-based studies have inconsistently found such an association (Bobo et al., 2010; Brennan et al., 2011; Eigenbrodt et al., 2001). These studies report that although middle-aged and older women maintained their alcohol consumption at stable levels, some slightly increased their level of alcohol consumption (Brennan et al., 2011; Platt et al., 2010; Tamers et al., 2014; Young et al., 2005).

The research to date has tended to focus on identifying patterns of alcohol consumption among middle-aged and older women or female adolescents rather than women who are in the reproductive age range. Exceptions are studies conducted by Fillmore (1987), Moore et al. (2005), and Cook et al. (2013). In addition, previous longitudinal studies have linked only a few time points with alcohol use trajectories and are limited by the long periods between follow-ups, normally at 5 to 10 or 12-year intervals (Cook et al., 2013; Kreager et al., 2010; Laborde & Mair, 2012; Thundal et al., 2000). Furthermore, where alcohol-use trajectories are considered, they have been derived by different methodologies such as: (i) using aggregate level changes, which involve changes in mean of daily or weekly alcohol consumption at each time point of survey (Brennan et al., 2011; Hajema et al., 1997); (ii) using individual-level changes which examine the variability in drinking status based on subjective categorisation criteria, latent curve modelling, or hierarchical modelling. These methodologies are generally reasonable but have theoretical and statistical limitations such as a prior assumption of the diversity of alcohol-consumption trajectories (Casswell et al., 2002; Jones & Nagin, 2013; Nagin, 2005; Nagin & Odgers, 2010b; Nagin & Tremblay, 2005); and (iii) using typical quantity per occasion or frequency of drinking to explore patterns of alcohol consumption. This may yield different patterns of alcohol consumption (Casswell et al., 2002).

2.3 Why alcohol consumption by women changes over the life course

In the previous section, a review of the evidence suggests that drinking behaviour amongst women may exhibit different forms such as stable consumption, declining consumption, increased or curvilinear consumption. Research has focused on the question of why alcohol consumption patterns might exhibit stability or change over time. The identification of predictors associated with the patterns of alcohol consumption by women may provide the information needed for developing intervention programs intended to alter harmful drinking trajectories.

There are a number of factors that may predict patterns of alcohol consumption such as individual characteristics, adverse life events, lifestyle behaviours, and mental health problems. In the sections below I review factors that may impact on alcohol-consumption trajectories.

2.3.1 Individual characteristics associated with the patterns of women's alcohol consumption

Individual characteristics have been the best predictors of membership of particular drinking patterns. Individual characteristics in these studies include but are not limited to socio-economic characteristics such as age, levels of education, marital status, income, employment status, number of children or parity as well as religious participation.

Ageing and patterns of alcohol consumption

The review of longitudinal studies suggests that advancing age is associated with a declining pattern of alcohol consumption by women (Brennan et al., 2011; Clemens et al., 2007; Hajema et al., 1997; Keyes, Li, et al., 2011; Molander et al., 2010; Moore et al., 2005; Shaw et al., 2011), especially a reduction in consumption for those who are members of the heavy drinking pattern (Harford, 1993; Thundal et al., 2000). However, some prospective studies have found that age is not statistically significantly associated with the patterns of alcohol consumption (Brennan et al., 2011; Platt et al., 2010; Tamers et al., 2014). There are several potential explanations for the association between ageing and different patterns of alcohol consumption. In comparison to younger women, older women may reduce their alcohol consumption for health-related reasons. Those who consume higher levels of alcohol or who slightly increase their alcohol consumption may

do so because of better financial and social opportunities to drink alcohol after their children enter adulthood.

Previous studies suggest women over 70 years of age tend to decrease their level of alcohol consumption (Brennan et al., 2011; Geels et al., 2013). In addition, previous studies, which found declining patterns of alcohol consumption among women, assessed drinking-behaviour change based on their whole sample's mean alcohol consumption (Fillmore et al., 1991; Molander et al., 2010; Shaw et al., 2011); therefore, the authors were unable to estimate trajectories of individual variations with growth curves or other dynamic modeling procedures.

Marital status and patterns of alcohol consumption

The association between marital status and different drinking patterns is well documented in both cross-sectional and longitudinal studies. Research has consistently found that marriage is associated with a low or declining pattern of alcohol consumption while being single is related to heavy or increased levels of alcohol consumption (Duncan et al., 2006; Li et al., 2010; Lonardo et al., 2010; Platt et al., 2010; Scott et al., 2010). For example, longitudinal studies in developed countries find that women who married had decreased odds of continuing to drink alcohol at high levels (Young et al., 2005).

Related to the association between cohabitation and pattern of alcohol consumption, a growing body of literature shows that, unlike marriage, cohabitation or living together with an intimate partner outside of marriage is associated with drug and alcohol use as well as heavy drinking (Bachman et al., 1984; Bachman et al., 2002; Karlamangla et al., 2006; Li et al., 2010). This later finding is disputed as several studies which show that drinking behaviour among cohabiters is similar to that of married women (Duncan et al., 2006; Plant et al., 2008) .

Income and patterns of alcohol consumption

In previous research the association between income and women's alcohol-consumption patterns has been well documented. These studies have shown that while lower income is associated with both abstaining and heavy drinking (Anderson, 2006; Cerda et al., 2008; Huckle et al., 2010; Karlamangla et al., 2006), higher income individuals are persistently linked to higher rates of heavy drinking (Huckle et al., 2010; Platt et al., 2010; Ziebarth & Grabka, 2009). There is some speculation about the association between drinking trajectories and income. First, women with lower incomes

cannot as easily afford alcohol (Wagenaar et al., 2009). Second, women with lower incomes may experience more pressure and stress in their lives. Alcohol in this context is a form of self-medication to relieve stressful life experiences (Menary et al., 2011; Morris et al., 2005; Robinson et al., 2011). Third, the context in which higher-income women consume alcohol may mean that higher levels of consumption are less likely to attract social disapproval (Peters & Stringham, 2006). In this case, drinking may be considered a social activity integral to personal and job-related networking.

Number of children and patterns of alcohol consumption

Parity may be another determinant of women's patterns of alcohol consumption over the reproductive life course. Researchers hypothesise that women with fewer children are more likely to be abstainers. Parity may be important because: (i) caring for a child is time consuming and demanding; (ii) caring for a child may not leave women with sufficient time to drink frequently or heavily; (iii) having children may leave less disposable funds for the purchase of alcohol. It is arguable that having more children and rearing many children may be stressful and may lead to higher levels of self-medication with alcohol. Moreover, after examining longitudinal data on child development in Britain, Staff et al. (2014) concluded that alcohol use is lower when women reside with child(ren) under five years of age. Relatively, little is known about the association between parity and alcohol-consumption trajectories over the reproductive life course.

Religiosity and patterns of alcohol consumption

A great deal of research has examined the role of religion in individual substance use, including alcohol consumption (Bazargan et al., 2004; Bowie et al., 2006; Krause, 2003; Lee et al., 2009; Molander et al., 2010; Platt et al., 2010). These studies have been conducted among adults and, in earlier samples, respondents who attended church regularly were less likely to consume alcohol than those who did not (Bazargan et al., 2004; Musick et al., 2000). Research on teenagers and adolescents also supports such associations by indicating that adolescents who are religious are less likely to drink alcohol. Frequency of church attendance is associated with fewer alcohol problems (Bachman et al., 2002; Bowie et al., 2006).

In a systematic review of 205 analyses within 85 articles examining the association between different dimensions of religiosity (organisational religiosity, religious affiliation, subjective religiosity, religious belief, non-organisational religiosity, religious coping,

spirituality, and multi-dimensional religiosity) and alcohol consumption, Chitwood et al. (2008) reported that 57.6% of these analyses found religiosity is a protective factor for alcohol consumption. However, about 41.4% results found a non-significant association between different dimensions of religiosity and alcohol consumption; while only two analyses produced a positive association between religiosity and alcohol use.

There are several possible explanations for the association between religiosity and alcohol consumption. Religious practice may involve support from other members (Ellison, 1994; Taylor & Chatters, 1986). Most religions have 'norms' that emphasise self-sufficiency and self-control within individuals (Durkheim, 1964); or regulate individual behaviours in order to survive and succeed (Weber, 1905). These norms discourage the use of alcohol; therefore, in some instances alcohol consumption is considered a social evil. Alternatively, religious attendance may be a marker for more positive coping skills, greater social connection, improved functional status, and decreased risky behaviours (Molander et al., 2010).

Much of the research on religion and alcohol consumption has focused specifically on older adults (Bazargan et al., 2004; Krause, 2003; Molander et al., 2010) or adolescents (Bachman et al., 2002; Bowie et al., 2006). Few studies examine the association among women at reproductive age. In addition, the association is based on general trends, less is known about whether or not religiosity predicts different trajectories of alcohol consumption over time.

2.3.2 Lifestyle behaviours and substance use associated with the patterns of women's alcohol consumption

Alcohol consumption may be one of many components of a person's health-related lifestyle (which could include tobacco smoking, hours sleeping, eating breakfast, and exercising regularly) mentioned by Belloc and Breslow (1972) and Schoenborn (1986). A health-related lifestyle may involve alcohol-consumption levels which are integrated into a broader range of lifestyle practices.

Many studies have explored the relationship between lifestyle behaviours and alcohol use (Bobo & Greek, 2011). These studies have consistently found that a pattern of some alcohol consumption is associated with good physical health (Bobo & Greek, 2011; French et al., 2009; Platt et al., 2010); while poor physical health or having more physical symptoms are associated with non-drinkers (Cederfjäll et al., 2004; Molander et al., 2010)

or those who decrease their alcohol consumption to moderate or nil (Brennan et al., 1999; Fillmore et al., 2003; Molander et al., 2010; Perreira & Sloan, 2001).

The association between physical activities or lifestyle behaviours and alcohol use is moderated by age of respondents. A study on US adults showed that the association between physical activities and alcohol use was observed more among younger than older adults (20–25 years old versus over 26 years old) due to youth being generally more engaged in physical activities and social situations conducive to drinking alcohol (Lisha et al., 2011).

The current literature review has limitation because, although it has attempted to examine the association between alcohol consumption and physical activities and physical health status, other characteristics of lifestyle such as hours sleeping and eating breakfast have not been examined.

2.3.3 Life events and mental health problems associated with the patterns of women's alcohol consumption

Life events or adversities may refer to a wide range of events that women and their partners may have recently experienced that might precipitate the use of alcohol. These include major job changes, problems with police, housing problems, financial problems, health problems, loss of relatives, serious troubles at work, serious disagreements with partner, and marital breakdown (Keyes, Hatzenbuehler, et al., 2011). Findings which are related to life events and alcohol use have been mixed, with some studies identifying that health-related life events and financial problems are associated with a decline in alcohol consumption (Brennan et al., 1999; Fillmore et al., 1991; Perreira & Sloan, 2001; Tamers et al., 2014); while adversity related to retirement, spouse, friends, and working is associated with the risk of alcohol use disorder (AUD) and increased alcohol use (Cerdeira et al., 2008; Gee et al., 2007; Keyes, Hatzenbuehler, et al., 2011; Perreira & Sloan, 2001; Sacco et al., 2014; Tamers et al., 2014; Veenstra et al., 2006).

The findings are generally inconclusive possibly due to life events generally including both desirable events (e.g. marriage, job promotion) and undesirable events (e.g. financial problems, deaths of loved ones). The later may lead to healthy and unhealthy behaviours related to alcohol consumption (Holmes & Rahe, 1967; Pohorecky, 1991). Given that this literature remains inconsistent, more data from large-scale studies are needed.

The link between mental health problems and patterns of alcohol consumption in population-based samples is also well documented. Consistent with the self-medication perspective, anxiety and depression are associated with the use of alcohol in the context that alcohol use may alleviate distressing psychiatric symptoms (Bolton et al., 2009; Khantzian, 1985; Menary et al., 2011; Morris et al., 2005). For example, in a longitudinal study of Australian women, researchers found that middle-aged women with mental health problems are more likely to drink at high levels (Young et al., 2005). This is consistent with other studies conducted in the United States which found that women who experience severe stress are more likely to drink at a high level and be a member of the increasing-consumption group (Cerda et al., 2008).

Despite many studies having demonstrated a relationship between stress and anxiety symptoms and alcohol consumption, there has been much inconsistency in the available literature. For example, a longitudinal study of changes in drinking patterns from mid to older age among a sample of people in the United States reported that baseline depressive symptoms were not significantly associated with frequency, quantity, or heavy drinking; but were related to transitioning to nondrinking (Molander et al., 2010). The finding is consistent with studies conducted by Musick et al. (2000), but inconsistent with studies showing that depression is associated with higher alcohol consumption (Hasin et al., 2007; Marmorstein, 2008; Menary et al., 2011; Morris et al., 2005).

2.4 Consequences of the patterns of alcohol consumption

While there are many studies which track the negative health consequences of alcohol dependence and/or alcohol abuse, rarely do studies address the potential for negative social and health consequences of 'normal' alcohol consumption in a community-based sample. In this section I aim to review the consequences not only for women who consume alcohol but also for their offspring who may be affected by maternal alcohol consumption.

A number of recent studies have examined whether women's health or their socio-economic status is affected by their trajectories of alcohol consumption. There are at least three life-course domains that could be expected to be associated with patterns of maternal alcohol consumption. These are family life, reproductive history, and subjective wellbeing. In this study I will prospectively examine the association between long-term

patterns of alcohol consumption by women who have recently given birth to a child and these three life-course domains.

2.4.1 Women's socio-economic status and family life

Many aspects of the association between alcohol use and family life have been well documented. Both cross-sectional (Harcourt & Adler-Baeder, 2015; Li et al., 2010; Shek & Leung, 2013) and longitudinal studies (Boden et al., 2013; Collins et al., 2007; Cranford, 2014; Keenan, Kenward, et al., 2014; Torvik et al., 2013; Waldron et al., 2011; Williams, Wray-Lake, et al., 2012) report an association between alcohol consumption and family problems. For example, using a New Zealand birth cohort, Boden et al. (2013) report that those with alcohol abuse/dependence were 1.6 to 1.7 times more likely to report a breakdown of a marital relationship. Similarly, in a review article, Rodriguez et al. (2014) report that AUD was lower among people who stayed married over time.

The research to date has tended to focus on experiences of an AUD rather than long term patterns of alcohol consumption in a community sample. While AUD may relate to a specific period in the life course, long-term patterns of alcohol consumption are likely to reflect a lifestyle which incorporates a persistent pattern of alcohol intake. It would be useful and potentially important to know if there is a relationship between patterns of long-term alcohol consumption in a community sample and a range of family life outcomes.

2.4.2 Women's reproductive health and subjective wellbeing outcomes

The relationship between alcohol consumption and reproductive behaviour has been established in cross-sectional surveys (Coleman, Coyle, et al., 2009; Prager et al., 2007; Steinberg & Finer, 2011). There is also a general consensus in longitudinal studies that alcohol has the potential to both affect and be affected by reproductive behaviour (Chiodo et al., 2012; Keenan, Grundy, et al., 2014; Pedersen, 2007; Roberts et al., 2015).

The available studies suggest that some forms of reproductive behaviour are associated with an increase in alcohol use. Women who report having had a pregnancy termination or those with only one child have higher levels of alcohol use (Coleman, Maxey, et al., 2009; Pedersen, 2007; Reardon et al., 2004; Roberts et al., 2015; Tran et al., 2014). The reverse causal association has also been observed, namely alcohol consumption has been reported as a cause of women's pregnancy termination. Women who drank at a heavier level and who reported more frequent use of alcohol were found to

have increased rates of termination (Andersen et al., 2012; Chiodo et al., 2012; Keenan, Grundy, et al., 2014). However, these later studies still have their limitations as they were conducted during pregnancy (Andersen et al., 2012; Chiodo et al., 2012) or alcohol consumption was measured at one time point (Keenan, Grundy, et al., 2014). The findings of previous studies may relate to the period around pregnancy only and are not directly relevant to understanding the relationship between persistent alcohol-consumption patterns over time and reproductive behaviour. Specifically, there is a need to answer the following question: Do women who drink more over the long term have different patterns of reproductive outcomes including pregnancy termination?

Little is known about the association between patterns of alcohol consumption and subjective wellbeing. Alcohol is a mood modifying substance that initially has sedative and anxiety/stress reducing qualities (Castle et al., 2006). There is little agreement about the association between alcohol consumption and subjective wellbeing in both cross-sectional and longitudinal surveys. While some studies suggest alcohol consumption may have positive (Chan et al., 2009; Stranges et al., 2006; Valencia-Martín et al., 2013) or adverse impacts (Koivumaa-Honkanen et al., 2012; Murphy et al., 2005; Strine et al., 2008; Swain et al., 2012) on wellbeing, other studies report no such association (Alex Mason & Spoth, 2011; Grant et al., 2009; Martinez et al., 2014). The majority of findings are based upon data in which alcohol consumption was measured either at one-time point or assessed by the present of an AUD. In some cases, the studies were conducted among an adolescent population. There remains the question of whether long-term alcohol consumption enhances or detracts from subjective wellbeing.

2.4.3 Offspring's alcohol use and alcohol use disorder

There is growing interest in measuring alcohol's harms to people other than the drinking mothers themselves (Rossow et al., 2015). However, studies of the association between maternal alcohol consumption and offspring's alcohol use or abuse have yielded inconsistent results. Some studies have found no association between maternal alcohol consumption and adolescent alcohol use (Koning et al., 2010; Marsden et al., 2005; Zhang et al., 1999), whereas others report such an association (Mares et al., 2011; Poelen et al., 2007; Van Der Vorst et al., 2009; Yeh et al., 2006; Yule et al., 2013). For example, Marsden et al. (2005) in a prospective cohort study found that the frequency of mother's alcohol use was not independently associated with their child's drinking frequency. In a five-year longitudinal analysis of 428 Dutch families, researchers also found no association

between maternal alcohol consumption and adolescent excessive drinking (Mares et al., 2011). However, data from a sample of twins and a sample of young people aged 12–30 from the Netherlands reported that in both cross-sectional and longitudinal data there were associations between mother's alcohol consumption and offspring's higher risk of drinking (Poelen et al., 2007).

The impact of maternal alcohol consumption on adolescent alcohol use may depend on offspring's sex (Casswell et al., 2002; Cleveland et al., 2014; Haugland et al., 2013; White et al., 2000). Findings regarding whether maternal alcohol consumption equally influences both male and female offsprings' alcohol consumption vary. On the one hand, it has been suggested that children tend to model their same sex parent's drinking behaviour (Casswell et al., 2002; Yeh et al., 2006). Thus, a mother's drinking may impact on her female children's alcohol consumption more than her male children's consumption (Haugland et al., 2013; Yeh et al., 2006; Yule et al., 2013). On the other hand, maternal alcohol consumption may predict male rather than female offspring's alcohol consumption (Cleveland et al., 2014). Some studies suggest that maternal alcohol consumption may equally influence male and female offspring's alcohol use (Englund et al., 2008; White et al., 2000).

2.4.4 Offspring's problem gambling

A range of factors have been associated with the risk of problem gambling among adolescents and young adults, such as sex, age, antisocial behaviours, academic performance, family socio-economic status, and parental gambling involvement (Barnes et al., 2005; Delfabbro et al., 2014; Forrest & McHale, 2012; Shead et al., 2010; Williams et al., 2015), as well as alcohol consumption. For example, higher proportions of gambling and gambling disorders were observed among male rather than female adolescents (Forrest & McHale, 2012); children who report poor family cohesion, poor academic performance, substance use, or having parents, sibling or friends who also gamble are more likely to report earlier onset of gambling behaviour and be involved in problem gambling (Delfabbro & Thrupp, 2003; Dowling et al., 2016; Shead et al., 2010).

It is not only the extent to which alcohol consumption normally coexists with gambling behaviours; it may also be an antecedent of problem gambling, suggesting considerable implications for intervention strategies. The correlation between alcohol consumption or AUD and problem gambling among adolescents and young adults has been well

documented in cross-sectional studies (Banwell et al., 2006; Delfabbro, 2008; LaBrie et al., 2003; Nehlin et al., 2013; Welte et al., 2001). For example, a national survey of gambling among 10,765 college students in the United States found that students who gambled were less likely to abstain from drinking alcohol (LaBrie et al., 2003); and a cross-sectional Swedish survey of youth aged 16 to 24 years found that, among males, the higher the alcohol consumption, the higher the likelihood of gambling and problem gambling behaviours (Fröberg et al., 2012). The few longitudinal studies examining alcohol consumption by adolescents as a risk factor for problem gambling consistently show that higher levels of alcohol consumption or early initiation of alcohol use have been associated with problem gambling (Abbott, Williams, et al., 2004; Barnes et al., 2002; Goudriaan et al., 2009; Scholes-Balog et al., 2014; Walker et al., 2012). We have previously found that those who started drinking alcohol before age 15 years were more likely to be gamblers than those who did not drink (Hayatbakhsh et al., 2013).

The gambling literature provides cross-sectional and longitudinal evidence about the association between adolescents' alcohol consumption and problem gambling behaviours; however, to our knowledge, there is no study examining the relation between maternal alcohol-consumption trajectories and young adult offspring having problem-gambling behaviours. Comorbidity between problem gambling and other substance use, including alcohol consumption or AUD, has long been recognised (Delfabbro, 2008; Lorains et al., 2011; Scholes-Balog et al., 2014). These studies suggest that those who consume or binge on alcohol are more likely to gamble and to have problem-gambling behaviours. In addition, reviews of alcohol consumption studies indicate that maternal alcohol consumption predicts an offspring's alcohol use (Cleveland et al., 2014; Englund et al., 2008; Mares et al., 2011; Poelen et al., 2007; Van Der Vorst et al., 2009). We thus hypothesise that there will be an association between maternal alcohol consumption and young adults' problem-gambling behaviour. A longitudinal association of maternal alcohol consumption predicting offspring's gambling behaviour has not previously been reported. Such research would provide knowledge about whether a mother's alcohol consumption trajectories relate to her adolescent offspring's problem-gambling behaviours. This may help in the development of prevention programs for both alcohol consumption and problem gambling.

AIMS AND OBJECTIVES

Aims

The literature reviewed in this thesis suggests that alcohol-consumption patterns among women may exhibit both stability and changeability over time. While research has been conducted to understand the patterns of alcohol consumption by female adolescents and middle-aged and older women; there has been little specific research describing how alcohol consumption by women changes over the life course, particularly that period of the life course associated with giving birth to children. Currently, findings on predictors and consequences associated with drinking patterns have been largely inconclusive due to the differences in measurement and research focus. The patterns of women's drinking over time are of concern, particularly because researchers and those who are involved in intervention programs need to better understand, not only factors related to drinking patterns but also, outcomes associated with these patterns. This kind of knowledge will contribute to planning better prevention and intervention programs. As such, the aims of this thesis are to:

1. describe how the patterns of alcohol consumption among women of reproductive age change over their life course
2. determine why the patterns of alcohol consumption among women change over time, that is, determine what factors are associated with the changing patterns of alcohol consumption among women
3. investigate the health and social consequences for mothers and their offspring associated with the patterns of alcohol consumption by women over the reproductive life course.

Objectives

To achieve the above aims, the thesis aims to answer following specific questions:

- How do the patterns of alcohol consumption by women change over the short time from the prenatal to postnatal period?
- Why do maternal patterns of alcohol consumption change from the prenatal to postnatal period?

- How do patterns of women's alcohol use change over their life course?
- Do individual characteristics, adverse life events, lifestyle behaviours, and mental health problems independently predict different patterns of women's alcohol use over the life course?
- Do maternal alcohol-consumption patterns predict offspring's alcohol use disorder? And if so, does the association differ according to the child's gender?
- Do maternal alcohol-consumption patterns predict offspring's problem gambling? And if so, does the relationship differ according to the child's gender?
- Do patterns of women's alcohol consumption predict their social and health outcomes?

Chapter 3: THEORETICAL FRAMEWORK, DATA AND RESEARCH METHODS

This section presents the theoretical framework for the study of women's alcohol-consumption trajectories and the predictors and consequences of long-term alcohol consumption. It is divided into four parts. In the first part, I consider the life course perspective as an analytical framework which guides the conduct of the study. In the second part, I describe the data source for the current study, and provide the retention rates for each phase of the study. In the third part I detail dependent variables, independent variables and covariates. Finally, the last section presents the plan for data and attrition analyses.

3.1 Life course as a research paradigm exploring trajectories and consequences of alcohol consumption by women over time

To understand human behaviour, observing the changing circumstances of an individual over their life course provides a particular and important set of insights. In this context, a life course approach has been emerging over the past 50 years and is considered a major research paradigm in contemporary social sciences such as sociology, criminology and social history. A life course approach generally adopts longitudinal methods that provide information about the patterns of human experience and behaviour over different stages of the life course. This contrasts with cross-sectional research which provides snapshots of a person's life at a point in time. Studying the lives of people as they change over time provides a more comprehensive view than the view provided by cross-sectional survey research (Elder & Giele, 2009).

The life course approach provides a framework that guides research exploring human behaviour at multiple times and over the course of human development (Elder, 1994). This idea links to a key concept in a life course perspective which is the concept of a life course trajectory. A trajectory is a pathway during the life span such as work or education, parenthood, or drinking behaviour. Trajectory refers to long-term patterns of behaviour and is marked by a sequence of transitions. Transitions refer to short-term changes, typical of life stages, for example having a child. Transitions are embedded in

trajectories and refer to changes in status, for example, starting or leaving school, entering or leaving the first job, marriage, giving birth (Elder & Giele, 2009). Trajectories also involve long-term patterns of stability and change (Elder, 1994). For example in a longitudinal study of a nationally representative sample of high school seniors in the United States, Bachman et al. (2002) indicated that adolescents start their drinking during their adolescence, increase the amounts/levels they drink into their early twenties, and decrease the amounts when they have a job or take on adult roles (e.g. marriage, becoming parents).

A cross-sectional study which has varied age groups could be thought to provide similar data to the data obtained from a longitudinal study but at a lower cost and with considerably less effort. However, this is simply not the case. For example, research has found that—although aggregate studies suggest that alcohol consumption by female adolescents usually peaks at age 21 years then declines (Bachman et al., 2002; Ham & Hope, 2003; Roche et al., 2007; Staff et al., 2010) and alcohol consumption by middle-aged and older-aged women typically declined with advancing age (Brennan et al., 2011; Clemens et al., 2007; Hajema et al., 1997; Keyes, Li, et al., 2011; Molander et al., 2010; Moore et al., 2005; Shaw et al., 2011)—no pattern holds true for every woman. Individual patterns of alcohol consumption may vary differently over time. Alcohol consumption behaviours fluctuate across life: some women may increase, decrease, or stop their drinking at some points; some never drink; and others may drink in a persistent or consistent manner. It is reasonable to expect that various groups will follow different alcohol-consumption patterns. The shapes of people's alcohol use trajectories can be expected to differ. A trajectory approach based upon longitudinal-collected data recognises variability both across people and over time, rather than assuming homogeneity of the directions and rates of change within the entire population (Elder & Giele, 2009; Hutchison, 2005; Maggs & Schulenberg, 2004). Therefore, the analysis of longitudinal data with repeat alcohol measures to identify the changes in consumption for individuals over their life course is the approach chosen for this study.

Besides exploring multiple trajectories of alcohol consumption, the life course approach offers the ability to determine risk and protective factors that predict and alter trajectories (Elder & Giele, 2009; Hutchison, 2005; Maggs & Schulenberg, 2004). In many empirical studies of alcohol consumption, researchers are interested in understanding characteristics which predict membership of particular drinking patterns. Previous studies have shown that stable or increasing pattern of drinking tends to be observed in older

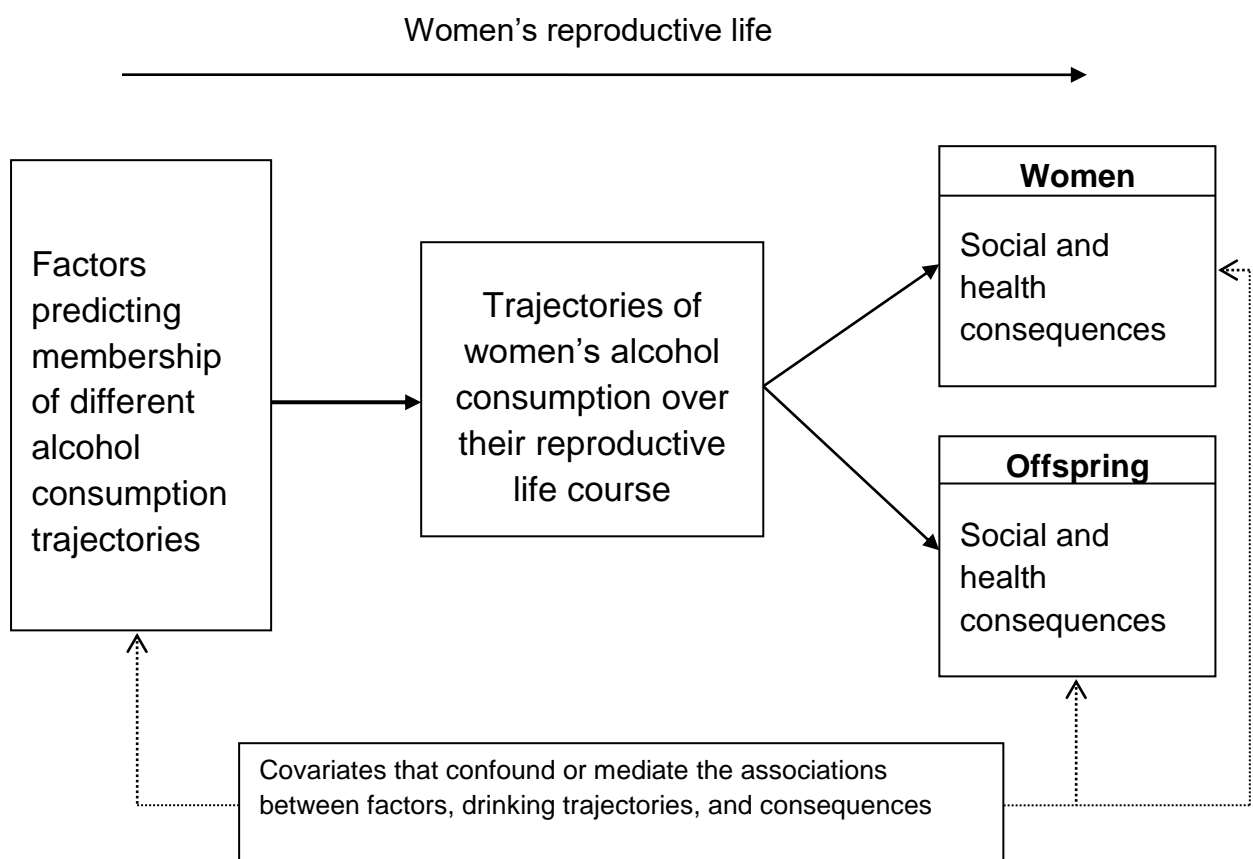
rather than younger age groups (Benzies et al., 2008; Sydén et al., 2014); lower income is associated with both abstaining and heavy drinking (Anderson, 2006; Huckle et al., 2010; Karlamangla et al., 2006) while higher-income individuals have persistently higher rates of heavy alcohol consumption (Huckle et al., 2010; Ziebarth & Grabka, 2009); women with fewer children are more likely to be abstainers (Neve et al., 1996). Such research is important because it suggests that levels of alcohol consumption change as women transition through their life stages.

The life course perspective not only provides the theoretical framework for determining the factors predicting women's alcohol consumption trajectories over their life course, it also offers a framework for exploring the social and health consequences associated with different drinking trajectories. Elder and Giele (2009) in their book title '*The craft of life course research* argue that by studying the early years of child development, researchers can understand social adaptations in later life, not just in the adolescent years but also in young adulthood. Elder and Giele (2009)'s suggestion is supported by Lanza et al. (2013) and other researchers (Britton et al., 2015; Petts, 2009) when they note that in the life course approach, if the first task of researchers lies in understanding the trajectories and which characteristics predict membership of these trajectories, the second task is about using these trajectories to predict the outcomes or consequences associated with membership of these trajectories. Based on this perspective, I suggest that the estimation of alcohol consumption trajectories over women's reproductive life course can ultimately be used to identify the impacts of different drinking trajectories on women's life domains. In addition, alcohol use may have its effect not only on the individual drinker but also the lives of their families, friends and their communities (Rossow et al., 2015). In this context, it is necessary to explore the effects of maternal drinking trajectories on their offspring.

Previous studies argue that there are a series of key life domains: material well-being, health, productivity (work or other forms of productive activity), intimacy (social and family connection/relationship), safety (security, personal control, privacy, autonomy), community (intended to be inclusive of the constructs of social class, community integration, community involvement), and emotional well-being (leisure, spiritual well-being, morale) (Cummins, 2005; Humphreys et al., 1996; Leelakulthanit & Day, 1993). While many studies pay attention to the association between various life domains and the quality of life, few studies address the linkage between alcohol dependence and life domains.

To achieve the research aims and objectives, this study employs a life course perspective as a research paradigm which guides the research methods. Specifically, I have used prospective cohort data from the MUSP to explore women’s alcohol-consumption trajectories over their life course. By applying group-based trajectory modelling, I was able to identify different drinking trajectories that women may exhibit across their reproductive life course. This approach has allowed me to identify how social, family and demographic factors, health status and life events throughout a women’s life may shape her drinking behaviours. Moreover, I apply the idea proposed by Lanza et al. (2013) and examine the effects of drinking trajectories on some of women’s life domains such as family life, reproductive health, and their well-being. The consequences of women’s alcohol consumption trajectories over their life course are examined for the women themselves and also for their child. The analytical framework for this study is presented in Figure 3-1.

Figure 3-1 Analytical framework of my research



The life course approach allows me to examine the long-term patterns of women’s alcohol consumption over their life course. By assessing short and long term trajectories of alcohol consumption it is also possible to determine whether there are sensitive periods

during women's lives when particular patterns of alcohol consumption are more harmful. Such information will be useful to inform intervention program initiatives.

3.2 Data source

3.2.1 Participants

The data for this thesis were taken from MUSP. The MUSP is a prospective pre-birth cohort study of 6753 women who gave birth to a live singleton baby at The Mater Misericordiae Mothers Hospital, one of the two major public obstetric hospitals in Brisbane between 1981 and 1984. Beginning in January 1981, 7223 pregnant women attending for their first clinic visit (at about 18 weeks' gestation) at the Mater hospital were invited to participate in the study. These women were approached and invited to complete prenatal assessment (included prenatal information and early pregnancy). The sample was re-interviewed at 3 to 5 days after the birth of the baby where data on late pregnancy together with their medical records were also collected. Women and their child have been followed up at 6 months (Time 2); and then at 5 (Time 3), 14 (Time 4), and 21 years (Time 5) after the birth of their baby. An additional follow-up had been conducted for women at 27 years (Time 6) and children at 30 years (Time 7) (Najman et al., 2005; Najman et al., 2014). To date there have been a number of stages of data collection from multiple sources. Briefly, MUSP comprises two sources of data, one addressing women and the other focusing on children from birth until 30 years of age (Najman et al., 2005).

Women, who participated in the study at their first prenatal visit (Time 1, or baseline survey), approximately 18 weeks' gestation with standard deviation (SD) = 5.83, were asked about their social demographic characteristics, life style, family structure, and other health related information including mental health before and during pregnancy. These women were followed up six months after delivery and asked to complete a 103-item questionnaire related to their baseline information (information collected at early in pregnancy) and other information relevant to their child's development. Five years after the birth of their child, these mothers were contacted for the next follow-up survey seeking information about their child and themselves using a 227-item questionnaire. The next follow-up survey was conducted 14 years after the birth and mothers were again asked to provide information on their family and themselves. At this phase of the study, offspring officially joined the study in their own right, completing a 141-item questionnaire regarding their social behaviours and family relationships. Both mothers and children were contacted

for further information regarding their socio-economic status, health behaviours and lifestyle at 21 years; after that, only mothers were resurveyed at Year 27; and only offspring were followed up at Year 30. Figure 3-2 describes the follow chart of mothers and children as well as the retention rate over phases of study.

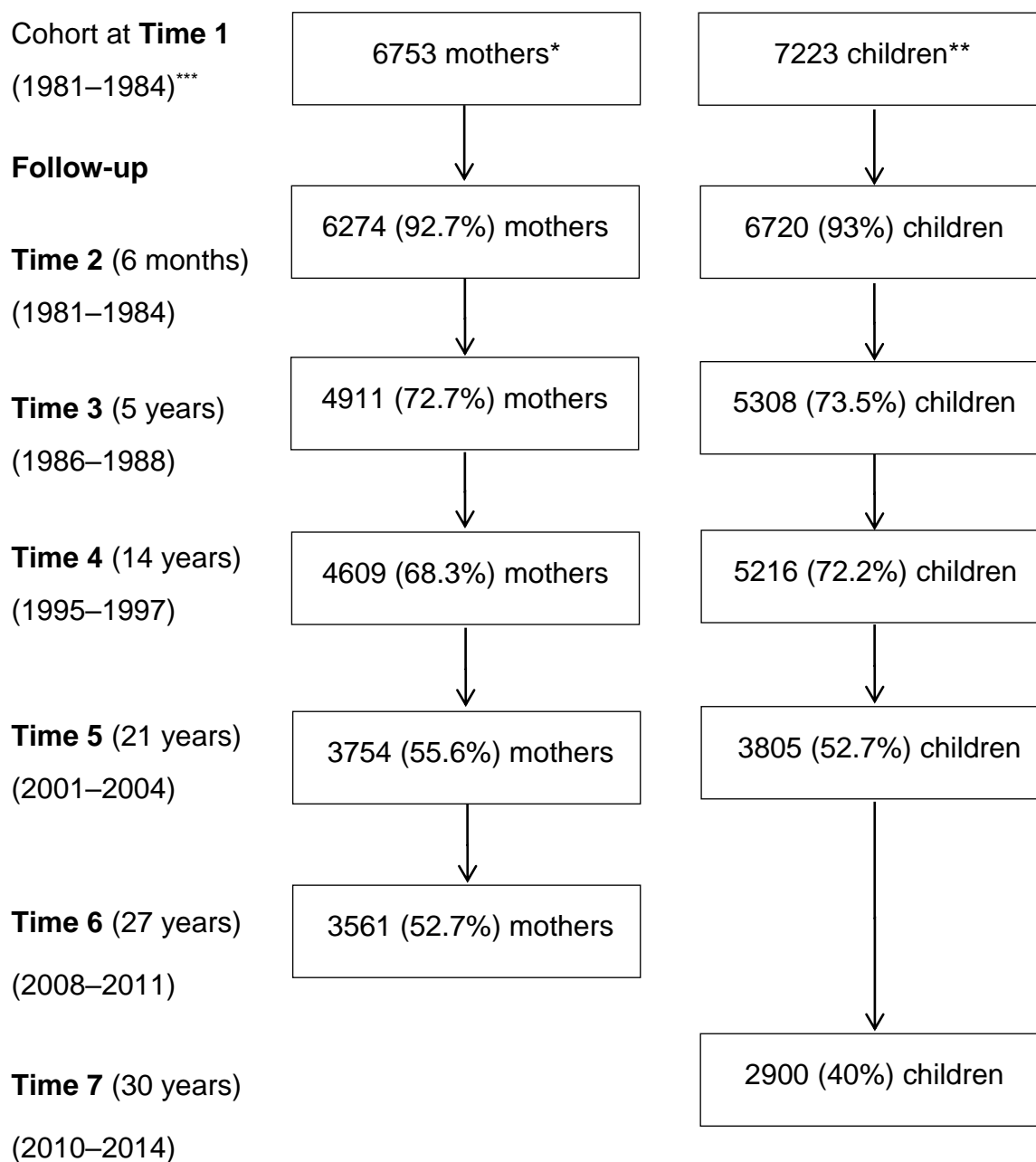
The number of subjects who provided information varies at each phase of the study as well as in each chapter due to those lost to follow-up, missing items in questionnaire responses, or the consistency between dependent and independent variables. Characteristics of those lost to follow-up, therefore, are discussed in each chapter.

3.2.2 Ethical clearance

Ethics committees from the Mater Hospital and The University of Queensland approved each phase of the MUSP study.

In addition, this PhD project was approved by the Behavioural & Social Sciences Ethical Review Committee, The University of Queensland (approval number # 2013000231).

Figure 3-2 Follow chart of mother and child samples and retention rate over phases of study



Source: (Najman et al., 2014)

Note: * Maternal cohort includes 50 mothers who had only multiple birth deliveries in study; ** Child singleton cohort includes 520 sets of sibling pairs; *** Included early pregnancy and late pregnancy data collection.

3.3 Measures of variables

The following section describes the variables and the measures used in the present study. They are divided into: measure of dependent variable (s), measure of independent variables, and covariates. The purpose of this section is to describe how the questions respondents were asked were measured.

3.3.1 Measure of dependent variables

In the present study, outcome variables were divided into two groups: (i) the patterns of maternal alcohol consumption; and (ii) the consequences of these patterns for mothers and also for their children. For mothers, the variables were family outcomes, reproductive health, and subjective well-being at 27-year follow-up; while for offspring, the variables were reported AUD at 21-year follow-up and risk behaviours for problem gambling at 30-year follow-up.

Measure of maternal alcohol consumption

There are several methods of measuring alcohol consumption such as graduated-frequency (GF), Knupfer Series (KS), and weekly recall diary (Greenfield, 2000; Heeb & Gmel, 2005; Sobell & Sobell, 1992; Stockwell et al., 2004). In the MUSP study, researchers used a quantity-frequency (QF) approach to measure mothers' typical or usual alcohol consumption pattern.

At each survey, women were asked how often they drank alcohol and how much alcohol they consumed at each occasion. Six pre-specified response options, ranging from never to daily alcohol consumption and from none to seven or more standard drinks (a standard drink is equivalent to a glass of alcohol which contains about 10 grams of pure alcohol), were provided. Guidelines from the Australia National Health and Medical Research Council in 2009 (NHMRC, 2009) suggest that women's alcohol consumption should be calculated on the basis of weekly alcohol consumption of a standard drink (containing 10 grams of pure alcohol). Alcohol consumption scores were estimated using a method described by Dawson (2003): multiplying the mid-point estimation of frequency by the mid-point of quantity (Table 3-1). For example, if a respondent reported she consumed alcohol daily with three to four standard glasses on a drinking day, the mid-point estimate was coded as 7 times a week (for frequency) and 3.5 glasses a week (for quantity)

consumed). Respondent's alcohol consumption scores, in this case, were about 24.5 as the product of the mid-point estimates of frequency and quantity of alcohol consumption.

Table 3-1 Frequency-quantity questions measuring self-report alcohol consumption

<i>Frequency-quantity questions</i>	<i>Mid-point estimation (per week)</i>
How often do you drink alcohol?	
Daily	7
A few times a week	3
A few times a month	0.75
A few times a year	0.1
Rarely	0.05
Never	0
How much alcohol do you drink at each occasion?	
Seven or more glasses	10
Five or six glasses	5.5
Three or four glasses	3.5
One or two glasses	1.5
Less than one glass	0.5
Never drink	0

Alcohol consumption at Time 1 (pre-pregnancy) was retrospectively assessed using mother's self-report at the first prenatal visit; while post-birth, consumption at Time 2 (6 months), Time 3 (5 years), Time 4 (14 years), and Time 5 (21 years) was assessed from the mother's self-report of current consumption. For consistency with other studies (French et al., 2014; Powers & Young, 2008), respondents' levels of alcohol consumption were categorised as non-drinkers (never drink), occasional drinkers (<1 drink per week), moderate drinkers (from 1 to 14 drinks per week), and heavy drinkers (>14 drinks per week). Table 3-2 presents the distribution of alcohol consumption among women at each phase of study.

Self-report measurement of alcohol consumption has been validated and widely used in both clinic and population samples (Del Boca & Darkes, 2003; Livingston & Callinan, 2015; Stockwell et al., 2004). This method is also popular as it costs less, being non-invasive and acceptable to respondents (Del Boca & Darkes, 2003). However, it may be the case that respondents underreport their level of alcohol consumption. This bias tends to involve a systematic level of underreporting by the heaviest drinkers (Stockwell et al., 2004) although it may be different from other groups (Livingston & Callinan, 2015).

Table 3-2 Frequency of alcohol consumption from baseline to 21-year follow-up

Phase of study	N	Percent
<i>Pre-pregnancy</i>	6753	100
Abstainers	1671	24.9
Occasional drinkers	2678	39.9
Moderate drinkers	2033	30.3
Heavy drinkers	323	4.8
<i>6 months follow-up</i>	6226	100
Abstainers	1663	26.7
Occasional drinkers	2613	42.0
Moderate drinkers	1860	29.9
Heavy drinkers	90	1.5
<i>5 years follow-up</i>	4821	100
Abstainers	1106	22.9
Occasional drinkers	2183	45.3
Moderate drinkers	1442	29.9
Heavy drinkers	90	1.9
<i>14 years follow-up</i>	4600	100
Abstainers	842	18.3
Occasional drinkers	2009	43.7
Moderate drinkers	1581	34.4
Heavy drinkers	168	3.6
<i>21 years follow-up</i>	3694	100
Abstainers	513	13.9
Occasional drinkers	1393	37.7
Moderate drinkers	1604	43.4
Heavy drinkers	184	5.0

Women's marital relationship

Women's marital relationship was assessed at the 27-year follow-up and included marital status which was measured using four categories: single, cohabiting, married, and separated/divorced/widowed. Due to the low percentage of single respondents (2.6%), marital status was regrouped into married, single/cohabiting, and separated/

divorced/widowed. The marital relationship variable was also measured by divorce and the number of partners. Women were asked 'Have you ever been divorced?' with possible responses never and ever. Women's number of partners was assessed by the question 'How many partners have you lived with for at least 3 months since the birth of the study child. The answers were categorised into none (no partner), 1 partner, and 2+ partners.

Women's reproductive history

Women's reproductive history was measured at the 27-year follow-up by two questions: 'How many times have you given birth to a live child?' and 'How many times have you had a termination?'. The responses were grouped as 1–3 children and 4+ children for the number of birth children; and none and 1+ times for pregnancy termination.

Women's subjective wellbeing

Wellbeing was measured by women's subjective assessment of happiness and satisfaction. Women were asked to self-rate their 'happiness' by responding to the question 'How would you say you feel these days?'. Possible responses were categorised into very happy, happy, and unhappy. Satisfaction was assessed by asking women the question 'How satisfied are you with your life as a whole these days?'. The answers were grouped into very satisfied, satisfied, and dissatisfied. These global questions regarding happiness and life satisfaction have been commonly used in previous studies (Fischer et al., 2014; Najman & Levine, 1981).

Offspring's alcohol use disorder

Offspring's AUD was assessed at the 21-year follow-up. The diagnosis of alcohol use disorder was obtained by administering the life-time (computerised) version of the Composite International Diagnostic Interview (CIDI) (WHO, 1993). The CIDI has been used in a range of epidemiological studies and has been shown to be a reliable and valid instrument (Hall et al., 1999; Teesson et al., 2000). This tool also provides the ICD-10 and DSM-IV diagnoses of alcohol abuse and alcohol dependence. Lifetime ever alcohol abuse or alcohol dependence were combined to create the category lifetime ever AUD, using DSM-IV diagnostic criteria (APA, 2000).

Young adult's problem gambling

At the 30-year follow-up, young adults were asked the question 'Do you spend money on gambling?' with possible responses 'yes' or 'no'. Those responding 'yes' were asked to complete a short version of the Canadian Problem Gambling Index (CPGI) to determine their levels of problem-gambling behaviours over the last 12 months. The CPGI is a well validated instrument (Ferris & Wynne, 2001) and has been widely used in previous studies in Australia and other countries (Abbott, Volberg, et al., 2004). Table 3-3 describes the nine-item Problem Gambling Severity Index which is a shortened version of the CPGI.

Table 3-3 Problem Gambling Severity Index

Responses: never = 0; sometimes = 1; most of the time = 2; always = 3
Bet more than afford to lose
Gamble with larger amounts
Tried to win back losses
Borrowed or sold to get money
Felt have a problem with gambling
Caused health problems
Told had gambling problem
Caused financial problems
Felt guilty about gambling

The score for each of the nine questions were added to generate an overall score ranging from 0 to 27 where respondents were classified into one of four gambling behaviour categories: 0 = non problem gamblers, 1–2 = low risk, 3–7 = a moderate risk, and 8+ = a problem gambler (Ferris & Wynne, 2001). Consistent with other studies (Acil Allen Consulting, 2014; Billi et al., 2014; Sproston et al., 2012), the proportions of moderate risk and problem gamblers in our study were low, 3.2% and 1.1%, respectively. To increase the statistical power, we collapsed four problem-gambling behaviours into two, where 0 = non problem gambler or no risk behaviour and 1+ = some risk behaviours associated with problem gambling. This is also the cut-off point of 10% of the population sample.

3.3.2 Measure of independent variables

The objectives of the present study are to examine not only the patterns of maternal alcohol consumption over women's reproductive life course but also the factors associated with particular drinking trajectories. The literature review in Chapter 2 provided the rationale for the selection of factors associated with and confounded drinking trajectories. The independent variables in the present study were defined as the information measured at pre-pregnancy which included maternal socio-economic status, lifestyle behaviours, stressful life events and mental health symptoms. In addition to these baseline variables, I also measured some covariates or confounding variables at different phase of study. These covariates included parental illicit drug use/problems, the quality of family communication, child's socio-economic status, child's antisocial behaviours, and child's alcohol and tobacco consumption at different phase of study.

Measure of maternal socio-economic status and religious activities at baseline

Maternal socio-economic characteristics were measured at pre-pregnancy by the following variables: maternal age, maternal educational level, maternal marital status, family income, and number of children.

In the present study, mothers were asked their date of birth at Time 1. Age was scored to the nearest year. The mean age was 25 years (SD = 5.15); the youngest of the mothers was 14 years old while the oldest mother at baseline was 47 years old. The maternal age variable was used as a continuous variable or discrete variable depending on the purpose of the analysis. More details are described in specific chapters.

Mother's education was self-reported at recruitment and reflected the highest level of education attained. These levels were categorised as: incomplete high school, completed high school only, and completed post high school education (college/university and other technical and further education training, TAFE).

At baseline, women reported one of four categories for their marital status: single, married, living together, or separated/divorced/widowed. I collapsed marital status into three categories: single, living together/ separated/divorced/ widowed, and married (reference group). This grouping was due to the small proportion of separated/divorced/widowed women (2.2%) and the different socio-economic characteristics between those who reported living together and those who were married (Khoo, 1987). In some instances, maternal marital status at 14 years was measured by asking the mother the

question ‘Is your present partner the father of this child?’ Possible responses—yes, no, and no partner—were collapsed into two categories: biological father and not biological father/no partner.

Family income was measured at baseline as low, \$10 399 or less; and medium-high, \$10 400 or more. The threshold of \$10 399 or less is estimated to be at around the poverty level in 1981–1983 (Najman et al., 2004). In addition, family income was also measured at the 14-year follow-up with two categories: \$20 800 or more and \$20 799 or less. The threshold \$20 799 or less is estimated to be at around the poverty level in 1995–1996 (Saunders, 1996).

Table 3-4 Characteristics of the number of children women had at each phase of study

Phase of study	Distribution of parity at each phase of study				
	N	Mean	SD	Min	Max
Pre-pregnancy	6218	1	1.2	0	8
Time 2–6 months follow-up	6218	2	1.2	1	9
Time 3–5 years follow-up	4843	2.6	1.1	1	10
Time 4–14 years follow-up	4134	2.8	1.2	1	11
Time 5–21 years follow-up	3048	2.8	1.2	1	11

The parity or the number of children in the family was measured on the basis of number of live-births women reported at their obstetrical visit at Time 1 and subsequent births reported at each follow-up. Table 3-4 describes the characteristics of parity women had at each phase of the study. The variable was used in both continuous and categorical forms according to the content of the chapters.

Church attendance was assessed at baseline by the question ‘How often do you go to church?’. Possible responses were weekly, monthly, less than once a month, and never attend. For the purpose of analyses, I collapsed the four categories into three: weekly/monthly, less than once a month, and never.

Measure of health lifestyle behaviours at baseline

Health-related lifestyle was measured using questions adapted from Breslow’s Lifestyle Index (Belloc et al., 1971) which has been validated and widely used in previous studies (Breslow & Enstrom, 1980; Haruyama et al., 2012; Noguchi et al., 2015). Table 3-5

presents the items related to Breslow's lifestyle. The Breslow's Lifestyle Index scores were added to generate a composite variable of healthy lifestyle ranging from 0 to 7. These scores were categorised into three groups: good (0–2), the reference group; average (3); and poor (4+).

Table 3-5 Items adapted from Breslow's Lifestyle Index

Questions	Coding
How many hours sleep did you usually get a night?	6 hours or less and 7 hours = 1; 8 hours and 9 hours or more = 0
How often did you eat breakfast?	rarely or never = 1, sometimes and almost every day = 0
How often did you eat in between your regular meals?	rarely or never = 0, sometimes and almost every day = 1
How often were you involved in any physical activities including active sport, swimming/taking long walks, and weekend trips in car, gardening, and physical exercise?	often and sometime = 0, and never = 1
How many hours a day did you watch television	never, less than 1 hour, 1–3 hours, 3–5 hours = 0; 5–7 hours and more than 7 hours = 1
How many times a week did you smoke cigarettes	not at all = 0; once, every few days, and every day = 1
Maintenance of proper weight, body mass index (BMI).	BMI (kg/m ²) = 0 if $18.5 \leq \text{BMI} \leq 24.9$; BMI (kg/m ²) = 1 if $\text{BMI} < 18.5$ and $\text{BMI} \geq 25$

Measure of stressful life events or adversity at baseline

The measure of a women's stressful life events was derived from a modification of the Social Readjustment Rating Scale (Table 3-6) by Holmes and Rahe (1967). Stressful life events were measured at the baseline by a series of items referring to events that women and their partners may have experienced within the past six months. Adversity was classified on the basis of average scores: low adversity (0–2 events) and high adversity (3+ events); the reference group was low adversity.

Table 3-6 Items adapted from the Social Readjustment Rating Scale

Items
(Responses: no = 1; yes = 0)
Someone close to you died or been seriously ill
Had a big problem with your own health
Had serious disagreements with your partner
Had serious disagreements with someone else close to you
Had serious financial problems
Had a major change in your partner's job situation
Had a major change in your job situation
Had any serious problems with housing or accommodation
You or your partner had a problem with the law

Measure of mental health symptoms at baseline

Women's mental health at baseline was assessed using the short form of the self-reported Delusions-Symptoms-States Inventory (DSSI) (Bedford et al., 1976). Seven symptoms were used to evaluate maternal depression (Cronbach's alpha = 0.787) and anxiety (Cronbach's alpha = 0.763) (more details in Table 2-7 and Table 2-8). For the purpose of this study, women were classified as depressed or anxious if they reported four or more of seven symptoms related to depression or anxiety, respectively. This approximates the clinical cut-off implied by Bedford and Foulds (Bedford & Foulds, 1977).

Birth outcomes

We included three variables representing birth outcomes. Birth outcome information was obtained by obstetricians who both worked at the hospital and were study investigators. Birth weight was categorised as normal (2,500 grams or more), the reference; and low birth weight (2,499 grams or less). Gestation was dichotomised into normal as the reference group (37 weeks or more) and preterm (36 weeks or less). Time to establish respiration was categorised as less than three minutes (reference group) and three minutes or more.

Table 3-7 DSSI items evaluating maternal depression

How you have been feeling recently?

(all the time = 1; most of the time = 2; some of the time = 3; rarely = 4; never = 5)

Have been so miserable that I have had difficulty sleeping

Have been depressed without knowing why

Have gone to bed not caring if I never woke up

Been so low in spirit that I have sat up for ages doing absolutely nothing

Future seems hopeless

Have lost interest in just about everything

Been so depressed that I have thought of doing away with myself

Table 3-8 DSSI items evaluating maternal anxiety

How you have been feeling recently?

(all the time = 1; most of the time = 2; some of the time = 3; rarely = 4; never = 5)

Have worried about every little thing

Have been breathless or had a pounding of my heart

Have been so worked up that couldn't sit still

For no good reason have had feelings of panic

Have had a pain or tense feeling in neck or head

Worrying has kept me awake at night

Been so anxious that couldn't make up mind about the simplest thing

3.3.3 Measure of covariates

Measure of parental illicit drug use

Existing evidence has also suggested that parental illicit drug use or illicit drug related problems have an adverse impact on offspring's alcohol consumption (Biederman et al., 2000; Mares et al., 2011). We measured parental illicit drug use with two variables: maternal illicit drug use at the 5-year phase of the study and paternal alcohol problems at the 14-year phase. At the 5-year follow-up survey, mothers were asked how often they used cannabis (i.e. marijuana, pot) in the last month, with prompts from every day to never. The responses were categorised into a binary variable 'users' and 'non-users'. At the 14-year follow-up, mothers provided information on the child's natural father's alcohol

use by answering the question, 'Has the natural father of your 13 year old had an alcohol problem?'. Three prompt responses were provided: no, yes, and do not know. Due to low frequencies of 'do not know' (5.5%), responses were grouped into two categories: yes and no/do not know.

Measure of family communication

The quality of family communication between mother and child may impact the association between maternal alcohol consumption and children alcohol use (Alati, Najman, et al., 2005; Barnes et al., 2000; Mares et al., 2011; Marsden et al., 2005; Ryan et al., 2010; Sandra & Christopher, 2014). In the present study, I used The Open Family Communication Scale (Barnes & Olson, 1982) to assess the quality of mother-child communication at the 14-year follow-up. The scale is comprised of 10 items measured on a five-point Likert scale showing the extent of agreement with each item (Table 3-9), low score represents open communication. The internal consistency, Cronbach's alpha value, was 0.85. The composite variable was classified into three categories: good (low thru 32.9), fair (33 thru 35), and poor (35.1 thru high) communication.

Table 3-9 The Open Family Communication Scale items

How well do the following statements describe your communication with your child?

(strongly agree = 1; agree = 2; unsure = 3; disagree = 4; strongly disagree = 5)

I can discuss my beliefs with my child without feeling restrained or embarrassed.

My child is always a good listener.

My child can tell how I'm feeling without asking.

I am very satisfied with how my child and I talk together.

If I were in trouble, I could tell my child.

I openly show affection to my child.

When I ask questions, I get honest answers from my child.

My child tries to understand my point of view.

I find it easy to discuss problems with my child.

It is very easy for me to express all my true feelings to my child.

Measure of offspring's antisocial behaviours

The association between maternal alcohol consumption and young adult's AUD may also reflect the child's antisocial behavior (Englund et al., 2008; Sartor et al., 2007). At the 14 year follow-up, we used the Youth Self-Report (YSR) (Achenbach, 1991) to assess

youth antisocial behavior/externalising behaviour (consisting of aggression and delinquency). Table 3-10 describes the YSR items related to child's antisocial behaviours. The YSR has been widely used as a measure of child's antisocial behavior. A composite variable with total of 30 items and a Cronbach's alpha value of 0.88 was used with 10% cut-offs designating 'cases'.

Table 3-10 YSR items related to child's antisocial behaviours

Which best describes your behaviour in the last six month? (often = 1; sometime = 2; rarely/never = 3)	
Does not seem to feel guilty after doing something wrong	Destroys things belonging to others
Hangs around with children who get in trouble	Disobeys at school
Lying or cheating	Easily jealous
Prefers being with other kids	Gets in many fights
Runs away from home	Attacked people physically
Sets fires	Screams a lot
Steals at home	Showing off or clowning
Steals outside home	Sudden changes in mood or feeling
Swearing or obscene language	Stubborn, sullen or irritable
Skips school	Talks too much
Uses alcohol or drugs for non-medical purposes	Teases a lot
Argues a lot	Cruelty, bullying or meanness to others
Bragging	Demands a lot of attention
Destroys his/her own things	Threatens people
Temper tantrums or hot temper	Usually loud

Measure of child's alcohol and tobacco consumption

Previous studies have suggested that early adolescent tobacco consumption is generally associated with AUD and the development of alcohol- related problems (Jackson et al., 2002; Mathers et al., 2006; Orlando et al., 2005; Wetzels et al., 2003). In this study, at the 14-year follow-up, offspring reported the average number of cigarettes they consumed during the week preceding the survey. Their responses were divided into two categories: non-smokers and smokers.

Child's alcohol consumption was measured at the 21-year follow-up by using frequency-quantity questions similar to those used to assess mother's alcohol consumption at each phase of study. Due to the low proportion of heavy alcohol consumption by offspring of mothers characterised by a moderate-escalating drinking trajectory and risk behaviours of problem gambling, I treated child's alcohol consumption as a covariate to test the possibility that maternal alcohol-consumption patterns could be related to offspring's alcohol consumption which in turn could be associated with offspring's problem-gambling behaviours.

3.4 Data analyses

The present study addresses three aims: (i) explore how the patterns of women's alcohol consumption changes over their life course; (ii) determine why these patterns change over time; and (iii) investigate the health and consequences associated with the patterns of alcohol consumption among women. To achieve the first aim, we employed latent class analysis, namely the group-based trajectory method, to project possible trajectories of women's alcohol consumption over time. Logistic regression analysis was used to obtain the second and third aims. Detailed information about the data analysis plan for specific dependent variable(s) and independent variable(s) is given in the methods section of relevant chapters. The following sections provide general information about statistical analyses used in this study.

3.4.1 Group-based trajectory method

The interest in exploring long-term patterns of human behaviour over time is a central theme of life course study in sociology, criminology, and other human behaviour sciences. From a wide variety of statistical methods available for the task, I selected the group-based trajectory model. Group-based trajectory modelling was developed by Nagin (2005) and his colleague (Jones & Nagin, 2007; Nagin & Odgers, 2010b), and has been applied in many longitudinal studies (Cook et al., 2013; Nagin & Tremblay, 2005; Xie et al., 2006). The group-based trajectory is an example of a finite mixture model that measures the course of an outcome over age or time. In general, the group-based trajectory provides a flexible and easily applied method for identifying distinctive clusters of individuals who follow similar developmental trajectories. The method uses maximum likelihood for the estimation of the model parameters. Group-based trajectory modelling is able to be used

with psychometric scale data, count data and dichotomous data. The method also uses different polynomial orders to identify different number of trajectory classes (Jones & Nagin, 2013).

The fundamental concept of group-based trajectory method (Jones & Nagin, 2013) is the distribution of outcomes conditional on time (in the present study but it may be age in other studies); that is, the distribution of outcome trajectories (alcohol consumption trajectory) denoted by $P(Y_i|Time_i)$, where the random vector Y_i represents individual i 's longitudinal sequence of behavioural outcomes and the vector $Time_i$ represents individual i 's time point when each of those measurements is recorded. The group-based trajectory model assumes that the population distribution of trajectories arises from a finite mixture of unknown order J . The likelihood for each individual i , conditional on the number of groups J , may be written as:

$$P(Y_i|Time_i) = \sum_{j=1}^J \pi^j \times P(Y_i|Time_i, j; \beta^j)$$

where π^j is the probability of membership in group j , and the conditional distribution of Y_i given membership in j is indexed by the unknown parameter vector β^j which among other things determines the shape of the group-specific trajectory. The trajectory is modeled with up to a fifth-order polynomial function of time (in the present study but it may be age in other studies). For given j , conditional independence is assumed for the sequential realisations of the elements of Y_i , y_{it} , over the T periods of measurement. Thus, the equation is written as:

$$P(Y_i|Time_i, j; \beta^j) = \prod_{t=i}^T p(y_{it}|time_{it}, y; \beta^j)$$

where $p(y_{it}|time_{it}, y; \beta^j)$ is the distribution of y_{it} conditional on membership in group j and the time of individual i at time t .

In addition to the unadjusted trajectory model, the group-based trajectory also provides a capacity to adjust for confounding by analysing the effect of the time-stable covariate on the probability of group membership, and the effect of time-dependent covariates on the trajectory itself. In the present study, I applied both time-stable and time-

varying covariates such as mother's age and parity to define the shape of the trajectory and membership of each trajectory.

Specifically, we employed the censored normal model to estimate the developmental trajectories of alcohol consumption over the mothers' reproductive life course. To reduce the effects of the skewed distribution of alcohol consumption score, a square root transformation was applied to alcohol data, consistent with other studies (Bobo et al., 2013).

We first used the unadjusted model to identify the optimal number of trajectory groups. We used quadratic, cubic, quartic polynomial terms to describe nonlinear trajectories as (i) mother's alcohol consumption was measured at four or five time points, and (ii) mother's age at each occasion was inconsistent. This selection is supported by Britton et al. (2015)'s study. The best fitting model was selected using the criteria of Bayesian Information Criterion (BIC) and the requirement of minimum mean posterior probability of the group (0.70 or greater in all groups). These criteria were also considered together with previous knowledge about women's alcohol consumption (Xie et al., 2006). Then, as suggested by previous studies (Jones & Nagin, 2007; Jones & Nagin, 2012), maternal age and parity were added to the model. We included maternal age at Time 1 as a fixed (time stable) covariate in the adjusted model since age is synchronous with the time variable in our data. However, parity at each time point was added as a time-varying (time-dependent) covariate in the adjusted model. The BICs of unadjusted and adjusted models were compared to select the best-fit model for further analyses. The paired sample *t*-test was applied to test mean daily alcohol consumption differences across surveys.

In this study, two longitudinal-research tasks proposed by Lanza et al. (2013) were performed: identifying trajectories of maternal alcohol consumption and using these trajectories to predict consequence outcomes associated with these trajectories. Therefore, maternal alcohol consumption trajectories in Chapter 4 and 5 are treated as the dependent variable; while in Chapter 6, 7, and 8 they are considered the independent variable in relation to hypothesised subsequent (in time) outcomes.

3.4.2 Prediction analyses

To achieve the second and third aims of the study, we initially assessed collinearity to examine the correlations among independent variables and covariates (Dormann et al., 2013; Mason & Perreault Jr, 1991). As a rule of thumb, if any of the variance inflation

factor (VIF) values exceeds 5 or 10, it implies that the associated regression coefficients are poorly estimated due to multicollinearity (Montgomery, 2008).

I then used cross tabulation and chi square tests to examine the potential association between dependent variable (e.g. maternal alcohol consumption trajectories in Chapter 4 and 5) and a variety of independent variables such as social demographic characteristics, mental health symptoms, and parity.

Next, I tested a bivariate prediction model or unadjusted model where there are dependent and independent variables in the model. The dependent variable in all chapters is a categorical variable with two, three, or four categories. Therefore, to examine its association with independent variables I employed binary logistic regression, ordered logistic regression, or multinomial logistic regression where appropriate.

Finally, I analysed multivariate prediction models or adjusted models where I control for other statistically significant independent variables and possible covariates. Again, binary logistic regression, ordered logistic regression, or multinomial logistic regression methods were applied according to the nature of the dependent variable.

Depending on the purpose of each chapter, I subsequently adjusted the association between dependent variable and independent variables using a range of covariates in different models to examine whether or not each predicting variable/group of variables confounded the associations. In Chapter 6 and 7, in order to examine how maternal alcohol consumption trajectories impact on young adult offspring's outcomes (AUD and risk of problem gambling), I performed all the analyses separately for male and female offspring.

3.4.3 Attrition analyses

Like other longitudinal studies, MUSP has to deal with the attrition or the loss to follow up from its original cohort. According to Figure 2-2, at the 21-year and 27-year follow-up only 3561 (52.7%) and 3754 (55.6%) mothers, respectively, provided their information while there had been 6753 mothers at baseline. Similarly, 52.7% of offspring remained in the study at the 21-year follow-up. The number reduced to 40% for the survey at 30 years after the birth. Missing data due to attrition and non-response may lead to lower study power and possibly lead to biases (Chatfield et al., 2005; Deeg, 2002; Twisk & de Vente, 2002).

I examined whether attrition affected the study results by employing the chi square test and multivariate logistic regression to compare the profile of those who were lost to follow-up and those who stayed in the study, and to predict those who would be lost to follow-up. In these analyses, I included some baseline variables which were available for all respondents such as socio-economic status, mental health symptoms, adversity.

Assuming the attrition is random, we applied multiple imputation (MI) calculation with 20 cycles and 50 cycles of imputation to complete the data. Then, I re-analysed the prediction models on the completed data to see if they produced similar or different results to the original results. Detailed information is given in relevant chapters where available.

CONCLUSION

This chapter has described the theoretical framework, the materials, and the methods used to examine the aims of study. In order to achieve the study aims, data were taken from multiple phases of the MUSP, between baseline survey (first clinic visits, average at 18 weeks of pregnancy) and 30 years follow-up survey.

Chapter 4 and chapter 5 will be devoted to explore the short-term and long-term patterns of alcohol consumption by women over 6 months, after the birth of the baby and over 21 years follow-up survey. I will also examine the predictors associated with the short-term and long-term patterns of maternal alcohol consumption. The dependent variables or outcomes of interest were short-term (data available for 6957 women) and long-term (data available for 3715 women) maternal alcohol consumption patterns. The main independent variables, measured at baseline survey, were maternal socio-economic status (marital status, income, parity, previous marriage, and church attendance), mental health, experience of adversity, health related lifestyle, and birth outcomes (birth weight, gestation, and respiration). Possible covariates at baseline survey were assessed in the analyses. Chapter 4 and 5 will address the research aim 1 and 2 of the current study.

By exploring the patterns of alcohol consumption over women's reproductive life course, the following chapters, chapter 6 to 8, are established to achieve the research aim 3: investigate the social and health consequences of mothers and their offspring associated with the patterns of alcohol consumption by women over the reproductive life course. Specifically, in chapter 6 and 7, I will examine the causal association between maternal alcohol consumption trajectories and their offspring's alcohol use disorder (data

available for 2531 mothers and their children remaining in the study at 21 years) and offspring's risk of problem gambling behaviour (data available for 1691 mothers and their children remaining in the study at 30 years). The dependent variables were offspring's alcohol use disorder (measured at 21 years) and risk of problem gambling (measured at 30 years); the main predictor were the patterns of maternal alcohol consumption, measured over 14 years and 21 years, respectively. A list of possible confounding variables, measured at baseline, 5, 14, and 21-year follow-up was included in the analyses.

In addition, in chapter 8, I will examine the associations between maternal alcohol consumption trajectories (measured over 21 years as main independent variable) and women's social and health consequences (marital relationship outcomes, reproductive history, and wellbeing outcomes), measured at 27 years as dependent variables. Measure of the same outcome behaviours together with socioeconomic status variables and mental health symptoms, measured at baseline survey were incorporated into the analyses. Data available for 3337 consecutive women giving birth in a public hospital and were followed-up over 27 years.

Chapter 4: PREDICTORS OF MATERNAL DRINKING TRAJECTORIES BEFORE AND AFTER PREGNANCY: EVIDENCE FROM A LONGITUDINAL STUDY

This chapter presents the findings relating to maternal drinking patterns before and after 6 months of pregnancy. Data were available for 6957 women. These data were analysed using group based-trajectory analysis over four time points, from pre-pregnancy (recall of alcohol consumption), early pregnancy (at about 18 weeks' gestation), late pregnancy (at about 25 weeks' gestation), and the six-month follow-up after the birth of baby. Predictors associated with drinking trajectories were examined using multinomial logistic regression. Three trajectories of maternal alcohol consumption were identified: abstainers/minimal consumption (53.2%), light consumption (39.4%), and heavy consumption (7.4%). The heavy consumption group substantially reduced their consumption in pregnancy but increased their consumption once the baby was born. Some 80.0% of this group were breastfeeding their babies. The light consumption group had only minor changes in their drinking pattern. Lower family income, being married, high frequency of church attendance, low level of adversity, poor health lifestyle, remaining married to original partner, and having many children predicted membership of the abstaining/minimal consumption trajectory. Being unmarried, having only one child, having poor health lifestyle, and never going to church predicted membership of the heavy consumption group. Women who consume higher levels of alcohol prior to their pregnancy reduce their consumption once pregnant; but tend to increase their alcohol consumption shortly after the birth.

4.1 Introduction

4.1.1 Patterns of maternal drinking pre and postpartum period

It has been estimated that between 38% and 82% of pregnant women in Australia consume alcohol (Anderson et al., 2013; Callinan & Room, 2012; Hutchinson et al., 2013) despite the possible adverse social and health outcomes (Kesmodel et al., 2012; Nykjaer et al., 2013). Alcohol consumption in pregnancy varies widely across countries, with estimates from 30% in the United States (Ethen et al., 2009) to 52% in France (De

Chazeron et al., 2008) and 71% in Denmark (Kesmodel et al., 2003). It is known that patterns of alcohol consumption change from pre-pregnancy to post pregnancy and that a majority of women reduce or abstain from alcohol consumption once they learn they are pregnant. However, once their child is born, many women have been found to return to the level of alcohol they consumed before they became pregnant, some concurrently while breastfeeding (Anderson et al., 2013; Callinan & Room, 2012; Giglia & Binns, 2007; Maloney et al., 2011; Meyer-Leu et al., 2011). Studies of women's alcohol consumption during pregnancy are limited by a reliance on non-population based samples (Meyer-Leu et al., 2011) and cross-sectional research designs (Maloney et al., 2011; Meyer-Leu et al., 2011) or even longitudinal studies which have linked only alcohol consumption before and during pregnancy (Anderson et al., 2013; Callinan & Room, 2012; Ethen et al., 2009) or during and post pregnancy (Breslow et al., 2007; Giglia & Binns, 2007; Maloney et al., 2011) but not over the prenatal to postnatal period. Further, little consideration has been given to the possibility that some women may change their drinking patterns more than others. There have been few previous studies of the social and environmental predictors of alcohol consumption pre and post pregnancy.

4.1.2 Predictors associated with drinking patterns among pregnant women

Research consistently links social demographic characteristics, mental health and other factors such as adversity and health related lifestyle to the pattern of alcohol consumption during pregnancy (Anderson et al., 2013; Ethen et al., 2009; Maloney et al., 2011; Skagerstrom et al., 2011). Most studies suggest that higher income is associated with drinking during pregnancy (Ethen et al., 2009; Giglia & Binns, 2007). High parity has also been found to predict more alcohol consumption during pregnancy (Hotham et al., 2008; Tamaki et al., 2008). Despite these general areas of agreement, there are still areas of uncertainty (Skagerstrom et al., 2011). While a good deal is known about predictors of alcohol consumption during or after pregnancy (Anderson et al., 2013; Maloney et al., 2011; Skagerstrom et al., 2011), less is known about patterns of change in alcohol consumption and predictors of these patterns over the prenatal to postnatal period.

This study uses data from a large Australian birth cohort to examine the trajectories of women's alcohol consumption from the prenatal to postnatal period. We also consider the extent to which the social and environmental context of the mothers impacts on these trajectories.

4.2 Materials and methods

4.2.1 Data source

The data are from the MUSP, a longitudinal pre-birth cohort study of 7223 women and their offspring in Brisbane recruited between 1981 and 1983 (Najman et al., 2005). Baseline data were collected from 7223 women at their first prenatal visit, early pregnancy, at about 18 weeks' gestation. These women were subsequently followed-up in late pregnancy and 6 months after the birth of the baby. This study is based on 6597 women for whom data were available across four time periods. Written informed consent was obtained at each survey. Ethics committees from the Mater Hospital and The University of Queensland approved each phase of study.

4.2.2 Measures of variables

Women were asked how often they drank alcohol and how much alcohol they consumed at each occasion. The questions were framed around the period before the women became pregnant, and early in pregnancy. The questions were repeated at the late pregnancy and the six-month follow-up. Six pre-specified response options ranging from never to daily alcohol consumption and from none to seven or more standard drinks were provided. Alcohol-consumption scores were estimated by multiplying frequency and quantity of alcohol consumption. We divided mothers into four categories: abstainers (no alcohol or very little alcohol), light drinkers (average less than a half glass per day), modest drinkers (half to less than one glass per day), and heaviest drinkers (average one glass per day or more). Maternal alcohol-consumption trajectories are projected based upon the continuous measure of alcohol consumption.

Predictors were assessed by maternal socio-economic status (marital status, income, parity, previous marriage, and church attendance), mental health, experience of adversity, and health related lifestyle at baseline. Marital status was measured by four different categories: single, married, de facto, and separated/divorced/widowed. Due to the low percentage of separated/divorced/widowed group (2.5%) and the different socio-economic characteristics between those who are de facto and those who are married (Khoo, 1987), marital status was regrouped as single, de facto/separated/divorced/ widowed, and married as the reference category. In a sensitivity analysis, we also categorised marital status into two groups—married/de facto and single/separated/divorced/widowed— and repeated the analysis. The results were no different from the original results. As women

who had multiple partners may have poorer health related behaviours (Blomgren et al., 2012), previous marriage was assessed by the yes and no value in which non-previous marriage was a reference category. Church attendance was measured by weekly/monthly (reference category), less than once a month, and never. This classification was based on the evidence that there is an association between the frequency of church attendance and the levels of alcohol consumption among pregnant women (Page et al., 2009). Parity was measured by study child only, two to three children, and four or more children; the reference category was study child only. Family income at first clinic visit was classified into two categories: \$10 399 or less and \$10 400 or more (reference category). The threshold \$10 399 and below is estimated to be at around the poverty level in 1981 to 1983 (Najman et al., 2004).

Maternal mental health was assessed using the short form of the DSSI (Bedford et al., 1976). Comparison of the DSSI with the Edinburgh Postnatal Depression Scale and the Hospital Anxiety and Depression Scale showed that these measures correlate well with each other and provide results that are broadly similar (Najman et al., 2000). Seven symptoms were used to evaluate maternal depression (Cronbach's alpha = 0.787) and anxiety (Cronbach's alpha = 0.763). Mothers were classified as depressed or anxious if they reported four or more of seven symptoms related to depression or anxiety, respectively.

Maternal adversity was conceptualised as events that are likely to significantly disturb a women's daily routine. It was measured using a series of items at baseline. These items refer to the following events that mothers and their partners may have recently experienced: major job changes, problems with police, housing problems, financial problems, health problems, loss (death) of relatives, serious troubles at work, serious disagreement with partners, and marital breakdown. Adversity was classified on the basis of scores as follows: low adversity (0–2 events), as reference category; and high adversity (3+ events).

Table 4-1 The distribution of the sample and predicting variables

Social background and predicting variables	N	Percentage (%)
Age	6597	100
<20	1012	15.34
20–24	2524	38.26
25–29	1901	28.82
30+	1160	17.58
Education level	6569	100
Incomplete high school	1163	17.70
Completed high school	4209	64.07
Post high school	1197	18.22
Family income	6202	100
\$ 10 400 or more	4173	67.28
\$ 10 399 or less	2029	32.72
Number of children	6553	100
Study child only	2646	40.38
Two to three	3218	49.11
Four or more	689	10.51
Marital status	6555	100
Married	5039	76.87
Single	635	9.69
De facto/sep/div/wid	881	13.44
Maternal depression	6475	100
Non depressed	6120	94.52
Depressed	355	5.48
Maternal anxiety	6477	100
Non anxious	5666	87.48
Anxious	811	12.52
Adversity	6425	100
Low (0–2)	5144	80.06
High (3+)	354	9.68
Health related life style	6540	100
Good (0–2)	2250	35.39
Average (3–4)	2658	41.81
Bad (5+)	1450	22.81

Health-related lifestyle was a composite variable constructed using a series of items such as hours slept, eating breakfast, doing exercise at the weekend, hours of watching television and cigarette smoking. The items have previously been used to predict life expectancy in the US population (Belloc et al., 1971). In the present study lifestyle was classified into three categories: good (0–2), as reference category; average (3–4); and poor health lifestyle (5+).

Maternal age was categorised as: <20 years (reference group), 20–24, 25–29, and >30; and educational level was classified as incomplete high school, completed high school (reference group), and post high school.

4.2.3 Data analyses

Statistical analyses were performed by STATA/SE 12. Group based-trajectory modelling developed by Nagin was applied to determine drinking trajectories (Nagin & Odgers, 2010a). The overview and technical application of the method have been described elsewhere (Jones & Nagin, 2013). The modelling is the application of specialised finite-mixture models which assume that a population is composed of a mixture of distinct groups defined by their developmental trajectories. A censored normal distribution was used in the model and applied to alcohol-consumption scores (Jones & Nagin, 2013). The best fitting model of drinking trajectories was selected based on Bayesian information criterion and the posterior probabilities. The paired sample t-test was applied to test mean daily alcohol consumption differences across the surveys. Univariate associations between predictors and drinking trajectories were examined to select significant associations for further analysis. Multivariate multinomial logistic regression controlling for the confounding variables was performed to determine predictors associated with drinking trajectories. A p -value of <0.05 was adopted as a threshold for significant results in all analyses.

Chi-square tests were performed to examine the differences between those who were lost to follow-up and those who remained in the research.

Because researchers use different criteria for assessing the levels of alcohol consumption, we also conducted sensitivity analyses in which we followed Power's (2008)' criteria defining alcohol consumption typically per week. The sensitivity analyses produced results which did not differ from the original results.

4.3 Results

The socio-demographic characteristics and the distribution of variables are presented in Table 4-1. Nearly 70.0% of women were 20 to 29 years of age. The majority of women were married, had completed high school and lived in moderate-income families. Women who only had given birth to the study child comprised 40.0% of the sample. At the baseline, some 5.5% of women met the criteria for depression and 12.5% of women were found to be anxious. About 60.4% of respondents never go to church; some 20.3% attend church less frequently (less than once a month) while the same proportion attend church weekly. Of the women in this sample, nearly 35.4% had a 'good' lifestyle while those who reported experiencing high levels of adversity only accounted for 10.0% of the sample.

The *chi-square tests*' results showed that those who were lost to follow-up were disproportionately young, under 24 years of age, unmarried, had incomplete high school, had a low family income, and were more likely to be experiencing mental health problems at baseline. There was no difference between those who remained in the cohort and those lost to follow-up in terms of alcohol consumption at the baseline survey and the number of children (details in Table 4-2).

Table 4-2 Comparison of characteristics of women who have been included versus those who have lost to follow-up at the six months follow-up survey after the birth

Background characteristics	Women who have been included in the analysis (n = 6597)	Women who have been lost to follow-up (n = 626)	p-value
Age of mothers at baseline survey			
<20	15.33	27.48	<0.001
20–24	38.27	40.42	
25–29	28.82	20.13	
30+	17.58	11.98	
n	6597	626	
Educational level			
Incomplete high school	17.70	23.63	<0.001
Completed high school	64.07	66.56	
Post high	18.22	9.82	
n	6569	601	
Marital status at baseline survey			
Married	76.87	57.36	<0.001
Single	9.69	16.69	

De facto/sep/div/wid	13.44	25.95	
n	6555	605	
Gross family income			
\$10 400 or more	67.28	48.99	<0.001
\$10 390 or less	32.72	51.04	
n	6202	547	
Number of children			
Study child only	40.38	43.10	
Two to three	49.11	45.69	0.766
Four or more	10.51	11.21	
n	6553	116	
Church attendance at baseline			
Weekly/monthly	19.30	15.26	
Less than once a month	20.28	17.58	<0.001
Never	60.43	67.16	
n	6540	603	
Maternal depression at baseline			
Non-depressed	94.52	90.66	<0.001
Depressed	5.48	9.34	
n	6475	610	
Maternal anxiety at baseline			
Non anxious	87.48	81.21	<0.001
Anxious	12.52	18.79	
n	6477	612	
Maternal adversity			
Low (0–2)	76.12	66.79	<0.001
High (3+)	23.88	33.21	
n	5989	536	
Healthy lifestyle behaviour			
Good (0–2)	35.39	24.55	
Average (3–4)	41.81	43.55	<0.001
Bad (5+)	22.81	31.90	
n	6358	558	
Alcohol consumption at baseline survey			
Abstainers	25.75	25.57	
Light drinkers	55.87	53.04	
Modest drinkers	7.85	7.48	0.089
Heaviest drinkers	10.52	13.91	
n	6597	575	

Three drinking trajectories were identified over four time points and presented in Figure 4-1. By examining the baseline categories of alcohol consumption, the trajectories are categorised as follows:

Abstainers/minimal drinkers (53.2% of the sample): This trajectory included mothers who reported no alcohol consumption or who drank minimally on each occasion over four time points.

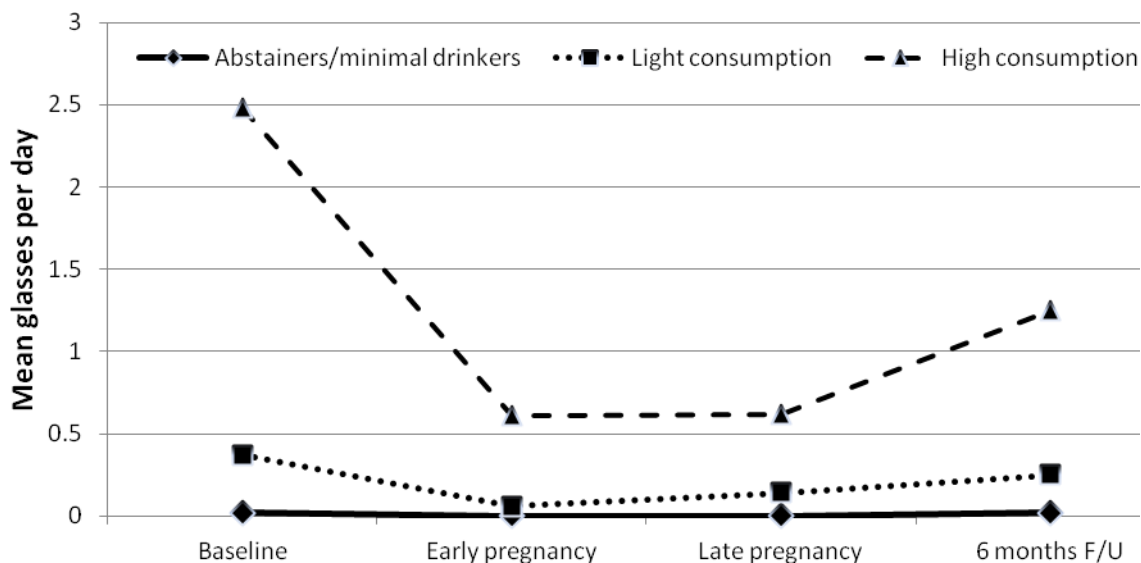
Light consumption (39.4%): Mothers in this trajectory drank an average of 0.37 glasses per day pre-pregnancy. There was a slight fluctuation during their pregnancy, with reduced alcohol consumption in early pregnancy and late pregnancy, respectively. At the six-month follow-up, these mothers had slightly increased their levels of alcohol consumption.

High consumption (7.4%): Mothers in this trajectory group had relatively high levels of consumption in the prenatal period. They had the greatest decline from an average of 2.5 glasses per day pre-pregnancy to approximately 0.61 glasses per day during pregnancy. By the six-month follow-up, the mean level of alcohol consumption had increased to 1.25 glasses per day.

Paired sample t-test results showed significant mean differences in daily alcohol consumption among light consumption trajectory across the time points. For the heavy consumption trajectory from pre-pregnancy to early pregnancy, there was a statistically significant decline in consumption while the levels of alcohol consumption significantly increased to, on average, 1.25 glasses per day by the six month follow-up.

Table 4-3 presents unadjusted association between each baseline predictor and different drinking trajectories. The reference category in all instances was the light consumption group. The abstainers/minimal consumption group were married women who had four or more children, were still married to their original partners, went to church more often, reported experiencing a low level of adversity, and had a relatively poor health lifestyle. Conversely, mothers in the high consumption trajectory were disproportionately those who were currently unmarried but had previously been married, had only one child, rarely or never went to church, lived on a low family income, reported some symptoms of anxiety, and experienced a high level of adversity. Low family income and having a poor health lifestyle predict membership of both the abstaining and high consumption trajectory groups.

Figure 4-1 Trajectories of average daily maternal alcohol consumption during the study periods and t-test results



MEAN GLASSES PERDAY FROM PRENATAL TO POSTNATAL PERIODS (n=6597)

	N (%)	Baseline	Early pregnancy	Late pregnancy	6 months F/U
Abstaining/minimal consumption pattern	3512 (53.24)	0.02**	0	0	0.02**
Light consumption	2599 (39.40)	0.37**	0.06**	0.14**	0.25**
High consumption	486 (7.37)	2.48**	0.61	0.62	1.25**

Note: ** $p < .001$

Adjusted analyses in Table 4-4 show that low income, being married, having many children, remaining married to original partners, going to church more often, experiencing a low level of adversity, and having a poor health lifestyle independently predict members of the abstainers group. Adjustment for maternal age and educational level appeared to reduce the strength of the relationship for all categories with the exception of unhealthy lifestyle where the magnitude of the association slightly increased.

For the heavy consumption group, after adjustment, low income, having a previous marriage, being anxious, and experiencing a high level of adversity were no longer

statistically significant. Mothers who were not currently married, had one child, never attended church, and reported a poor health lifestyle predicted membership of the heavy drinking trajectory.

Table 4-3 Bivariate multinomial logistic regression between alcohol consumption trajectories and predictors at baseline survey

Predicting variables ^a	N	Trajectories of alcohol consumption from prenatal to post-natal periods				
		Light consumption pattern	Abstaining pattern		High consumption pattern	
		Ref. (%)	% ^b	OR (95% CI) ^c		%
Family income						
\$10 400 or more	4173	71.71	64.42	1.00	64.41	1.00
\$10 390 or less	2029	28.29	35.58	1.40 (1.25–1.57)	35.59	1.40 (1.13–1.73)
Marital status						
Married	5039	76.48	80.21	1.00	54.87	1.00
Single	635	9.69	8.34	0.82 (0.69–0.98)	19.46	2.80 (2.14–3.67)
De facto/sep/div/wid	881	13.83	11.46	0.79 (0.68–0.92)	25.67	2.59 (2.03–3.29)
Number of children^d						
Study child only	2646	41.08	38.05	1.00	53.54	1.00
Two to three	3218	49.75	50.37	1.09 (0.98–1.22)	36.46	0.56 (0.46–0.69)
Four or more	689	9.18	11.58	1.36 (1.14–1.63)	10.00	0.84 (0.59–1.17)
Previous marriage						
No	5836	88.08	91.87	1.00	83.40	1.00
Yes	666	11.92	8.13	0.65 (0.55–0.77)	16.60	1.47 (1.12–1.92)
Church attendance						
Weekly/Monthly	1262	14.21	24.76	1.00	7.04	1.00
Less than once a month	1326	22.49	18.81	0.48 (0.41; 0.57)	19.05	1.71 (1.13; 2.59)
Never	3592	63.30	56.43	0.51 (0.44; 0.59)	73.91	2.36 (1.63; 3.41)

Maternal depression							
Non-depressed	6120	94.29	95.02	1.00		92.07	1.00
Depressed	355	5.71	4.98	0.86	(0.69–1.08)	7.93	1.42 (0.98–2.06)
Maternal anxiety							
Non anxious	5666	87.46	88.07	1.00		83.37	1.00
Anxious	811	12.54	11.93	0.94	(0.81–1.10)	16.63	1.39 (1.06–1.82)
Maternal adversity							
Low (0–2)	4559	74.84	78.08	1.00		68.16	1.00
High (3+)	1430	25.16	21.92	0.83 (0.74–0.95)		31.84	1.39 (1.10–1.75)
Health related lifestyle							
Good (0–2)	2250	38.47	34.28	1.00		26.81	1.00
Average (3–4)	2658	42.68	40.87	1.07	(0.96–1.21)	43.83	1.47 (1.16–1.87)
Bad (5+)	1450	18.86	24.84	1.48 (1.28–1.70)		29.36	2.23 (1.71– 2.91)

Note: Bold = $p < 0.05$; ^aAssessed at the pre-pregnancy unless otherwise indicated. ^b The percentage with trajectory of alcohol consumption within each category. ^cUnivariate association. ^d At the time of childbirth.

4.4 Discussion

The study sample is taken from public obstetrical patients who are predominantly from middle to lower economic status, much more likely to be smokers, to be unmarried at the time of recruitment and have exhibited a range of poor health outcomes (Najman et al., 2005). The study suggests that all respondents in the sample fit into one of three alcohol-consumption trajectories from the prenatal to the postnatal period: an abstainer/minimal consumption group; a light consumption group; and a high consumption group. The later is characterised by women who drink heavily prenatally, reduce their consumption during pregnancy, then return to heavier consumption again during the breastfeeding period. The increase of levels of alcohol consumption for the light consumption group is small and not clinically relevant. However, changes in levels of alcohol consumption for the high consumption group raise concerns about alcohol consumption during their period of breastfeeding. Women who were the heaviest drinkers at the baseline survey were most likely to increase their consumption after the baby was born, and consume alcohol around the time they were breastfeeding. Our finding is consistent with that of Giglia and Binns (2007) who reported that women who are heavy drinkers substantially reduce their alcohol consumption during pregnancy but they substantially increase their drinking after pregnancy.

Some of our findings are consistent with previous studies (Anderson et al., 2013; Callinan & Room, 2012; Ethen et al., 2009; Maloney et al., 2011) which confirm that it is common for women to reduce their level of alcohol consumption when they find out they are pregnant. Compared to other groups, the heavy consumption trajectory is a U-shaped curve with significant changes over the prenatal to postnatal period. Of the 486 women in the heavy consumption group, 77.0% reported breastfeeding after the birth (the rate for light consumption is 81.6% and for the abstainers/minimal consumption group is 76.6%, more details in Appendix Table 4-1). This percentage is similar to the percentage of all women in the study sample who breastfed their child after the birth (78.6%). This must be of concern for researchers and those involved in delivering clinical services. Heavy alcohol consumption during breastfeeding may result in negative outcomes for the child, potentially impacting on motor development, drowsiness, and a disrupted sleep pattern (Giglia & Binns, 2006; Hastrup et al., 2014). There is a possibility that women may lack knowledge or ignore the negative effect of alcohol consumption when they are

breastfeeding. A program dealing with the risks associated with heavy alcohol consumption after the birth of a baby should be targeted to women in the heavy consumption group.

Table 4-4 Multivariate multinomial logistic regression between alcohol consumption trajectories and predictors at baseline survey adjusted for mother's age and level of education

Predicting variables ^b	Trajectories of alcohol consumption from prenatal to postnatal periods		
	Light consumption pattern ^a	Abstaining pattern	Heavy consumption pattern
	Ref. (%)	OR (95% CI)	OR (95% CI)
Gross family income			
\$10 400 or more	1.0	1.0	1.0
\$10 390 or less	1.0	1.34 (1.17; 1.53)	0.93 (0.71; 1.21)
Marital status			
Married	1.0	1.0	1.0
Single	1.0	0.64 (0.48; 0.85)	1.65 (1.01; 2.70)
De facto/sep/div/wid	1.0	0.74 (0.61; 0.90)	2.38 (1.76; 3.22)
Number of children			
Study child only	1.0	1.0	1.0
Two to three	1.0	1.16 (1.02; 1.33)	0.58 (0.45; 0.75)
Four or more	1.0	1.32 (1.05; 1.65)	0.59 (0.38; 0.92)
Previous marriage			
No	1.0	1.0	1.0
Yes	1.0	0.77 (0.63; 0.95)	1.14 (0.81; 1.61)
Church attendance at baseline			
Weekly/monthly	1.0	1.0	1.0
Less than once a month	1.0	0.48 (0.40; 0.58)	1.24 (0.79; 1.93)
Never	1.0	0.45 (0.38; 0.53)	1.61 (1.09; 2.40)
Maternal anxiety			
Non anxious	1.0	1.0	1.0
Anxious	1.0	0.91 (0.76; 1.10)	0.98 (0.69; 1.39)
Maternal adversity			
Low (0–2)	1.0	1.0	1.0
High (3+)	1.0	0.79 (0.68; 0.91)	1.11 (0.85; 1.44)
Health related lifestyle			
Good (0–2)	1.0	1.0	1.0
Average (3–4)	1.0	1.15 (1.01; 1.31)	1.36 (1.04; 1.78)
Bad (5+)	1.0	1.61 (1.36; 1.90)	1.80 (1.30; 2.48)

Note: Bold = $p < 0.05$; ^a Reference group. ^b Adjusted for maternal age, level of education and other significant predictors in bivariate analyses.

In our analysis, it appears that lower income predicts membership of the abstaining/minimal consumption trajectory. This finding is consistent with previous studies (Anderson et al., 2013; Ethen et al., 2009; Giglia & Binns, 2007; Skagerstrom et al., 2011). This may be because lower income mothers cannot as easily afford alcohol. We did not find an association between higher income and heavy consumption trajectory as suggested in other studies (Chang et al., 2006; Pevalin et al., 2001).

Our study also finds an inverse association between parity and the levels of alcohol consumption. Women with more than two children were more likely to be abstainers/minimal drinkers than those who had one child. It is to be expected that women with more children will have less time available for recreational drinking. Our results relating to parity and alcohol consumption support the finding from Meschke et al. (2008) and contradicts those from Hotham et al. (2008) and Tamaki et al. (2008).

There remain some limitations in our study. First, alcohol consumption measurement was based on self-report data and it is likely that women have underreported their drinking levels. Nevertheless, as noted by researchers, a self-report measurement of alcohol consumption is generally a reliable and valid way of measuring alcohol consumption among populations (Del Boca & Darkes, 2003). While it may be the case that respondents underreport their level of alcohol consumption, this underreporting appears to be proportional to the amount of alcohol consumed (Stockwell et al., 2004).

Second, we combined abstainer and very light minimal drinker categories. There is evidence that these groups differ in some respects (Alati, Lawlor, et al., 2005). However, from the point of view of the analysis in this paper these differences did not appear to be important and it would have complicated the analysis to have separate categories.

Another limitation is loss to follow-up. It is notable that while many of the above differences are statistically significant, rates of follow-up are high (90.5%), and many of the above differences are of a modest magnitude. Consequently, it should not greatly affect the overall study results and to the extent that the results are affected they are likely to represent conservative estimates of the 'real' association (Najman et al., 2005).

Finally, some would argue that our results were only valid at the time this data was initially collected, around 30 years ago. Our findings are supported by our recent cross-sectional survey on alcohol consumption showing that the levels of alcohol consumption of women pre-pregnancy have remained stable but the decline of alcohol consumption during

pregnancy is greater. In addition, although the drinking patterns among women since the 1980's have changed, the patterns from prenatal to postnatal period have remained largely unchanged particularly among the heaviest drinking group. Alvik et al. (2006) and Giglia and Binns (2007) in their longitudinal study among Perth pregnant and lactating women showed that women who were the heaviest drinking pre-pregnancy reduced their consumption the most. They substantially increased their drinking at 4, 6, and 12 months postpartum (Appendix Table 4-2).

Conclusion

Patterns of alcohol consumption by women from the prenatal to postnatal period are relative stable with three main consumption trajectories. The heavy consumption trajectory group is a matter of concern as 80% of women were breastfeeding their babies around the time they reported consuming alcohol. This finding suggests the need for a public health campaign to educate women about the risks of alcohol use during breastfeeding. It is also noted that high consumption after birth was more prevalent among participants who were unmarried, had one child, never went to church, and had a relatively poor health lifestyle. Alcohol use is intrinsic to a broader range of health behaviours, all of which need to be considered in framing a public health response.

Chapter 5: TRAJECTORIES OF ALCOHOL CONSUMPTION OVER 21 YEARS OF MOTHERS' REPRODUCTIVE LIFE COURSE

Little is known about the patterns of women's alcohol consumption over their reproductive life course. This chapter identified trajectories of alcohol consumption by mothers over 21 years of their reproductive life course and examines baseline predictors of these trajectories. Data were obtained from a prospective cohort study of 3715 women over 21 years of follow-up. Group based-trajectory modelling was used to identify typical drinking trajectories over the maternal reproductive life course. Multinomial logistic regression was employed to examine predictors associated with these trajectories. I found four trajectories of alcohol consumption for mothers over the 21-year period. These trajectories included abstainers (11.9%), low-stable drinkers (58.0%), moderate-escalating drinkers (25.3%), and heavy-escalating drinkers (4.8%). The number of drinking trajectories in chapter 5 (four drinking trajectories) is different from the ones in chapter 4 (three drinking trajectories) probably because women may change their drinking behaviours over the longer time period (over 21 years) rather than short time period involved in the previous chapter. After adjustment for significant covariates, membership of the abstaining trajectory was predicted by lower family income, being married, and high frequency of church attendance while membership of the heavier-escalating trajectory was associated with women who were not currently married, never go to church and have unhealthy lifestyle behaviours. Patterns of women's alcohol consumption exhibit a high level of stability for abstainers and women who drink at low levels. After the birth of their child, there are some changes in alcohol consumption for the moderate and heavy-escalating alcohol consumption groups. Low risk patterns of consumption are associated with variables which generally reflected a low risk behaviour lifestyle. Intervention programs should particularly target women engaging in the heavy-escalating alcohol consumption group as this group increase their consumption shortly after the birth of their child. There is a need to understand more about the social and health consequences for mothers and their children of being in the moderate and heavy-escalating drinking trajectory groups.

5.1 Introduction

The pattern of maternal alcohol consumption over the reproductive life course is greatly understudied. Research involving women's use of alcohol has tended to focus on short periods of their lives, generally during pregnancy (Anderson et al., 2013; Liu et al., 2014; Maloney et al., 2011) or old age (Brennan et al., 2011; Molander et al., 2010), with little interest in the maternal reproductive life course. The reproductive life course stage for women involves a period of relatively good health but with numerous competing commitments. Childrearing may be the central activity during this period but the formation and maintenance of a dyadic partnership, the initiation and development of a career, the maintenance and enhancement of social networks, and major transitions involving the death of parents, marital breakdown, and the growing independence of children are all characteristic exposures during the reproductive life course (Evans, 1985; Mishra et al., 2010; Neve et al., 2000). There is a need to know more about how women transition through this life stage.

5.1.1 The changes in women's alcohol consumption

Much of what is known about alcohol consumption over a mother's reproductive life is derived from cross-sectional studies involving comparisons of alcohol consumption by different age groups (Geels et al., 2013; Wilsnack, 2012). The evidence shows that high levels of drinking are common in younger women, and that alcohol-consumption levels decline in middle and old age (Australian Institute of Health and Welfare, 2011; Roche & Deehan, 2002; Wilsnack, 2012). Some longitudinal studies examining alcohol consumption by women have identified multiple drinking trajectories, including patterns of stable consumption, increasing consumption, decreasing consumption, and a curvilinear pattern (Brennan et al., 2011; Cook et al., 2013; Gee et al., 2007; Platt et al., 2010; Powers & Young, 2008). This line of studies has contributed important information about the multiple trajectories of alcohol consumption by women as they progress through their life stages. Longitudinal studies have focused on either middle-aged or older women (Brennan et al., 2011; Gee et al., 2007; Platt et al., 2010; Powers & Young, 2008) or non-population-based samples (Cook et al., 2013). Relatively few have examined the development trajectory of maternal alcohol consumption over women's reproductive life course.

5.1.2 Characteristics associated with the changes of women's alcohol consumption

Previous studies have suggested that changes in alcohol consumption by reproductive-aged women are associated with family-related characteristics such as income, marital status, the number of children, religiosity, and childrearing/parenthood (Ahlström et al., 2001; Bachman et al., 2013; Kuntsche et al., 2011; Paradis, 2011). According to these studies, being married, having child/children, and taking parental responsibility limit the opportunities that women may have for recreational drinking or becoming heavy drinkers. However, there are some gaps in knowledge which this paper aims to address. For example, there is little explicit information about alcohol consumption over the whole period of childrearing. Much of the literature has focused on the foetal outcomes of alcohol consumption in pregnancy. Few if any look at the whole period the child is reared. Some studies suggest that women with fewer children are more likely to be abstainers (Hotham et al., 2008; Neve et al., 1996; Tamaki et al., 2008). There is also the suggestion that having and rearing more children may be stressful and lead to higher levels of what is sometimes described as self-medication with alcohol (Alati, Lawlor, et al., 2005; Perkin et al., 1993; Tran et al., 2014).

We use prospectively collected data involving a sample of reproductive aged-women in Brisbane, Queensland, Australia with 21 years of follow-up to (i) identify typical trajectories of alcohol consumption exhibited by mothers over their reproductive life course; and (ii) document the predictors of these trajectories.

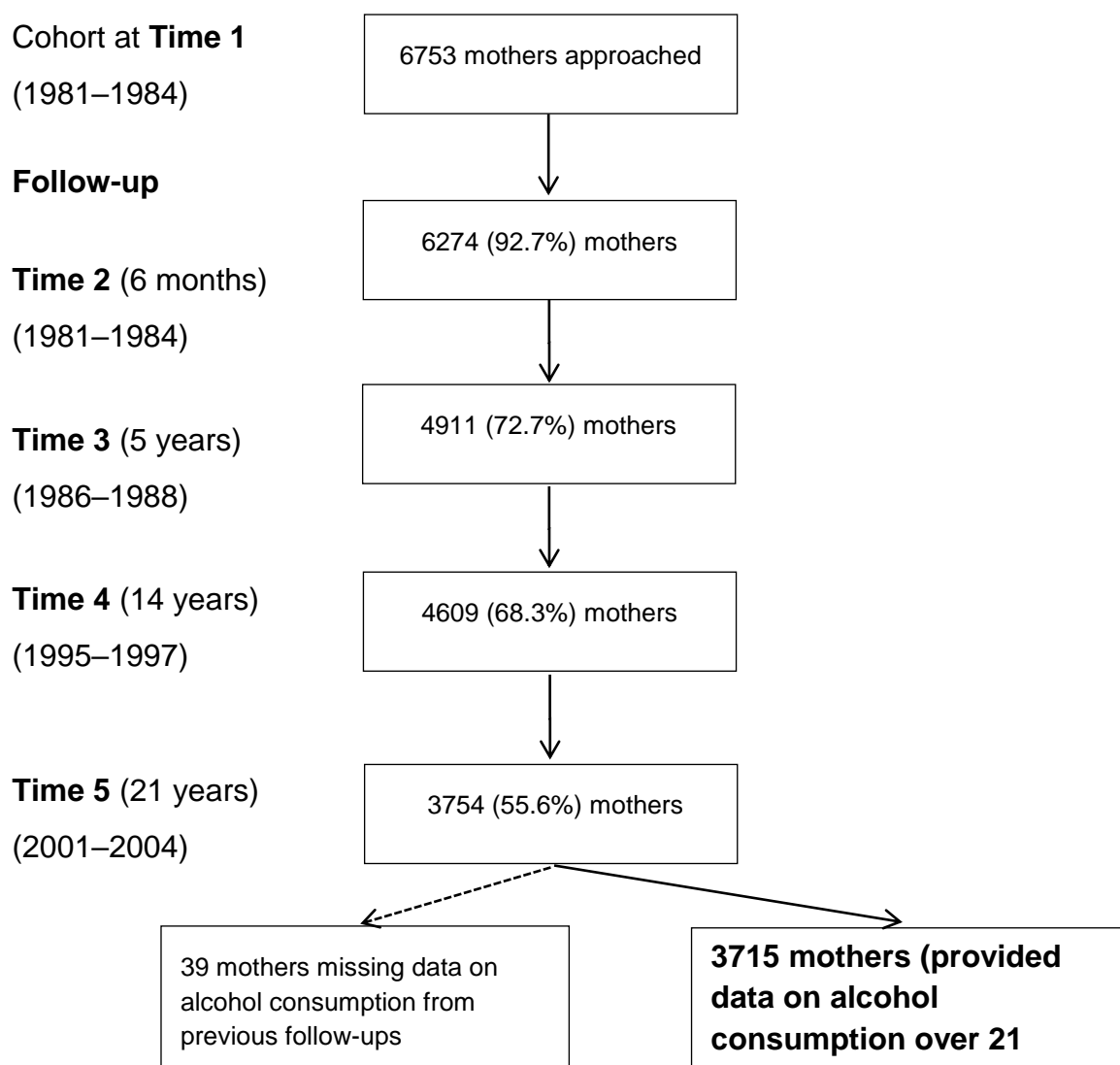
5.2 Materials and methods

5.2.1 Data source

Data were taken from the MUSP, a prospective pre-birth cohort study of 6753 women who gave birth to a live singleton baby at one of the two major public obstetric hospitals in Brisbane between 1981 and 1984. Details of the study have been described elsewhere (Najman et al., 2014). Women, who participated in the study at their first prenatal visit (Time 1), approximately 18 weeks' gestation with standard deviation (SD) = 5.83, were asked about their alcohol consumption, social demographic characteristics, life style behaviours, and other health related information. These mothers were followed-up at 6 months (Time 2), and then at 5 (Time 3), 14 (Time 4), and 21 years (Time 5) after the birth

of their baby. Ethics committees from the Mater Hospital and The University of Queensland approved each phase of the study.

Figure 5-1 Sampling frame and retention rate



Of the 3754 mothers at Time 5 (21 years), 2976 had provided complete alcohol consumption data over five time points; and 739 had provided alcohol consumption data for four of the five time points. We conducted a series of sensitivity analyses which compared the results from the sample of 2976 mothers with the results from the sample of 3715 mothers. The analyses produced similar results for the two samples suggesting there was no difference between them. This study is based on the sample of 3715 women from all consecutive women giving birth in a public hospital over a three-year period (between 1981 and 1984) who were followed-up over 21 years. Figure 5-1 provides details and a flowchart of the retention rate of the sample. Mean age of mothers at recruitment time was

25.5 (SD = 5.03). Of the women in this sample, about 64% had completed high school while 20% were in tertiary education, and 16% had not finished high school. Some 80% of women were married and about 30% of women were living in a family at or below poverty (\$10 399 or less per year at the time of recruitment). At baseline, about 5% of women met the criteria for depression and 11% of women were found to meet the criteria for anxiety. About 88% of mothers had healthy lifestyle behaviours; 2% of women met the criteria for a high level of adversity at their first clinic visit.

5.2.2 Measures

Alcohol consumption

In this study, a frequency and quantity question to measure the mothers' alcohol consumption over the previous 12 months was repeated across five time points. Alcohol consumption at Time 1 (pre-pregnancy) was retrospectively assessed at the first prenatal visit; while post-birth, consumption at Time 2 (6 months), Time 3 (5 years), Time 4 (14 years), and Time 5 (21 years) was assessed from the mother's self-report. At each survey, the women were asked how often they drank alcohol and how much alcohol they consumed on each occasion. Six pre-specified response options, ranging from never to daily alcohol consumption and from none to seven or more standard drinks, were provided. Guidelines from the Australia National Health and Medical Research Council in 2009 (NHMRC, 2009) suggest that women's alcohol consumption should be calculated on the basis of weekly alcohol consumption of a standard drink (containing 10 grams of pure alcohol). In the present study, alcohol consumption scores were estimated using a method described by Dawson (2003): multiplying the mid-point estimation of frequency by the mid-point of quantity. For consistency with other studies (French et al., 2014; Powers & Young, 2008), respondents' levels of alcohol consumption were categorised as non-drinkers (never drink), occasional drinkers (<1 drink per week), moderate drinkers (from 1 to 14 drinks per week), and heavy drinkers (>14 drinks per week).

Measure of predicting variables

Socio-economic characteristics and church attendance

Socio-economic characteristics were assessed by marital status and family income. Respondents reported one of four categories for their marital status: single, married, living together, or separated/divorced/widowed. However, we collapsed marital status into three

categories: single, living together/ separated/divorced/ widowed, and married (reference group). This grouping was due to the small proportion of separated/divorced/widowed women (2.2%) and the different socio-economic characteristics between those who reported living together and those who were married (Khoo, 1987). Family income was measured as low, \$10 399 or less; and medium-high, \$10 400 or more (reference group). The threshold of \$10 399 or less is estimated to be at around the poverty level in the period 1981–1983 (Najman et al., 2004). Church attendance was measured as weekly/monthly (reference group), less than once a month, and never.

Stressful life events/adversity

In this study, the measure of a women's stressful life events was derived from a modification of the social readjustment rating scale by Holmes and Rahe (1967). Stressful life events were measured at the baseline by a series of items referring to events that women and their partners may have experienced within the past six months: major job changes, problems with police, housing problems, financial problems, health problems, loss of relatives, serious troubles at work, serious disagreement with partners, and marital breakdown. Adversity was classified on the basis of average scores: low adversity (0–2 events) and high adversity (3+ events); the reference group was low adversity.

Health related lifestyle

Health related lifestyle was measured using questions adapted from Breslow's lifestyle index (Belloc et al., 1971) which has been validated and widely used in previous studies (Breslow & Enstrom, 1980; Haruyama et al., 2012; Noguchi et al., 2015). These questions and possible responses were scored as follow: (1) how many hours sleep did you usually get a night? (6 or less and 7 = 1; 8 and 9 or more = 0); (2) how often did you eat breakfast and (3) how often did you eat in between your regular meals? (rarely or never = 0, sometimes and almost every day = 1); (4) how often were you involved in any physical activities including active sport, swimming/taking long walks, week-end trips in car, gardening, and physical exercise? (often and sometimes = 0, and never = 1); (5) how many hours a day did you watch television (never, less than 1, 1–3, 3–5 = 0; 5–7 and more than 7 = 1); (6) how many times a week did you smoke cigarettes (not at all = 0; once, every few days, and every day = 1); and (7) maintenance of proper weight, body mass index (BMI). BMI (kg/m^2) between 18.5 and less than 25 was scored 0, and BMI less than 18.5 or 25 or more was coded as 1 (Doherty et al., 2006; World Health Organization, 2000). The Breslow's lifestyle index scores were added to generate a composite variable

of healthy lifestyle ranging from 0 to 7. These scores were categorised into three groups: good (0–2), the reference group; average (3); and poor (4+).

Mental health problems

Women's mental health at baseline was assessed using the short form of the self-reported DSSI (Bedford & Foulds, 1978). Seven symptoms were used to evaluate maternal depression (Cronbach's alpha = 0.787) and anxiety (Cronbach's alpha = 0.763). For the purpose of this study, women were classified as depressed or anxious if they reported four or more of seven symptoms related to depression or anxiety, respectively. This approximates the clinical cut-off implied by Bedford and Foulds (1978).

Birth outcomes

We included three variables representing birth outcomes. Birth outcome information was obtained by obstetricians who both worked at the hospital and were study investigators. Birth weight was categorised as normal (2500 grams or more), the reference; and low birth weight (2499 grams or less). Gestation was dichotomised into normal as the reference group (37 weeks or more) and preterm (36 weeks or less). Time to establish respiration was categorised as less than three minutes (reference group) and three minutes or more.

Covariates

Maternal age, education level, and parity may be important covariates that deflect patterns of maternal alcohol consumption as well as the association between alcohol consumption trajectories and potential predictors. In our study, mothers were asked their date of birth at Time 1. Age was scored to the nearest year. Mother's education was self-reported at recruitment and reflected the highest level of education attained. These levels were classified as: incomplete high school, completed high school only, and completed post high school education (college/university and other technical and further education training, TAFE). Parity was measured on the basis of number of live-born children women reported at their obstetrical visit at Time 1 and subsequent births reported at each follow-up.

5.2.3 Data analyses

The analysis was carried out in four stages using STATA/SE 13.0. The first stage involved identifying distinct groups of individuals with a similar pattern of alcohol consumption over time. Group-based trajectory modelling developed by Nagin (2005) was employed in this stage. The overview and technical application of group-based trajectory models have been described elsewhere (Nagin & Odgers, 2010b). Briefly, group-based trajectory models are the application of specialised finite-mixture models which assume that a population is composed of a mixture of distinct groups, defined by their developmental trajectories. In this study, we employed the censored normal model (Jones & Nagin, 2013) to estimate the developmental trajectories of alcohol consumption over the mothers' reproductive life course. To reduce the effects of the skewed distribution of alcohol consumption score, square root transformation was applied to alcohol data, consistent with other studies (Bobo et al., 2013). We first used the unadjusted model to identify the optimal number of trajectory groups. The best fitting model was selected using the criteria of Bayesian Information Criterion (BIC) and the requirement of minimum mean posterior probability of group (0.70 or greater in all groups). These criteria were also considered together with previous knowledge on women's alcohol consumption (Xie et al., 2006). Then, as suggested by previous studies (Jones & Nagin, 2007; Jones & Nagin, 2012), maternal age and parity were added to the model. We included maternal age at Time 1 as a fixed covariate in the adjusted model since age is synchronous with the time variable in our data. However, parity at each time point was added as a time-varying covariate in the adjusted model. The BICs of unadjusted and adjusted models were compared to select the best-fit model for further analyses.

At the second stage, we assessed collinearity to examine the correlations among predicting variables. The variance inflation factor (VIF) ranging from 1.01 to 1.46 indicated that no collinearity was involved. All predicting variables are included in further analyses.

To identify the independent impact of each predicting variable on trajectories of maternal alcohol consumption over the life course, multivariate multinomial logistic regression was used in the third stage of the analyses. We first examined the bivariate associations between drinking trajectories and baseline predictors. Then, predictors that were statistically significant in bivariate analyses were retained for the multivariate model where we controlled other significant predictors and age and educational levels as covariates. A p -value of <0.05 was adopted as a significance threshold for all analyses.

Of the cohort of 6753 women recruited at pre-pregnancy, the retention rate at the 21-year follow-up was 55.0%. To assess how attrition may affect our results, we used a multivariate logistic regression model with baseline predictors to predict those who were lost to follow-up. Assuming their data is missing at random (Sterne et al., 2009), we used MI produced by STATA to impute missing data from predicting variables, covariates, and outcomes. Initially, we used 20 cycles of imputation for the analyses of imputed data. Subsequently, sensitivity analysis was employed by repeating the whole process using 50 cycles of imputation.

5.3 Results

5.3.1 Women's trajectories of alcohol consumption

Results from the unadjusted model suggested that, like previous studies, we could identify from two to four possible maternal alcohol-consumption trajectory groups. BIC was improved (moves closer to 0) as the number of groups increased in the model ($BIC_2 = -25\,349.87$ and $BIC_3 = -24\,750.79$). The BIC for the four-group model ($BIC_4 = -24\,350.75$) was closest to 0 suggesting that the four-group model fitted our sample best. The posterior probabilities for the four-group model which ranged from 0.77 to 0.90 also suggested a good fit. The distribution of membership in each group is presented in Table 5-1.

Adjusting maternal age at pre-pregnancy as a fixed covariate and parity as a time-varying covariate further improved the model fit ($BIC = -22,490.34$; posterior probabilities range from 0.86 to 0.90). The adjustment slightly changed membership numbers in each group (more details in Table 5-1). The fitted model showed distinct alcohol-consumption trajectories. We selected the four-group model with two covariates as our final model for further analyses.

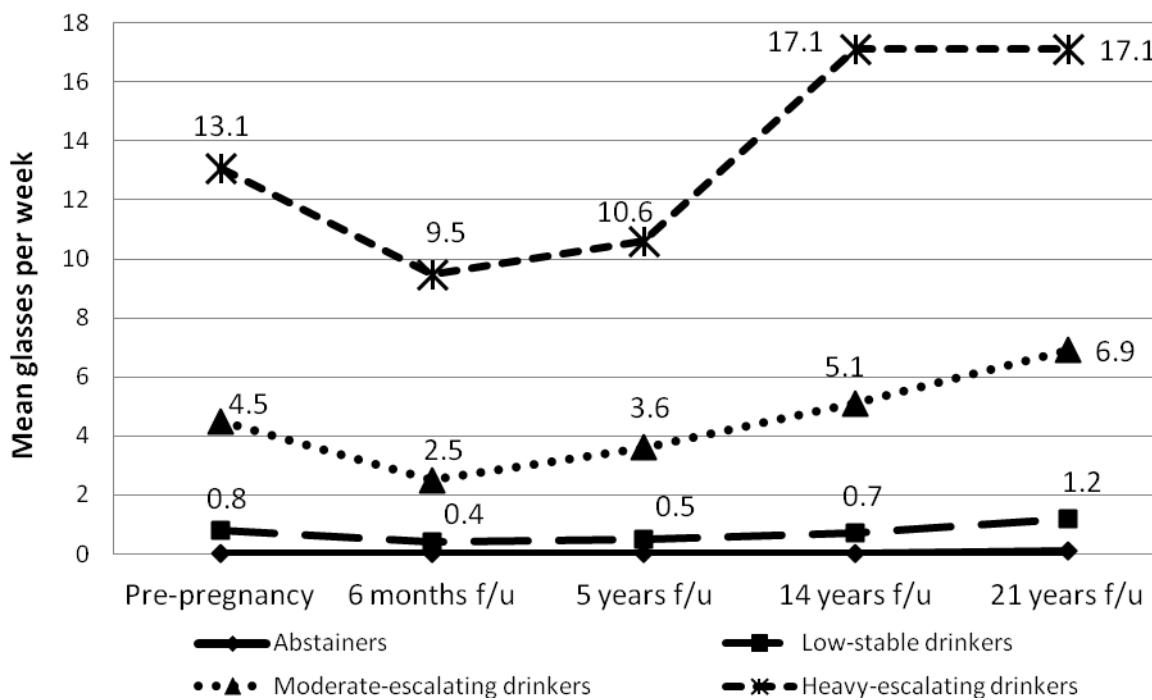
Table 5-1 Characteristics of four group drinking trajectories in unadjusted and adjusted model

Parameters	Four-group model of maternal alcohol consumption trajectory	
	<i>Unadjusted model</i>	<i>Adjusted model</i>
	N (%)	N (%)
Group 1	472 (12.7%)	441 (11.9%)
Group 2	2159 (58.1%)	2155 (58.0%)
Group 3	936 (25.2%)	940 (25.3%)
Group 4	148 (4.0%)	179 (4.8%)
BIC	BIC = -24 350.75	BIC = -22 490.34
Mean posterior probability		
Group 1	0.86	0.86
Group 2	0.90	0.90
Group 3	0.82	0.86
Group 4	0.77	0.89

Figure 5-2 presents the four-group trajectories of maternal alcohol consumption over 21 years. The bottom line was labelled the '**abstainers group**', which included women who reported no alcohol consumption or drank minimally on each occasion over the five intervals. This group was estimated to comprise 11.9% of the sample with mean posterior probability = 0.86. The lower-middle line was named the '**low-stable group**', consisting of 58.0% of the sample, with average posterior probability of membership = 0.90. Women in this trajectory group consumed very low levels of alcohol across all phases of the study. The average alcohol consumption of the low-stable group ranged from 0.4 to 1.2 glasses per week. The upper-middle line was called the '**moderate-escalating group**', comprising 25.3% of the sample, mean posterior probability = 0.86. Women in this trajectory group consumed about 4.5 standard drinks per week at pre-pregnancy. They reduced their consumption to 2.5 glasses per week when they were pregnant; then slowly increased their consumption but still at a low-moderate level of alcohol consumption at 5 and 14 years after the birth of their baby. At 21 years, their weekly average alcohol consumption was the equivalent of 6.9 glasses per week. The top line in Figure 4-2 was named the '**heavy-escalating group**' comprising about 4.8% of the sample, the mean posterior probability = 0.89. This group included only a small proportion of the sample, however, the pattern of alcohol consumption among this group changed very much over time. Women in this group were those who consumed an average of almost two glasses a day (13.1

standard glasses per week) at pre-pregnancy. They reduced their consumption to 9.5 glasses a week during pregnancy; then had slightly increased alcohol consumption at the five-year follow-up. From Year 5 to Year 14, these women sharply escalated their alcohol consumption from a moderate level (10.6 at Year 5) to a heavy level (17.1 at Year 14). From Year 14 to Year 21, the mean level of alcohol consumption among the heavy-escalating group did not change.

Figure 5-2 Mean maternal alcohol consumption per week of each drinking trajectory over time



5.3.2 Predictors of membership in different trajectories of alcohol consumption

Baseline predictors of trajectories of maternal alcohol consumption over the 21-year period were examined using bivariate and multivariate multinomial logistic regression analyses, with the low-stable trajectory group as the reference category. In Table 5-2, the bivariate association between each predictor and maternal alcohol consumption trajectories is presented. Membership of the abstaining trajectory was predicted by mothers who were married, had a low family income, had a healthy lifestyle, and who went to church more often. Membership of the moderate-escalating trajectory group was predicted by those who had higher income, were unmarried and who less often or never went to church. Women who were unmarried, had an unhealthy lifestyle, reported never

going to church, and had a low birth-weight child were significantly more likely to be members of the heavy-escalating alcohol consumption group.

Table 5-3 presents multivariate multinomial logistic regression analyses, controlling for the influence of other significant predictors in bivariate analyses and covariates. Adjustment did not significantly change the magnitude of associations between predicting variables and membership of the moderate-escalating group. However, after adjustment, healthy lifestyle behaviour and low birth weight of their child were no longer significantly associated with membership of the abstainer and heavy-escalating groups, respectively. Other predicting variables which were statistically significant in bivariate associations for abstainers and the heavy-escalating group remained independently significant.

Table 5-4 presents the results following the attrition analyses. Results from the multivariate logistic regression model showed that mothers who were lost to follow-up were more likely to be young, had a lower educational level, lower family income, were more often unmarried, had higher rates of anxiety, and reported unhealthy lifestyle behaviours more often. MI analyses indicated that there were no substantive differences in the analyses of completed cases ($n = 3715$) and multiple imputed cases ($n = 6735$), suggesting that our findings do not reflect selection bias.

5.4 Discussion

The maternal cohort was recruited early in pregnancy and followed up over a 21-year period. We found four distinct trajectories of alcohol consumption by women over their reproductive life course. The largest trajectory group comprised low-stable drinkers (58.0%), followed by moderate-escalating drinkers (25.3%), abstainers (11.9%), and heavy-escalating drinkers (4.8%). Our study did not identify the decreasing or curvilinear pattern found in other research (Brennan et al., 2011; Powers & Young, 2008).

Table 5-2 Bivariate multinomial logistic regression between alcohol-consumption trajectories and baseline predicting variables

Predicting variables ¹	N (%)	Trajectories of alcohol consumption over 21 years of follow-up surveys								
		Low-stable drinkers ²			Abstainers		Moderate-escalating drinkers		Heavy-escalating drinkers	
		Ref. (%)	% ³	OR (95% CI)	%	OR (95% CI)	%	OR (95% CI)		
Family income										
\$10 400 or more	2468 (69.9)	58.0	10.5	1.0	26.6	1.0	4.9	1.0		
\$10 390 or less	1064 (30.1)	58.5	14.8	1.4 (1.1–1.7)	21.9	0.8 (0.7–0.9)	4.8	1.0 (0.7–1.4)		
Marital status										
Married	2950 (79.9)	58.5	13.2	1.0	23.8	1.0	4.4	1.0		
Single	309 (8.4)	56.3	5.8	0.4 (0.3–0.7)	33.0	1.4 (1.1–1.9)	4.8	1.1 (0.6–2.0)		
Living together/Sep/Div/Wid	431 (11.7)	56.4	6.3	0.5 (0.3–0.7)	29.7	1.3 (1.0–1.6)	7.6	1.8 (1.2–2.7)		
Church attendance										
Weekly/monthly	710 (19.3)	53.0	28.0	1.0	16.6	1.0	2.4	1.0		
Less than once a month	765 (20.8)	62.6	7.8	0.2 (0.2–0.3)	25.9	1.3 (1.0–1.7)	3.4	1.3 (0.7–2.4)		
Never	2209 (59.9)	57.9	8.1	0.3 (0.2–0.3)	27.9	1.5 (1.2–1.9)	6.0	2.3 (1.4–3.8)		
Maternal depression										
Non-depressed	3474 (95.3)	58.1	11.7	1.0	25.3	1.0	4.9	1.0		
Depressed	172 (4.7)	28.1	12.8	1.1 (0.7–1.7)	25.6	1.0 (0.7–1.4)	3.5	0.7 (0.3–1.6)		
Maternal anxiety										
Non anxious	3259 (89.3)	58.3	11.6	1.0	25.2	1.0	4.9	1.0		
Anxious	392 (10.7)	56.2	13.5	1.2 (0.9–1.7)	25.8	1.0 (0.8–1.3)	4.6	1.0 (0.6–1.6)		

Healthy lifestyle behaviour

Good (0–2)	2421 (70.2)	58.2	12.6	1.0	25.1	1.0	4.1	1.0
Moderate (3)	660 (19.1)	57.6	9.8	0.8 (0.6–1.1)	26.8	1.1 (0.9–1.3)	5.8	1.4 (0.9–2.1)
Bad (4+)	370 (10.7)	59.4	7.3	0.6 (0.4–0.9)	25.7	1.0 (0.8–1.3)	8.6	2.1 (1.4–3.2)

Maternal adversity

Low (0–2)	2659 (77.7)	58.4	11.8	1.0	25.2	1.0	4.5	1.0
High (3+)	761 (22.3)	57.6	11.8	1.0 (0.8–1.3)	25.2	1.0 (0.8–1.2)	5.4	1.2 (0.8–1.7)

Child's birth weight

Normal (2500 g or more)	3543 (95.4)	58.1	11.9	1.0	58.1	1.0	4.7	1.0
Low birth weight (2499 g or less)	171 (4.6)	56.1	11.1	7.0 (0.6–1.6)	56.1	1.0 (0.7–1.4)	8.2	1.8 (1.0–3.2)

Child's gestation

Normal (37 weeks or more)	3557 (95.7)	58.2	11.9	1.0	25.2	1.0	4.7	1.0
Premature (36 weeks or less)	158 (4.3)	54.4	10.8	1.0 (0.6–1.6)	27.2	1.1 (0.8–1.7)	7.6	1.7 (0.9–3.2)

Child's respiration time

Less than 3 minutes	3442 (96.4)	57.7	12.0	1.0	25.5	1.0	4.7	1.0
3 minutes or more	127 (3.6)	60.6	8.7	0.7 (0.4–1.3)	23.6	0.9 (0.6–1.3)	7.1	1.4 (0.7–2.9)

Note: Bold = $p < 0.05$; ¹ Assessed at baseline survey unless otherwise indicated. ² Reference group. ³ The percentage with trajectory of alcohol consumption within each category.

The four trajectories found in this study exhibit evidence of a high level of stability for abstainers and low-stable drinkers, but changeability for moderate and heavy-escalating drinkers over their reproductive life course. Members of the abstainers and the low-stable group consistently did not consume alcohol, or consumed at a very low level, over 21 years. The biggest reduction is observed during the period of pregnancy and delivery among moderate and heavy drinking mothers, consistent with the findings from previous research (Bachman et al., 2013; Emslie et al., 2015; Maloney et al., 2011). However, six months after the birth of the baby, alcohol consumption levels among the moderate-escalating groups started to increase but remained at a moderate level at the 5, 14 and 21 year follow-ups; while alcohol consumption in the heavy-escalating group sharply increased at Year 5 from moderate to heavy (17.1 glasses per week) and remained at this drinking level at the 21-year follow-up (Figure 5-2). The pattern of alcohol consumption in the heavy-escalating group suggests the need to focus on prevention and intervention with these women after they have given birth as they breastfeed their baby while apparently consuming moderate levels of alcohol (Giglia & Binns, 2007; Tran et al., 2014). The result also suggests that interventions may be needed during the child-adolescent motherhood period where children may be influenced by their mother's drinking behaviour (Cleveland et al., 2014; Van Der Vorst et al., 2009).

Examinations of baseline predictors associated with four drinking trajectory groups indicate the differences among profiles of abstainers versus moderate and heavy-escalating drinkers. Predictors associated with abstainers are those who had low family income and being married. The results appear inconsistent with some studies (Huckle et al., 2010; Karlamangla et al., 2006) but in line with the work from Cerdá and colleagues (Cerdá et al., 2011). Frequency of religious participation is a protective factor against alcohol consumption (Krause, 2003). This finding may be limited to Australian society as Australians have a low rate of church attendance (Australian Bureau of Statistics, 2013). Our study shows that women with increasing consumption over time tend to be affluent (except for the heavy-escalating group), are more likely to be unmarried, and less religious—consistent with previous studies (Karlamangla et al., 2006; Platt et al., 2010).

Table 5-3 Multivariate multinomial logistic regression between alcohol consumption trajectories and baseline predicting variables adjusted for maternal educational levels and other significant predictors

Predicting variables	Trajectories of alcohol consumption up to 21 years follow-up surveys			
	Low stable drinkers ¹	Abstainers	Moderate- escalating drinkers	Heavy- escalating drinkers
	Ref. (%)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Gross family income				
\$10 400 or more	1.0	1.0	1.0	1.0
\$10 390 or less	1.0	1.8 (1.4–2.3)	0.8 (0.6–0.9)	0.8 (0.5–1.1)
Marital status				
Married	1.0	1.0	1.0	1.0
Single	1.0	0.5 (0.3–0.8)	1.3 (1.0–1.8)	0.8 (0.4–1.6)
Living together/sep/div/wid	1.0	0.7 (0.4–1.1)	1.2 (0.9–1.6)	1.6 (1.0–2.4)
Church attendance				
Weekly/monthly	1.0	1.0	1.0	1.0
Less than once a month	1.0	0.2 (0.1–0.3)	1.2 (0.9–1.6)	1.1 (0.5–2.0)
Never	1.0	0.2 (0.2–0.3)	1.6 (1.2–2.0)	1.9 (1.1–3.3)
Healthy lifestyle behaviours				
Good (0–2)	1.0	1.0	1.0	1.0
Moderate (3)		0.9 (0.7–1.3)	1.0 (0.8–1.3)	1.3 (0.8–1.9)
Bad (4+)	1.0	0.7 (0.4–1.1)	1.0 (0.8–1.3)	1.7 (1.1–2.6)
Child birth weight				
Normal (2500 g or more)	1.0	1.0	1.0	1.0
Low birth weight (2499 g or less)	1.0	1.0 (0.6–1.4)	0.9 (0.6–1.4)	1.7 (0.9–3.3)

Note: Bold = $p < 0.05$; ¹ Reference group.

This study has some limitations. First, it is possible that maternal age and the number of children women have over their life course might affect patterns of alcohol consumption. We tested the influence of two covariates by adjusting parity as a time-varying covariate and age of mothers at pre-pregnancy as a fixed covariate in the trajectory model. We also conducted sensitivity analyses, identifying possible drinking trajectory groups and stratified by (i) age groups (younger mothers—25 years or less, and older mother—26 years or more), (ii) parity before participating in the study (no previous child and had at least one child), and (iii) the production of age and parity groups. The sensitivity analyses yielded the same results as the one in the adjusted model. It might be of interest to note that those in

the abstainers group were the oldest mothers (but only by about a year) who had at least one child before participating in the study; while those in the low-stable and moderate-escalating drinker groups were younger mothers. There did not seem to be much of a difference in subsequent numbers of children among drinking trajectory groups, possibly due to the adjustment of parity in the model.

Table 5-4 Multivariate attrition analyses predicting those who would be lost to follow-up at the 21- year phase

Predicting variables ¹	Odds of being lost to follow-up	
	Unadjusted	Adjusted ²
	OR (95% CI)	OR (95% CI)
Maternal age		
25 years or less (ref.)	1.0	1.0
26 years or more	0.7 (0.6–0.8)	0.8 (0.7–0.9)
Maternal education		
Post high school (ref.)	1.0	1.0
Completed high school	1.3 (1.2–1.5)	1.3 (1.1–1.5)
Incomplete high school	1.8 (1.5–2.1)	1.5 (1.2–1.8)
Family income		
\$10 400 or more (ref.)	1.0	1.0
\$10 390 or less	1.6 (1.4–1.8)	1.2 (1.0–1.3)
Marital status		
Married (ref.)	1.0	1.0
Single	2.0 (1.7–2.3)	1.3 (1.0–1.8)
Living together/sep/div/wid	1.9 (1.7–2.2)	1.6 (1.3–1.9)
Parity groups		
No previous baby (ref.)	1.0	1.0
Had at least one baby	1.0 (0.9–1.1)	1.0 (0.9–1.1)
Church attendance		
Weekly/monthly (ref.)	1.0	1.0
Less than once a month	1.0 (0.8–1.1)	0.9 (0.7–1.0)
Never	1.1 (1.0–1.3)	0.9 (0.7–1.0)
Maternal depression		
Non depressed (ref.)	1.0	1.0
Depressed	1.6 (1.3–2.0)	1.9 (0.7–1.4)

Maternal anxiety

Non anxious (ref.)	1.0	1.0
Anxious	1.6 (1.4–1.9)	1.3 (1.0–1.5)

Healthy lifestyle behaviour

Good (0–2) (ref.)	1.0	1.0
Average (3–4)	1.4 (1.2–1.6)	1.2 (1.0–1.4)
Bad (5+)	1.6 (1.4–1.9)	1.3 (1.1–1.6)

Maternal adversity

Low (0–2) (ref.)	1.0	1.0
High (3+)	1.4 (1.3–1.6)	1.1 (0.9–1.3)

Note: Bold = $p < 0.05$; ¹Assessed at baseline survey unless otherwise indicated. ²Model was adjusted for all factors listed. These factors were used in main analyses.

Second, in our study we did not collect participants' alcohol consumption history. We only examined women's alcohol consumption over the previous 12 months at pre-pregnancy; and post-birth at 6 months; and 5, 14, and 21 years. Women in the abstaining trajectory group were those who reported not drinking alcohol over 12 months at each phase of study. Further research should address the patterns of different categories of abstainers as mentioned in previous research (Goldman & Najman, 1984).

Finally, we tested the possibility that loss to follow-up may have biased our findings. Of 6753 mothers who were recruited at baseline, loss to follow-up at the 21-year follow-up was about 45%. Our MI analyses indicated that loss to follow-up had only minimal impact on findings.

Conclusion

About one in twenty women is characterised by a pattern of escalating alcohol consumption which extends over the reproductive life course. Intervention programs might need to target these women as early as possible, perhaps even during their pregnancy. The focus of such an intervention would be on the period following the birth of their child. There is also a need to know more about the social and health consequences to mothers and their children of the mothers being in the moderate and heavy-escalating alcohol consumption trajectory groups.

Chapter 6: GENDER DIFFERENCE IN OFFSPRING'S ALCOHOL USE DISORDER BY 21 YEARS: A LONGITUDINAL STUDY OF MATERNAL INFLUENCES

There is little known about the extent to which maternal alcohol consumption influences offspring's alcohol use disorder. This section aims to examine whether different maternal alcohol consumption trajectories predict gender difference in adolescent alcohol use disorder at child age 21 years. Data was from 2531 mother-child pairs for whom data are available at the 21-year follow-up survey. Maternal alcohol consumption trajectories were determined by group-based trajectory modelling. Offspring's lifetime ever alcohol use disorder was assessed using DSM-IV diagnostic criteria. Over 14 years of follow-up after the birth of a child, three distinct alcohol consumption trajectories were identified (abstainer, low-stable and moderate-escalating drinker). A maternal trajectory of moderate-escalating alcohol consumption independently predicted offspring's lifetime ever alcohol use disorder at 21 years after adjustment for a range of potential confounders. 'Cross-gender influence' is observed in the study. The pattern of maternal alcohol consumption may have an independent effect on offspring alcohol consumption, with male offspring being more vulnerable to the effects of maternal alcohol use than are female offspring. Programs intended to address alcohol consumption by adolescents and young adults need to focus on the behaviours of both parents as well as offspring's age at first alcohol use over the child's early life course.

6.1 Introduction

Adolescents commonly consume alcohol (Haugland et al., 2013; Järvinen & Room, 2007; White & Bariola, 2012). Parents are the primary influence on adolescent alcohol consumption (Janssen et al., 2014; Sandra & Christopher, 2014; Sartor et al., 2007). Parental alcohol use may impact on offspring's alcohol use for a number of reasons. Parents who consume alcohol will have alcohol available at home. Children may model their parent's use of alcohol. Parents who consume alcohol are also more likely to be in social networks which approve of alcohol consumption (Cleveland et al., 2014; Van Der Vorst et al., 2006). Many studies have addressed the impact of parental alcohol use on

alcohol consumption by children (Cleveland et al., 2014; Haugland et al., 2013; Mares et al., 2011; Van Der Vorst et al., 2009; Yeh et al., 2006). There are, however, few studies examining the gender differences in the association between long-term patterns of maternal alcohol consumption and AUD diagnosed in male and female offspring.

6.1.1 Maternal alcohol consumption and offspring's alcohol use

Studies of the association between maternal alcohol consumption and offspring's alcohol use or abuse have yielded inconsistent results. Some studies have found no association between maternal alcohol consumption and adolescent alcohol use (Koning et al., 2010; Marsden et al., 2005; Zhang et al., 1999) whereas others report such an association (Mares et al., 2011; Poelen et al., 2007; Van Der Vorst et al., 2009; Yeh et al., 2006; Yule et al., 2013). For example, Marsden and colleague (Marsden et al., 2005) in a prospective cohort study found that the frequency of mother's alcohol use was not independently associated with their child's drinking frequency. In a five-year longitudinal analysis of 428 Dutch families, researchers also found no association between maternal alcohol consumption and adolescent excessive drinking (Mares et al., 2011). However, researchers using twin data from a sample of children aged 12–30 years old in the Netherlands reported both cross-sectional and longitudinal associations between mother's alcohol consumption and offspring's higher risk of drinking (Poelen et al., 2007).

6.1.2 Gender differences in the association between maternal alcohol consumption and offspring's alcohol use disorder

The impact of maternal alcohol consumption on adolescent alcohol use may depend on offspring's gender (Casswell et al., 2002; Cleveland et al., 2014; Haugland et al., 2013; White et al., 2000). Findings regarding whether maternal alcohol consumption equally influences both male and female offspring's alcohol consumption vary. On the one hand, it has been suggested that children tend to model their same sex parent's drinking behaviour (Casswell et al., 2002; Yeh et al., 2006). Thus, mother's drinking may impact on their female children's alcohol consumption more than their male children's (Haugland et al., 2013; Yeh et al., 2006; Yule et al., 2013). On the other hand, maternal alcohol consumption has been found to predict male rather than female offspring's alcohol consumption (Cleveland et al., 2014). Some studies suggest that maternal alcohol consumption may equally influence male and female offspring's alcohol use (Englund et al., 2008; White et al., 2000).

6.1.3 Limitations and gaps in previous research

A number of studies have addressed the association between long-term patterns of maternal alcohol consumption and offspring's alcohol use with inconsistent findings. Most previous studies examining the association between maternal alcohol consumption and alcohol use by children have been based on population samples outside Australia. For example, researchers conducted studies in New Zealand (Casswell et al., 2002) and the United States (Englund et al., 2008) where the rates of adolescent alcohol use are lower than in Australia (Ministry of Health, 2007; Toumbourou et al., 2009). Most existing studies have dealt with the measurement of maternal alcohol consumption at one time point rather than at multiple time points. Examining long-term patterns of maternal alcohol consumption is more likely to show the influence of a lifestyle than measurement at a single time point. Arguably parental alcohol use assessed at a single point in time is a less stable measure of parental influence than a pattern which may be stable over an extended period of time. Finally, previous studies tend to measure adolescent outcomes based upon frequency and quantity estimates of alcohol consumption or alcohol related problems. There are few studies where the adolescent outcome is a diagnostic assessment of an AUD.

To address these gaps, the present study aims to (i) examine whether different maternal alcohol consumption trajectories predict adolescent AUD; and (ii) whether mothers' patterns of alcohol consumption have a greater impact on male or female children.

6.2 Methods

6.2.1 Participants and procedures

Data were taken from the MUSP, a prospective pre-birth cohort study of women enrolled at a public obstetric hospital in Brisbane, Australia between 1981 and 1984. Details of the study have been described elsewhere (Fischer et al., 2014). Of those who were recruited at their first clinic visit, approximately 18 weeks of gestation, 6753 women were asked about their alcohol consumption, social demographic characteristics, life style behaviours, and health information before pregnancy. These women were re-interviewed when their child was 6 months, 5, 14 and 21 years of age. Offspring's information was also collected through mother reports at each phase of the study and through self-report at the

14-year and 21-year follow-up surveys. At 21 years, 3778 pairs of mother and child provided information and 2531 offspring completed the lifetime computerised version of CIDI (CIDI-Auto). The present study is based on the sub sample of 2531 mothers and their children remaining in the study at 21 years. The sub sample includes mothers who provided details of their alcohol consumption for up to four phases of the study (pre-pregnancy to the 14-year follow-up) and their children who completed the CIDI-Auto at 21 years. Written informed consent was obtained from mothers at all data collection phases and from the adolescent at the 21-year follow-up of the study. Ethics committees from the Mater Hospital and from The University of Queensland approved each phase of study.

6.2.2 Measures

Measure of outcome variable

Offspring's AUD was assessed at the 21-year follow-up. The AUD diagnoses are based upon administration of the CIDI (WHO, 1993). Lifetime ever alcohol abuse or alcohol dependence were combined to create the category lifetime ever AUD, using DSM-IV diagnostic criteria (APA, 2000).

Measure of main predictor

The main exposure in this study is the maternal alcohol consumption trajectory over 14 years. These trajectories were based upon self-reported information from mothers at pre-pregnancy; and 6 months, 5 and 14 years after the birth of their child.

Maternal alcohol consumption at each phase of study

At each survey, mothers were asked how often they drank alcohol and how much alcohol they consumed at each occasion. Respectively, six pre-specified response options ranging from never to daily alcohol consumption and from none to seven or more standard drinks were provided. Guidelines from the Australia National Health and Medical Research Council in 2009 (NHMRC, 2009) suggest that women's alcohol consumption should be calculated on the basis of weekly alcohol consumption standard drink (containing 10 grams of pure alcohol) scores. In the present study, alcohol consumption scores were estimated using a method described by Dawson (2003): multiplying the mid-point estimate of frequency by the mid-point estimate of quantity. For consistency with other studies (French et al., 2014; Powers & Young, 2008), respondents' levels of alcohol consumption were categorised as non-drinkers (never drink), occasional drinkers (< 1 drink per week),

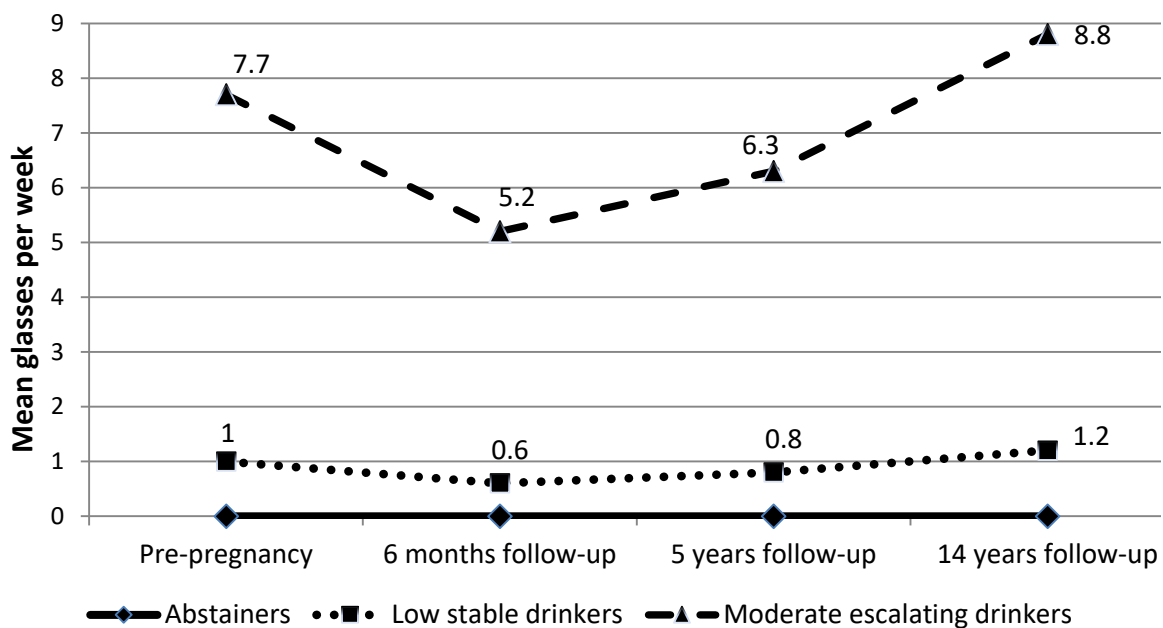
moderate drinkers (from 1 to 14 drinks per week), and heavy drinkers (>14 drinks per week).

Long-term trajectories of maternal alcohol consumption

Long-term trajectories of alcohol consumption by women were examined by using group-based trajectory modelling (Nagin, 2005). We used a censored normal model suggested by Jones and Nagin (2012) to examine the changes in alcohol consumption. Consistent with other studies (Bobo et al., 2013; Casswell et al., 2002), square root transformation was applied to alcohol data to reduce the effects of the skewed distribution. As the patterns of maternal alcohol consumption may covariate by maternal age and the number of their children (Roche & Deehan, 2002; Tran et al., 2014; Wilsnack, 2012), we conducted unadjusted and adjusted analyses of group-based trajectory modelling to explore the optimal drinking trajectories. Our unadjusted analyses showed that we could identify from two to four drinking trajectory groups in the sample. The best-fitting model was selected using the trajectory's principle, the larger the BIC the better fit of the model, and previous knowledge on women's alcohol consumption (Bobo & Greek, 2011; Brennan et al., 2011; Britton et al., 2015; Xie et al., 2006). As a result, a three-group trajectory model of drinkers with BIC = -19402.03 and mean posterior probability ranging from 0.85 to 0.93 was finally chosen for adjusted analyses. It is noted that the model with four drinking-trajectory groups had the better BIC than the one with three drinking-trajectory groups (BIC = -19109.04 versus BIC = -19402.03); however, the number of cases in one of the four drinking trajectories was too small (~2%) for further analyses.

In further analyses, I adjusted the three drinking-trajectory groups by adding maternal age at baseline as a fixed covariate in the model since age is synchronous with the time variable in the data. I also added parity at each time point up to the 14-year follow-up as a time-varying covariate in the adjusted model. The adjusted analysis slightly improved the model fit with BIC = -18531.29; however, membership numbers in each drinking group did not alter very much (more details in Appendix Table 6-1). We selected the three drinking-trajectory model with two covariates as the final model for examining the association between maternal alcohol-consumption trajectories over the 14-year follow-up and offspring's AUD at 21 years.

Figure 6-1 Average weekly alcohol consumption trajectories by mothers over 14 years



MEAN GLASSES PER WEEK FROM PRE-PREGNANCY TO 14 YEAR FOLLOW_UP SURVEY

	N (%)	Pre-pregnancy	6 months	5 years	14 years
Abstainers	349 (13.8)	0	0	0	0
Low-stable drinkers	1718 (67.9)	1	0.6	0.8	1.2
Moderate-escalating drinkers	464 (18.3)	7.7	5.2	6.3	8.8

Figure 6-1 presents mother’s alcohol-consumption trajectories over 14 years. Group 1, consisting of those who reported no or very little alcohol consumption across surveys, had 13.8% of respondents. This group was labeled as abstainers. Group 2, the low-stable drinkers, comprised 67.9% of respondents. Members in the low-stable drinkers-trajectory group consumed an average of one standard drink per week pre-pregnancy. As a group, they slightly reduced their consumption when they found out they were pregnant. These women returned to their near pre-pregnancy level of alcohol consumption by the 5-year follow-up. At 14 years, their weekly average alcohol consumption was the equivalent of 1.2 glasses a week. Finally, Group 3, comprising 18.3% of respondents, was labeled the moderate-escalating alcohol-consumption group. This group included women who had a moderate level of alcohol consumption pre-pregnancy. At six months after the birth of their child, they consumed less than they had pre-pregnancy. However, women in this group

gradually increased their consumption over time with a mean of about nine glasses per week.

Covariates

To examine the independent association between maternal alcohol consumption trajectories over 14 years and offspring's AUD, we included a number of potential confounding variables in the different models that are presented. It has been suggested that the association between maternal alcohol consumption and adolescent alcohol use or adolescent AUD may be confounded by socio-economic status (Bradley & Corwyn, 2002; Cerdá et al., 2011; Huckle et al., 2010; Melotti et al., 2013). Women with the lowest socio-economic status might be the heaviest drinkers, but there may be other reasons why their children have a drinking problem. In this study, indicators of socio-economic status were measured by mother's age at baseline, marital status and family income at the 14-year follow-up. Mother's age was categorised as <20, 20–29, and 30+ years. Teenage mothers might be expected to be both heavier drinkers and have children who are problem drinkers. Family income was classified into two categories: \$20 800 or more and \$20 799 or less. The threshold \$20 799 or less is estimated to be at around the poverty level in the period 1995–1996 in Australia (Saunders, 1996). Maternal marital status at the 14-year follow-up was measured by the question 'Is your present partner the father of this child?' Possible responses— yes, no, and no partner—were collapsed into two categories: biological father and not biological father/no partner.

The quality of family communication between mother and children may impact the association between maternal alcohol consumption and children's alcohol use (Alati, Najman, et al., 2005; Barnes et al., 2000; Mares et al., 2011; Marsden et al., 2005; Ryan et al., 2010; Sandra & Christopher, 2014). In the present study, we used The Open Family Communication Scale (Barnes & Olson, 1982) using a five-point Likert scale to assess the quality of mother-child communication at the 14-year follow-up. Low score represents open communication. The scale is comprised of 10 items and has a Cronbach's alpha value of 0.85. The composite variable was classified into three categories: good (low thru 32.9), fair (33 thru 35), and poor (35.1 thru high) communication.

Existing evidence has also suggested that parental illicit drug use or illicit drug related problems have an adverse impact on offspring's alcohol consumption (Biederman et al., 2000; Mares et al., 2011). I measured parental illicit drug use with two variables: maternal illicit drug use at the 5-year phase of the study, and paternal alcohol problems at

the 14-year phase. At the 5-year phase, mothers were asked how often they used cannabis (marihuana, pot) in the last month, with prompts from every day to never. The responses were categorised into a binary variable 'users' and 'non-users'. At the 14-year follow-up, mothers provided information about paternal alcohol use by answering the question, 'Has the natural father of your 13 year old had an alcohol problem?'. Three prompt responses were provided: no, yes, and do not know. Due to the low frequency of 'do not know' (5.5%) responses, responses were grouped into two categories: yes and no/do not know.

The association between maternal alcohol consumption and young adult's AUD may also reflect the offspring's antisocial behaviour (Englund et al., 2008; Sartor et al., 2007). At the 14-year follow-up, we used the YSR (Achenbach, 1991) to assess youth antisocial behaviour/externalising behaviour (consisting of aggression and delinquency). The YSR has been widely used as a measure of a child's antisocial behaviour. A composite variable with a total of 30 items and a Cronbach's alpha value of 0.88 was used with 10% cut-offs designating 'cases'.

Previous studies have shown that early-adolescent tobacco consumption is generally associated with AUD and the development of alcohol-related problems (Jackson et al., 2002; Mathers et al., 2006; Orlando et al., 2005; Wetzels et al., 2003). In this study, at the 14-year follow-up, offspring reported the average number of cigarettes they consumed during the week preceding the survey. Their responses were divided into two groups: non-smokers and smokers.

6.2.3 Data analysis

The data analyses were performed in four stages. First, we assessed collinearity to examine the correlations among predictor variables. The VIF ranged from 1.02 to 1.24 indicating that no collinearity was involved. All predicting variables will be included in further analyses.

At the second stage, logistic regression models were used to examine an association between maternal patterns of alcohol consumption and their offspring's AUD. I first examined the crude association between the outcome variable (offspring's AUD) and the main predictor (trajectories of maternal alcohol consumption). I subsequently adjusted the association using a range of covariates in different models to examine whether or not each predicting variable/group confounded the association as suggested by previous research

(Englund et al., 2008; Mares et al., 2011; Melotti et al., 2013; Ryan et al., 2010). I first adjusted for maternal socio-economic status (Model 1). Subsequent models progressively included mother-child communication at the 14-year follow-up (Model 2); maternal illicit drug use at the 5-year follow-up and paternal alcohol problems at the 14-year follow-up (Model 3); offspring's antisocial behaviours at the 14-year follow-up (Model 4), and offspring's tobacco consumption at the 14-year follow-up (Model 5).

Next, to examine whether the effect of maternal trajectories of alcohol consumption over 14 years on offspring's AUD varies by the sex of child, all the analyses were performed separately for male and female offspring.

Finally, of the cohort of 3778 mother-child pairs at the 21-year follow-up, 67.0% (2531) children completed the CIDI survey. The chi-square test was used to compare the profile of those who had data in the CIDI and those who did not. To assess how attrition may have affected my results, I assumed the data to be missing at random (Sterne et al., 2009). I used MI produced by Stata to impute missing data from the main predictor, covariates, and outcome. Initially, I used 20 cycles of imputation for the analyses of imputed data. Subsequently, sensitivity analysis was employed by repeating the whole process using 50 cycles of imputation.

Stata version 13.0 was used to perform the analyses where a *p*-value of <0.05 was adopted as a threshold for significant results. The abstainers-trajectory group was selected as the reference category in all our analyses. Data presented in the results section is mainly based on the analyses of 2531 mother-children pairs.

6.3 Results

Of the 2531 young adults who completed the CIDI-auto at 21 years, 27.7% (*n* = 702) met DSM-IV criteria for lifetime ever AUD of which males accounted for 67.1% (*n* = 471). The lifetime prevalence of AUD is higher than data from a national cross-sectional survey in which 11.1% youth aged 16–24 years reported alcohol abuse or dependence in the last year (Mewton et al., 2011). The higher rate likely reflects lifetime ever AUD rather than only in the last 12 months as in Mewton's study.

Table 6-1 Offspring's alcohol use disorder at 21 years according to explanatory factors

Explanatory factors	Overall	Offspring's alcohol use disorder at the 21-year follow-up		
		No (%)	Yes (%)	P-value
Maternal alcohol consumption trajectories				
Non drinkers	349	80.8	19.2	
Low-stable drinkers	1718	72.0	28.0	<0.000
Moderate-escalating drinkers	464	66.8	33.2	
Maternal age^a				
<20	358	69.0	31.0	
20-29	1711	72.7	27.3	0.323
30+	462	73.2	26.8	
Family income^b				
\$20 800 or more	1880	72.7	27.3	
\$20 799 or less	418	70.3	29.7	0.337
Maternal marital status^b				
Remain stable	1705	73.9	26.1	
Changed	630	68.6	31.4	<0.05
The quality of family communication^b				
Good	1902	73.5	26.5	
Fair	216	70.8	29.2	<0.05
Poor	219	64.8	35.2	
Maternal illicit drug use^c				
Non-users	2200	73.1	26.9	
Users	68	61.8	38.2	<0.05
Paternal alcohol problem^b				
No/ Do not know	1140	74.4	25.6	
Yes	222	68.9	31.1	0.091
Offspring's antisocial behaviours^b				
No	2198	74.1	25.9	
Yes (10% cut-off)	217	56.7	43.3	<0.000
Offspring's tobacco consumption^b				
No	2161	74.2	25.8	
Yes	249	57.4	42.6	<0.000

Note: ^a Measured at the baseline survey; ^b Measured at 14-year follow-up; ^c Measured at 5-year follow-up

Table 6- 1 describes the associations between a variety of explanatory predictors and offspring’s AUD. Maternal alcohol consumption trajectories over 14 years, maternal illicit drug use at the 5-year follow-up, and maternal marital status, the quality of family communication, child antisocial behaviours, and child tobacco consumption at the 14-year follow-up were significantly associated with offspring’s AUD at age 21 years. Adolescents were more likely to report an AUD if their mother was in the moderate-escalating drinkers group, or their mother changed her marital status over the 14 years, or they had poor communication with parents, or engaged in antisocial behaviours, or consumed tobacco.

Table 6-2 Maternal alcohol consumption trajectories and offspring’s alcohol use disorder at the 21-year follow-up (unadjusted and adjusted analyses)

Maternal alcohol consumption trajectories ^a	Offspring’s alcohol use disorder, Odds Ratio (95% CI)					
	Unadjusted	Adjusted				
		Model 1 ^b	Model 2 ^c	Model 3 ^d	Model 4 ^e	Model 5 ^f
Abstainers (ref.)	1.0	1.0	1.0	1.0	1.0	1.0
Low-stable drinkers	1.6 (1.2–2.2)	1.7 (1.2–2.3)	1.7 (1.2–2.3)	1.5 (0.9–2.4)	1.5 (0.9–2.3)	1.4 (0.9–2.2)
Moderate-escalating drinkers	2.1 (1.5–2.9)	2.1 (1.5–3.0)	2.0 (1.5–2.9)	2.1 (1.3–3.4)	2.1 (1.3–3.4)	2.0 (1.2–3.2)

Note: Bold = $p < 0.05$; ^a Assessed over 14-year follow-up; ^b Controlled for maternal age, marital status, and income at 14-year follow-up; ^c Controlled for Model 1 plus the quality of mother and offspring communication at 14-year follow-up; ^d Controlled for Model 2 plus maternal illicit drug use at 5-year follow-up and paternal alcohol problems at 14-year follow-up; ^e Controlled for Model 3 plus offspring’s antisocial behaviours at 14-year follow-up; ^f Controlled for Model 4 plus offspring’s smoking at 14-year follow-up.

Table 6-2 presents bivariate and multivariate associations between offspring’s AUD and maternal alcohol consumption trajectories. Bivariate results from logistic regression analysis shows that mothers in the higher maternal alcohol consumption trajectory groups are more likely to have offspring with a lifetime ever AUD. The results remained statistically significant when adjusted for maternal socio-economic status and mother–child communication (Model 1 and 2, respectively). Further adjustment for parental substance use and alcohol related problems (Model 3), child’s antisocial behaviour (Model 4), and child’s tobacco consumption eliminated the significant association with the low-stable drinkers trajectory group. Membership of this trajectory group is no longer related to children’s AUD. Women who were in the moderate escalating alcohol consumption trajectory were more likely to have children with a lifetime ever AUD after controlling for a range of confounding variables.

Table 6-3 shows the results for male and female offspring separately. Among female adolescents, adjustment for mother’s socio-economic status and mother-child communication revealed that female’s AUD was predicted by those whose mothers had had long-term moderate-escalating alcohol consumption. The association became a non-significant association when parental substance use/problems and child’s antisocial behaviours and cigarette smoking were added, indicating that the association between female’s AUD and maternal patterns of alcohol consumption may be confounded by the additional covariates. Alternatively, results presented in Table 6-3 for male offspring indicate that male offspring who had a mother in the higher alcohol consumption trajectory groups were more likely to have lifetime ever AUD. Maternal trajectories of alcohol consumption over 14 years appear to predict subsequent male rather than female offspring AUD.

Table 6-3 Maternal alcohol-consumption trajectories and offspring alcohol use disorder at 21-year follow-up by gender of the child (unadjusted and adjusted analyses)

Maternal alcohol consumption trajectories ^a	Offspring’s alcohol use disorder, Odds Ratio (95% CI)					
	Unadjusted	Adjusted				
		Model 1 ^b	Model 2 ^c	Model 3 ^d	Model 4 ^e	Model 5 ^f
Female offspring						
Abstainers (ref.)	1.0	1.0	1.0	1.0	1.0	1.0
Low-stable drinkers	1.3 (0.8–2.3)	1.3 (0.8–2.1)	1.3 (0.8–2.1)	1.0 (0.5–1.9)	1.0 (0.5–1.9)	0.9 (0.4–1.7)
Moderate-escalating drinkers	2.0 (1.2–3.3)	1.8 (1.1–3.2)	1.8 (1.0–3.1)	1.6 (0.8–3.4)	1.6 (0.8–3.4)	1.5 (0.7–3.3)
Male offspring						
Abstainers (ref.)	1.0	1.0	1.0	1.0	1.0	1.0
Low-stable drinkers	1.9 (1.3–2.8)	2.1 (1.4–3.2)	2.1 (1.4–3.2)	2.2 (1.2–3.9)	2.1 (1.2–3.8)	2.1 (1.2–3.7)
Moderate-escalating drinkers	2.5 (1.6–3.9)	2.7 (1.7–4.3)	2.7 (1.7–4.4)	2.8 (1.4–5.6)	2.7 (1.4–5.4)	2.6 (1.3–5.1)

Note: Bold = $p < 0.05$; ^a Assessed over 14-year follow-up; ^b Controlled for maternal age, marital status, and income at 14-year follow-up; ^c Controlled for Model 1 plus the quality of mother and offspring communication at 14-year follow-up; ^d Controlled for Model 2 plus maternal illicit drug use at 5-year follow-up and paternal alcohol problems at 14-year follow-up; ^e Controlled for Model 3 plus offspring’s antisocial behaviours at 14-year follow-up; ^f Controlled for Model 4 plus offspring’s smoking at 14 year-year follow-up.

Table 6-4 Profile of offspring who completed CIDI and those who did not complete CIDI at 21 years

Background characteristics	Offspring who completed the CIDI (n = 2531; 67.0%)	Offspring who did not complete the CIDI (n = 1247; 33.0%)	p-value
Maternal alcohol consumption trajectories			
Abstainers	13.5	16.0	0.11
Light drinkers	69.7	67.4	
Heaviest drinkers	16.8	16.6	
n	2531	1247	
Offspring's gender			
Male	48.5	45.1	0.05
Female	51.5	54.8	
n	2531	1247	
Child's marital status			
Single	81.1	72.4	<0.001
Married/Living together/Others	18.9	27.6	
n	2524	1240	
Child's educational level			
Incomplete secondary school	20.8	21.4	<0.01
Completed secondary school	54.6	49.1	
College-TAFE/University	24.6	29.5	
n	2520	1230	
Child's weekly income			
\$160 +	78.9	81.5	0.05
\$0 to \$159	21.1	18.5	
n	2512	1225	
Child's OP score			
1-7	10.5	8.1	<0.001
8-11	9.9	8.5	
12-25	31.0	27.4	
No OP score	48.6	56.0	
n	2456	1189	

In the present study, attrition was 33.0%. Chi-square analyses to compare the profile of those who remained in the study and completed the CIDI and those who did not complete the CIDI or were lost to follow-up showed that generally those who were lost to follow-up were more likely to be female, single, have a higher level of education, have a

higher weekly income, and not have an OP academic score (Table 6-4). Repeated analyses which used 20 cycle and 50 cycle MI showed similar results as the ones in the complete sample of 2531 mother-child pairs suggesting that our findings do not reflect selection bias (more details in Appendix Tables 6-2 and 6-3).

6.4 Discussion

This study has examined the gender difference in the longitudinal association between mother's alcohol consumption trajectories and offspring's AUD. Using prospective cohort data of mothers and their offspring in Brisbane, Queensland, Australia over 21 years, two study aims were addressed. While several previous studies find no association between maternal alcohol use and their children's drinking (Koning et al., 2010; Marsden et al., 2005), our findings suggest that a maternal trajectory of moderate-escalating alcohol consumption over 14 years is independently associated with offspring's AUD at 21 years even after adjustment for a range of potential confounding variables. Mothers who consume alcohol at a moderate level over an extended period of their child's early life course are more likely to have offspring with lifetime ever AUD. These findings are in line with findings in some previous studies (Poelen et al., 2007; Van Der Vorst et al., 2009; Yule et al., 2013).

There is substantial evidence showing that parental alcohol use has an association with adolescent alcohol consumption. However, the question as to whether mothers or fathers, or both influence alcohol consumption patterns of offspring has been unresolved. In my analyses, after adjustment for paternal alcohol consumption at the 14-year follow-up, being in the maternal moderate-escalating alcohol consumption trajectory group independently impacts on offspring's AUD. This may reflect mothers spending more time than fathers in interacting with their children, particularly child-care activities. Mothers may also be more involved in their children's emotional lives (Biblarz & Stacey, 2010; Klimes-Dougan et al., 2007; Lytton & Romney, 1991). In addition, parents who consume alcohol will have alcohol available at home. Previous studies suggested that having alcohol available at home is related to higher drinking levels in adolescents (Van Zundert et al., 2006).

The association between mother's alcohol consumption trajectories and adolescent offspring' AUD differs by the gender of the child. In our study, it seems there is a 'cross-

gender influence' observed for the moderate-escalating drinkers trajectory group. This finding differs somewhat from previous research which indicates that children tend to model their same sex parents' drinking behavior (Yeh et al., 2006) but it is supported by the work of Cleveland et al. (Cleveland et al., 2014) and Englund et al. (Englund et al., 2008) showing that maternal alcohol consumption is a good predictor of male alcohol use outcomes. Further analyses showed that among children who have mothers in the moderate-escalating drinking trajectory group, a higher proportion of female offspring reported experiencing poor communication with their mother (66.7% versus 33.3%). Mothers appear to be more open and possibly closer to their male children. It is possible that male offspring may be more likely to model their mothers' alcohol consumption behaviours.

Previous studies have shown that early age at first alcohol use increases risk of later development of adolescent alcohol use disorder (Blomeyer et al., 2011; Bolland et al., 2016). This may affect the association between maternal alcohol consumption trajectories and offspring's alcohol use disorder. We tested this possibility and found that when controlled for age at first consumption before 14-years (Model 5) either in male or in female sample, the adjustment did not significantly change the magnitude of the associations, indicating that the association between maternal alcohol consumption trajectories and offspring's alcohol use disorder is independent of age at first consumption of alcohol and other confounding variables. However, controlling for age at first consumption attenuated the association between moderate-escalating drinker group and offspring's alcohol use disorder in the general sample, suggesting that at least part of this association is explained by early age of alcohol consumption. In addition, further analyses also indicated that offspring who had had consumed alcohol at the 14-year follow-up were more likely to report having alcohol use disorder at 21 years. The result may suggest that prevention addressing alcohol consumption by adolescent and young adults may need to be earlier, even at 14 years or less as many offspring start using alcohol at a young age.

The present study has some limitations. The MUSP study has not collected information on father's alcohol consumption at each phase of the study. We only asked mothers at 14 years about father's alcohol use problems. Therefore, we cannot assess the influence of paternal alcohol consumption trajectories. There is a good reason to expect that young adult's alcohol use or AUD may also be related to father's alcohol consumption (Haugland et al., 2013; Van Der Vorst et al., 2009). It is possible that the association between mother's alcohol consumption patterns and offspring's AUD may partly reflect

paternal influences. This could result in residual confounding effect of father's alcohol use levels. In this study, the decision to use categorical forms of data may underestimate the contribution of some of the more marginal associations. Another limitation is that the prevalence rate of alcohol use disorder is much higher among male offspring. This may affect the confidence intervals rather than the point estimates. Our results showed that the point estimates for female offspring are consistently lower suggesting that the gender differences do not simply reflect the lower number of affected females. In the current study, I only controlled for family variables but not for other genetic and broader environment factors. Finally, loss to follow-up might be expected to have biased some results. Of the cohort of 3778 mothers and children at the 14-year follow-up, the attrition was about 33.0%. Our MI analyses indicated that the results are not likely to have been substantially affected by selection bias.

Conclusion

Membership of the moderate-escalating alcohol consumption trajectory group independently predicted offspring's AUD at 21 years even after adjustment for a range of potential confounding variables. Cross gender differences were observed in the associations between maternal drinking trajectories and offspring's AUD. It appears that patterns of maternal alcohol consumption may have an independent effect on offspring's alcohol consumption, with male children being more vulnerable to the effects of maternal alcohol use than are female children. Programs intended to address alcohol consumption by adolescents and young adults may need to focus on the behaviours of both parents early in the child life course.

Chapter 7: GENDER DIFFERENCES IN THE PROSPECTIVE ASSOCIATION BETWEEN MATERNAL ALCOHOL-CONSUMPTION TRAJECTORIES AND YOUNG ADULT OFFSPRING'S PROBLEM GAMBLING AT 30 YEARS

Although a large number of studies have examined the association between young adult's alcohol consumption and their problem gambling behaviours, none of these studies address the prospective association between mother's alcohol consumption and their young adult offspring's problem gambling behaviours. Using data from a 30-year prospective pre-birth cohort study in Brisbane, Australia (n = 1,691), this chapter examines whether different maternal alcohol consumption trajectories predict offspring's risk of problem gambling behaviours and whether these associations differ by the young adults' gender. Offspring's level of problem gambling behaviours was assessed by the short version of the Canadian Problem Gambling Index, with about 10.6% of young adults having some risk of problem gambling behaviours. Trajectories of maternal alcohol consumption were determined by group-based trajectory modelling over five time points. The results suggest that mother's alcohol consumption patterns fit into three drinking trajectory groups, namely abstainers (17.2%), a low-stable drinkers group (64.6%) and a moderate-escalating drinkers group (18.2%). Multivariate logistic regression analyses showed that the moderate-escalating alcohol trajectory group is independently associated with a risk of their male young adult offspring having problem gambling behaviours at 30 years—even after adjustment for a range of potential confounding variables. Mothers who exhibit a persistent life course pattern of moderate-escalating drinking have male children who have a higher risk of engaging in problem gambling behaviours. Offspring's alcohol consumption partially mediated the association between maternal drinking trajectories and young adult's risk of problem behaviours. High levels of maternal alcohol consumption may lead to male offspring antisocial behaviours. Programs intended to address problem gambling behaviours by young adults may need to focus on male group with a focus which specifically addresses family influences as these contribute to gambling behaviour.

7.1 Background

Between 5.3% and 12.1% of Australian adults are estimated to manifest behaviours associated with problem gambling (Acil Allen Consulting, 2014; Attorney-General, 2012; Billi et al., 2014; Davidson & Rodgers, 2010; Sproston et al., 2012; The Social Research Centre, 2013). These proportions are generally consistent with figures reported for other countries such as the United States, Canada, Sweden, and the United Kingdom (Abbott et al., 2014; Orford et al., 2012; Wardle et al., 2011; Williams, West, et al., 2012). Studies across countries have shown that prevalence estimates for problem gambling among adolescents and young adults are higher than in adult populations (Delfabbro et al., 2014; Scholes-Balog et al., 2014; Volberg et al., 2010). Among young people aged 13 to 17 years, between 60% and 80% gamble at least once per year, and around 3% to 5% report symptoms of problem gambling or pathological gambling (Delfabbro et al., 2014).

A range of factors have been associated with the risk of problem gambling among adolescents and young adults, such as gender, age, antisocial behaviours, academic performance, family socio-economic status, parental gambling involvement (Barnes et al., 2005; Delfabbro et al., 2014; Forrest & McHale, 2012; Shead et al., 2010; Williams et al., 2015), as well as alcohol consumption. It is not only the extent to which alcohol consumption normally coexists with gambling behaviours; it may also be an antecedent of problem gambling, suggesting considerable implications for intervention strategies. The correlation between alcohol consumption or AUD and problem gambling among adolescents and young adults has been well documented in cross-sectional studies (Banwell et al., 2006; Delfabbro, 2008; LaBrie et al., 2003; Nehlin et al., 2013; Welte et al., 2001). For example, a national survey of gambling among 10 765 college students in the United States found that students who gambled were less likely to abstain from drinking alcohol (LaBrie et al., 2003); and a cross-sectional Swedish survey of youth aged 16 to 24 years found that, among males, the higher the alcohol consumption, the higher the likelihood of gambling and problem-gambling behaviours (Fröberg et al., 2012). The few longitudinal studies examining alcohol consumption by adolescents as a risk factor for problem gambling consistently show that higher levels of alcohol consumption or early initiation of alcohol use have been associated with problem gambling (Abbott, Williams, et al., 2004; Barnes et al., 2002; Goudriaan et al., 2009; Scholes-Balog et al., 2014; Walker et al., 2012). I have previously found that those who started drinking alcohol before age 15

years were more likely to be gamblers than those who did not drink (Hayatbakhsh et al., 2013).

The gambling literature provides cross-sectional and longitudinal evidence on the association between adolescents' alcohol consumption and problem-gambling behaviours; however, to our knowledge, there is no study examining the relation between maternal alcohol-consumption trajectories and their young adult offspring having problem-gambling behaviours. Comorbidity between problem gambling and other substance use, including alcohol consumption or AUD, has long been recognised (Delfabbro, 2008; Lorains et al., 2011; Scholes-Balog et al., 2014). These studies suggest that those who consume or binge on alcohol are more likely to gamble and to have problem-gambling behaviours. In addition, reviews on alcohol consumption indicate that maternal alcohol consumption predicts an offspring's alcohol use (Cleveland et al., 2014; Englund et al., 2008; Mares et al., 2011; Poelen et al., 2007; Van Der Vorst et al., 2009). We thus hypothesise that there will be an association between maternal alcohol consumption and young adults' problem-gambling behaviour. A longitudinal association of maternal alcohol consumption predicting offspring gambling behaviour has not previously been reported. Such research would provide knowledge about whether a mother's alcohol-consumption trajectories relate to her young adult's problem-gambling behaviours. This may help in the development of prevention programs for both alcohol consumption and problem gambling.

The present study uses prospective data from the Mater-University of Queensland Study of Pregnancy, comprising a linked pre-birth cohort of mothers and children spanning over 30 years. Given that male adolescents are more likely to be involved in problem gambling than female adolescents (Abbott et al., 2014; Delfabbro, 2008; Scholes-Balog et al., 2014), and that maternal alcohol consumption has a greater effect on male drinking than female drinking (Cleveland et al., 2014; Englund et al., 2008), it was hypothesised, first, that maternal alcohol-consumption trajectories may be associated with young adult's problem gambling; and second, that a mother's pattern of alcohol consumption may have a greater impact on male than female young-adult gambling behaviours.

7.2 Method

7.2.1 Participants and procedures

Data were taken from the MUSP, a prospective pre-birth cohort study of women enrolled at a public obstetric hospital in Brisbane, Australia between 1981 and 1984. Details of the study have been described elsewhere (Najman et al., 2005; Najman et al., 2014). Women were recruited at their first clinic visit (Time 1), at approximately 18 weeks gestation, and 6753 women were asked about their alcohol consumption, social demographic characteristics, lifestyle behaviours, and health information before pregnancy. These women were re-interviewed when their child was 6 months old (Time 2); and at 5 (Time 3), 14 (Time 4) and 21 (Time 5) years of age. Their offspring were also interviewed for the follow-up surveys at 14, 21 and 30 years. The present study is based on the sub-sample of 1691 mothers and their children remaining in the study at 30 years (Time 4, Time 5, and Time 6, respectively). The sub-sample includes mothers who provided details of their alcohol consumption for up to five phases of the study (Time 1 to 5) and their children who provided data on gambling behaviours at 30 years (Time 6). Written informed consent was obtained from mothers at all data collection phases and from the young adults at the study's 30-year follow-up. Ethics committees from the Mater Hospital and from The University of Queensland approved each phase of study.

7.2.2 Measures of variables

Measure of young adult's risk of problem-gambling behaviour

At the 30-year follow-up, young adults were asked the question '*Do you spend money on gambling?*' with possible responses 'yes' or 'no'. Only those responding 'yes' were asked to complete a short version of the CPGI to determine their levels of problem-gambling behaviours over the last 12 months. The CPGI has been tested and re-tested for its validity and reliability in surveys of both a general population and a clinical sample with Cronbach's alpha = 0.84, higher than the one tested for other measures such as the DSM-IV and South Oaks Gambling Screen (SOGS) (Ferris & Wynne, 2001). The tool has been widely used in previous studies in Queensland in 2001, 2003–04, 2006–07, and 2011–12 (Attorney-General, 2012), in other states in Australia and other countries (Abbott, Volberg, et al., 2004). The short version of CPGI comprises nine questions as follow: (1) Bet more than afford to lose, (2) Gamble with larger amounts, (3) Tried to win back losses, (4) Borrowed or sold to get money, (5) Felt have a problem with gambling, (6) Caused health

problems, (7) Told had gambling problem, (8) Caused financial problems, and (9) Felt guilty about gambling.

The responses of the CPGI are 'never' scored 0; 'sometimes' scored 1; 'most of the time' scored 2; and 'almost always' scored 3. In the present study, together with the responses about spending money on gambling, individual scores for the nine questions were added to generate an overall score ranging from 0 to 27. Respondents were then classified into one of four gambling-behaviour categories: 0 = non problem gamblers (including those who had not gambled and who had gambled for recreational purpose), 1–2 = low risk, 3–7 = a moderate risk, and 8+ = a problem gambler (Ferris & Wynne, 2001). Consistent with other studies (Acil Allen Consulting, 2014; Billi et al., 2014; Sproston et al., 2012), the proportions of moderate risk and problem gamblers in our study were low, 3.2% and 1.1%, respectively. To increase the statistical power, we collapsed the four problem-gambling behaviours into two groups: non-problem gambler and no-risk-behaviour–some-risk-behaviours of problem gambling (included low risk, moderate risk, and problem gamblers). The distribution of no risk and some risk behaviours of problem gambling is also the cut-off point of 10% of the population sample.

Measure of main predictor

The main exposure in this study is the maternal alcohol-consumption trajectory over 21 years. These trajectories were based upon self-reported information from the mothers at Time 1, Time 2, Time 3, Time 4, and Time 5.

Maternal alcohol consumption at each phase of study

At each survey, mothers were asked how often they drank alcohol and how much alcohol they consumed on each occasion. Respectively, six pre-specified response options ranging from never to daily alcohol consumption and from none to seven or more standard drinks were provided. Guidelines from the Australia National Health and Medical Research Council (NHMRC, 2009) suggest that women's alcohol consumption should be based on the weekly number of standard drinks (containing 10 grams of pure alcohol) consumed. In our study, alcohol consumption scores were estimated by a method described by Dawson (2003), whereby the mid-point estimate of frequency was multiplied by the mid-point of quantity consumed¹. For consistency with other studies (French et al.,

¹ For example, if a respondent reported she consumed alcohol daily, drinking three to four standard glasses, the mid-point estimate was coded as 7 times a week (for frequency) and 3.5 glasses a day (for quantity)

2014; Powers & Young, 2008), respondents' levels of alcohol consumption were categorised as non-drinkers (never drink), occasional drinkers (<1 drink per week), moderate drinkers (from 1 to 14 drinks per week), and heavy drinkers (>14 drinks per week).

Long term trajectories of maternal alcohol consumption

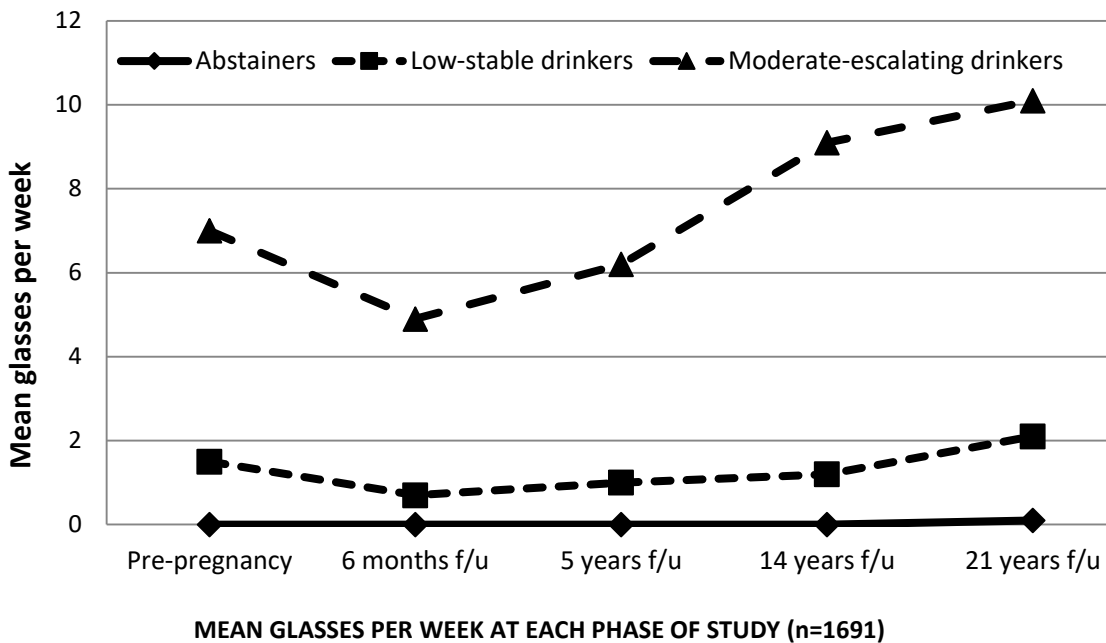
Long-term trajectories of alcohol consumption by women were examined by using group-based trajectory modelling (Nagin, 2005). We used a censored normal model suggested by Jones and Nagin (2012) to examine the changes of alcohol consumption. Consistent with other studies (Bobo et al., 2013; Casswell et al., 2002), square root transformation was applied to alcohol data to reduce the effects of the skewed distribution. First, we used an unconditional model to identify the number of trajectory groups. Then, because the pattern of maternal alcohol consumption over a mothers' life course may depend on the number of children she has (Brennan et al., 2010; Roche & Deehan, 2002; Tran et al., 2014; Wilsnack, 2012), I fitted a conditional model by adding a parity variable as a function of a time-varying covariate in the model while simultaneously estimating the parameters that defined the trajectory group.

The estimation of the unconditional trajectory group model showed that I could identify between two to four drinking-trajectory groups in the sample. The three-group model had the largest BIC (BIC = -22675.65) with mean posterior probability ranging from 0.86 to 0.93, suggesting that it represented a better fit with the mother sample than the other models. The fitted model provided distinct drinking trajectories that were much bigger than the minimum average posterior probability of 0.70 for all groups (Nagin, 2005), and was also in line with previous studies of alcohol consumption patterns by women (Brennan et al., 2011; Xie et al., 2006).

In the conditional trajectory model, adding the number of offspring over five time periods slightly improved the model fit (BIC = -21068.01). On the basis of the BIC criteria, we selected a conditional model with three drinking-trajectory groups as the final model for examining the association between maternal alcohol-consumption trajectories and their young adult's risk of problem-gambling behaviours.

consumed). The respondent's alcohol consumption score, in this case, was 24.5 as the product of the mid-point estimates of frequency and quantity of alcohol consumption.

Figure 7-1 Maternal alcohol-consumption trajectories at five times over 21 years



	N (%)	Pre-pregnancy	6 months	5 years	14 years	21 years
Abstainers	291 (17.2)	0.0	0.0	0.0	0.0	0.1
Low-stable drinkers	1092 (64.6)	1.5	0.7	1.0	1.2	2.1
Moderate-escalating drinkers	308 (18.2)	7.0	4.9	6.2	9.1	10.1

Figure 7-1 displays the shape of three drinking trajectories and the mean alcohol consumption level of each trajectory over five time points.

- The largest group (an estimated 64.6% of the sample, average posterior probability of membership = 0.92) was labelled as the **low-stable drinkers** group. Women in this trajectory group consumed 1.5 standard drinks per week at Time 1. They reduced their consumption by half when they found out they were pregnant, then slowly increased, but their level of alcohol consumption was still low at Time 3 and Time 4, 14 years after the birth of their baby. After 21 years (Time 5), their weekly average alcohol consumption was the equivalent to two glasses a week.
- The next largest group consisted of **moderate-escalating drinkers** (an estimated 18.2% of sample, average posterior probability of membership = 0.92). Members of

this group were those who consumed alcohol at a moderate level (7 standard glasses per week) at Time 1, pre-pregnancy. They slightly reduced their consumption at Time 2, but returned to their pre-pregnancy drinking level at Time 3, the 5-year follow-up; then, gradually continued to increase their level of alcohol use. At the 21-year follow-up, weekly average alcohol consumption among these women was 10.1 standard glasses per week.

- The third group was **the abstainers** (an estimated 17.2% of sample, average posterior probability of membership = 0.86) who reported having had no alcohol consumption or minimal consumption at the five survey times.

Covariates

To examine the independent association between maternal alcohol-consumption trajectories over 21 years and their young adult's risk of problem-gambling behaviours, we included a number of potential confounding variables in different models. These covariates included mother's age at Time 1, mother's income and marital status at Time 4; paternal alcohol use problems at Time 4; the young adult's socio-economic status (educational levels, income, and marital status) at Time 5.

In addition, we controlled for offspring's alcohol consumption which was measured at Time 6, the same time as gambling behaviour was assessed. Offspring's alcohol consumption was measured using a similar tool (*frequency-quantity questions*) to the one used at each phase of the study to assess mother's alcohol consumption. Due to the low proportion of heavy alcohol consumption by offspring of mothers with a moderate-escalating drinking trajectory and risk behaviours of problem gambling, we treated young adult's alcohol consumption as a covariate to test the possibility that maternal alcohol-consumption patterns are related to offspring's alcohol consumption which in turn is associated with offspring's problem-gambling behaviours.

Analyses of data

The data analyses were performed in four stages. First, we assessed collinearity to examine the correlations among the predictor variable and covariates. The VIF, ranging from 1.02 to 1.48, indicated that no collinearity was involved. All predicting variables were included in further analyses.

Second, we examined the association between maternal patterns of alcohol consumption and young adult offspring's risk of problem-gambling behaviours using logistic regression models. Initially, we examined the crude association between the outcome variable (risk of problem-gambling behaviours) and the main predictor (trajectory of maternal alcohol consumption). We subsequently adjusted the association using a range of covariates in different models to examine whether or not each predicting variable/group confounded the association as suggested by previous research (Delfabbro et al., 2014; Forrest & McHale, 2012; Hayatbakhsh et al., 2013). We adjusted for mother's age at baseline; mother's income and marital status at the 14-year follow-up (Model 1); then included paternal alcohol related problems at the 14-year follow-up (Model 2); young adult's socio-economic characteristics at the 21-year follow-up (Model 3); and young adult's alcohol consumption at the 30-year follow-up (Model 4).

Next, to examine whether the effect of the maternal trajectory of alcohol consumption on offspring's risk of problem-gambling behaviours varies according to their sex, we performed all the analyses separately for male and female young adults.

Of the cohort of 3416 mother-child pairs at Time 6, about 1691 (49.5%) children were retained and provided information on problem-gambling behaviours. We assessed how attrition may have affected the results using a multivariable logistic regression model of loss-to-follow-up with young adult's demographic characteristics at the 21-year follow-up (e.g. gender, employment, income, marital status, and impulsive behaviours). Starting from a 'missing at random' assumption (Sterne et al., 2009), We used Stata to multiply imputed missing data from the main predictor, covariates, and outcomes. Initially, I used 20 cycles of imputation for the analyses of imputed data. Subsequently, sensitivity analysis was employed by repeating the whole process using 50 cycles of imputation.

All analyses were undertaken using STATA version 13.0 where a p -value of <0.05 was adopted as a threshold for significant results. The no risk gambling behaviour was selected as the reference category in all our analyses. Data presented in the results section is based on the analyses of 1691 mother-child pairs.

7.3 Results

Overall, 10.6% ($n = 180$) of participants at age 30 years reported having some risk behaviours of problem gambling, with males accounting for 58.3% ($n = 105$). The

prevalence of risk of problem–gambling behaviours among male young-adult offspring in our sample is consistent with previous studies (Forrest & McHale, 2012; Scholes-Balog et al., 2014). Among those who were determined as having some risk of problem-gambling behaviours, more than 80% had a high income and were single; and nearly two-thirds finished their secondary schooling. The univariate analysis between maternal alcohol-consumption trajectories and offspring’s risk of problem-gambling behaviours shows that young-adult offspring who have mothers in the moderate-escalating group tend to have greater risk of problem-gambling behaviours than those with mothers in the low-stable and abstainers groups (15.9% versus 9.7% and 8.5%, respectively).

Table 7-1 Maternal alcohol consumption trajectories and young adult’s risk of problem-gambling behaviours at 30 year follow-up

Maternal alcohol consumption trajectories ^a	No (%)	Risk of problem-gambling behaviours				
		Odds Ratio (95% CI)				
		Unadjusted	Adjusted			
			Model 1 ^b	Model 2 ^c	Model 3 ^d	Model 4 ^e
Abstainers	291 (17.2)	1.0	1.0	1.0	1.0	1.0
Low-stable drinkers	1,092 (64.6)	1.2 (0.7–1.9)	1.2 (0.7–1.9)	1.1 (0.6–1.9)	1.1 (0.6–2.1)	0.9 (0.5–1.7)
Moderate-escalating drinkers	308 (18.2)	2.1 (1.3–3.6)	2.0 (1.2-3.5)	2.1 (1.1-4.1)	2.2 (1.1-4.2)	1.6 (0.8-3.2)

Note: Reference group is no risk behaviours of problem gambling; ^a Assessed over 21 years of follow-ups; ^b Controlled for mother’s SES (maternal age at baseline, maternal marital status and income at 14-year follow-up); ^c Controlled for Model 1 plus paternal alcohol problems at 14–year follow-up; ^d Controlled for Model 2 plus young adult’s SES (income, education, marital status) at 21- year follow-up; ^e Controlled for Model 3 plus young adult’s alcohol consumption at 30–year follow-up.

Table 7-1 presents bivariate and multivariate associations between young adult’s risk of problem-gambling behaviours and maternal alcohol-consumption trajectories. Bivariate results from logistic regression analysis show that the maternal moderate-escalating group is statistically associated with young adult’s risk of problem-gambling behaviours, while the low-stable group is not related to any risk of problem-gambling behaviours. The results remained statistically significant for the moderate-escalating group when adjusted for mother and young adult’s socio-economic status and paternal alcohol problems (Model 1-3). The model was no longer statistically significant when adjusted for offspring’s alcohol consumption, suggesting that the association between mother’s moderate-escalating

drinking trajectory and young adult's risk of problem-gambling behaviours was confounded by alcohol use by offspring.

Table 7-2 Maternal alcohol-consumption trajectories and female young adult's risk of problem-gambling behaviours at 30 year follow-up

Maternal alcohol consumption trajectories ^a	No (%)	Risk of problem-gambling behaviours				
		Odds Ratio (95% CI)				
		Unadjusted	Adjusted			
			Model 1 ^b	Model 2 ^c	Model 3 ^d	Model 4 ^e
Abstainers	178 (16.9)	1.0	1.0	1.0	1.0	1.0
Low-stable drinkers	686 (65.0)	0.9 (0.5–1.7)	0.9 (0.5–1.7)	0.8 (0.4–1.6)	0.6 (0.3–1.4)	0.7 (0.3–1.6)
Moderate-escalating drinkers	191 (18.1)	1.2 (0.6–2.6)	1.2 (0.6–2.6)	1.0 (0.5–2.3)	1.1 (0.5–2.7)	1.2 (0.5–2.9)

Note: Reference group is no risk behaviours of problem gambling; ^a Assessed over 21 years of follow-ups; ^b Controlled for mother's SES (maternal age at baseline, maternal marital status and income at 14-year follow-up); ^c Controlled for Model 1 plus paternal alcohol problems at 14-year follow-up; ^d Controlled for Model 2 plus young adult's SES (income, education, marital status) at 21-year follow-up; ^e Controlled for Model 3 plus young adult's alcohol consumption at 30-year follow-up

Table 7-2 and 7-3 show the results for male and female young adult offspring separately. Maternal alcohol-consumption trajectories did not significantly predict risk of problem-gambling behaviours for young-adult females (Table 7-2). However, the analyses among male offspring indicate a strong association between the maternal moderate-escalating group and young-adult males' risk of problem-gambling behaviours with ORs ranging from 3.6 (95% CI: 1.7–7.6) for unadjusted to 4.7 (95% CI: 1.7–13.1) for adjusted analyses (Table 6-3). Adjustment for offspring's alcohol consumption at the 30-year follow-up appeared to reduce the strength of the association between maternal moderate-escalating drinking trajectory and young adult males' risk of problem-gambling behaviours, ORs reducing from 4.7 (95% CI: 1.7–13.1) in Model 3 to 3.0 (95% CI: 1.0–8.7) in Model 4. Maternal alcohol consumption at the moderate-escalating group appears to predict problem-gambling behaviours for their male rather than female young-adult offspring. Women who exhibit a persistent life course pattern of heavier alcohol consumption have male children who have a high risk of engaging in problem-gambling behaviours.

Table 7-3 Maternal alcohol-consumption trajectories and young-adult males' risk of problem-gambling behaviours at 30-year follow-up

Maternal alcohol consumption trajectories ^a	No (%)	Risk of problem-gambling behaviours				
		Odds Ratio (95% CI)				
		Unadjusted	Adjusted			
			Model 1 ^b	Model 2 ^c	Model 3 ^d	Model 4 ^e
Abstainers	113 (17.8)	1.0	1.0	1.0	1.0	1.0
Low-stable drinkers	406 (63.8)	1.6 (0.8–3.2)	1.7 (0.8–3.4)	2.1 (0.8–5.3)	2.0 (0.8–5.1)	1.5 (0.6–4.1)
Moderate-escalating drinkers	117 (18.4)	3.6 (1.7–7.6)	3.7 (1.7–8.0)	4.8 (1.8–12.9)	4.7 (1.7–13.1)	3.0 (1.0–8.7)

Note: Bold = $p < 0.05$; Reference group is no risk behaviours of problem gambling; ^a Assessed over 21-years of follow-ups; ^b Controlled for mother's SES (maternal age at baseline, maternal marital status and income at 14-year follow-up); ^c Controlled for Model 1 plus paternal alcohol problems at 14-year follow-up; ^d Controlled for Model 2 plus young adult's SES (income, education, marital status) at 21-year follow-up; ^e Controlled for Model 3 plus young adult's alcohol consumption at 30-year follow-up.

Of the cohort of 3416 mother-child pairs at Time 5, a 21-year follow-up, about 1725 (50.5%) were lost to follow-up and did not provide information on gambling behaviours at Time 6, the 30-year follow-up. Young adults who dropped out of the study or were excluded from the study due to not providing gambling information were more likely to be males who did not finish their secondary schooling and had higher income levels (Table 7-4). Repeated analyses which used 20 cycle and 50 cycle MI showed similar results to the ones in the main analyses, suggesting that our findings do not reflect selection bias.

7.4 Discussion

Using the data from a linked pre-birth cohort of mothers and children extending over 30 years, I examined the association between a mother's alcohol-consumption trajectory and her offspring's risk of problem-gambling behaviour, including the extent of gender differences. We found that a maternal trajectory of moderate-escalating alcohol consumption over 21 years is independently associated with a risk of their young-adult offspring having problem-gambling behaviours at 30 years—even after adjustment for a range of potential confounding variables, with the exception of alcohol use by offspring.

Mothers who consume alcohol at a moderate to heavier level over an extended period of their child's early life course are more likely to have a child at risk of problem gambling.

Table 7-4 Multivariate attrition analyses predicting those who would be lost to follow-up at the 30year phase

Predicting variables ¹	Odds of being lost to follow-up	
	Unadjusted	Adjusted ²
	OR (95% CI)	OR (95% CI)
Gender		
Male (ref.)	1.0	1.0
Female	0.4 (0.4–0.5)	0.5 (0.4–0.5)
Marital status		
Never married (ref.)	1.0	1.0
Cohabitation	0.9 (0.8–1.1)	1.0 (0.8–1.2)
Married	0.8 (0.5–1.1)	0.9 (0.6–1.3)
Sep/di/wid	2.2 (0.9–5.4)	2.4 (0.9–6.5)
Educational level		
Lower secondary (ref.)	1.0	1.0
Secondary school	0.4 (0.3–0.5)	0.4 (0.4–0.5)
College—TAFE/Uni	0.4 (0.3–0.5)	0.4 (0.4–0.5)
Income		
\$160+ per week (ref.)	1.0	1.0
\$0 to \$159 per week	0.7 (0.6–0.8)	0.7 (0.6–0.8)
Impulsive behaviours		
Normal (ref.)	1.0	1.0
High	0.9 (0.7–1.2)	0.9 (0.7–1.1)
Maternal alcohol consumption trajectories		
Abstainers (ref.)	1.0	1.0
Low-stable drinkers	0.8 (0.7–1.0)	0.8 (0.7–1.0)
Moderate-escalating drinkers	0.8 (0.6–0.9)	0.8 (0.6–1.0)

Note: Bold = $p < 0.05$; ¹Assessed at 21-year follow-up. ²Model was adjusted for all factors listed.

The association between mother's alcohol-consumption trajectories and problem-gambling behaviour by their young-adult offspring differs by their gender. In our study, there is 'cross-gender influence' observed for the moderate-escalating drinkers group. A mother's moderate-escalating drinking trajectory is a predictor of gambling, especially

problem gambling, by male offspring but not female offspring. This finding differs somewhat from previous research which indicates that children tend to model their same sex parents' substance use (Yeh et al., 2006), but it is supported by the work of Cleveland et al. (2014) and Englund et al. (2008), showing that maternal alcohol consumption is a good predictor of male alcohol use.

Adjustment for mothers and their young adult offspring's socio-economic status does not change the magnitude of the association among the young adult male group. However, it is of note that adjustment for paternal alcohol-related problems increased the magnitude of the association (OR = 3.6; 95% CI: 1.7–7.6 in unadjusted model; OR = 3.7; 95% CI: 1.7–8.0 in Model 1; and OR = 4.8; 95% CI: 1.8–12.9 in Model 2), suggesting that paternal alcohol consumption is associated with and contributes to young adults' problem-gambling behaviour. We were unable to test whether the mother's or father's alcohol consumption pattern had the greater impact on their offspring's problem-gambling behaviours as we did not have this information for fathers. However, our analyses suggest that father's alcohol use partly predicts offspring's problem-gambling outcomes at 30 years. Further research should address the patterns of both paternal and maternal alcohol consumption on offspring's problem-gambling behaviour.

Our study results show that alcohol consumption by offspring partially mediated the association between mother's moderate-escalating drinking trajectory and young adult's risk of problem-gambling behaviours. After adjustment for offspring's alcohol consumption, the association of maternal alcohol consumption and offspring gambling was no longer statistically significant. The results suggest that together with maternal alcohol consumption trajectories, alcohol use by offspring is associated with and contributes to gambling behaviours. Alternatively, the present study implies the co-occurrence of alcohol consumption and gambling problems among offspring, suggesting that such behaviours may have a shared antecedent factor.

Our analyses indicated that not only is there a significant co-occurrence between alcohol consumption and problem gambling among the general sample but also that this association is considerably stronger in males than females. Prevention and intervention programs need to target males for this reason.

There are number of possible mechanisms explaining why maternal alcohol consumption is associated with offspring's gambling behaviour generally and problem gambling-behaviour in particularly. First, both alcohol use and gambling behaviour may

reflect other influences such as family problems or poor parenting—possibly associated with being a teenage mother or a history of family poverty (Barnes et al., 2005; Forrest & McHale, 2012; Shead et al., 2010). In our analyses we controlled for a number of confounders and found that the association between maternal alcohol use and gambling remained largely unaffected. To the extent that family dynamics are associated with family problems and related factors, these dynamics are not responsible for the gambling behaviour of offspring.

Second, alcohol use and gambling behaviour are both forms of sensation seeking and/or risk taking (Hayatbakhsh et al., 2013; Magoon et al., 2005; Vitaro et al., 2001). It may simply be the case that offspring of mothers who consume alcohol in a persistent manner are more prone to behave in a risky manner, of which offspring drinking and gambling are a part. Males are more likely to consume alcohol and to gamble at a risky level, and females are less likely to behave in delinquent and/or deviant ways (Delfabbro & King, 2012). Consequently, males are more likely to reflect such associations than females.

A third possibility is associated with the disinhibiting effects of alcohol. Thus it may be that mothers who are more persistent consumers of alcohol behave in a more disinhibited manner, and they themselves are more likely to gamble and take risks. The gambling behaviour of offspring, in this context, is simply learned behaviour. Another possibility is that mothers who consume alcohol have offspring who are more likely to consume alcohol (Cleveland et al., 2014; Englund et al., 2008; Van Der Vorst et al., 2009). The gambling behaviour of offspring may simply reflect their own level of disinhibition which may involve gambling as an outlet. It is, in this study, not possible to determine which of the above possibilities is correct. Specific studies which test some of the above options are needed. However, we have identified a causal pathway that links maternal alcohol-consumption trajectories with levels of alcohol consumption by offspring and offspring problem-gambling behaviour.

The present study had some limitations. It is likely that self-reported alcohol consumption typically accounts for up to 60% of total alcohol sales. Problems with sampling, non-response bias as well as under-reporting bias may all contribute to the underestimates of alcohol consumed (Gmel & Rehm, 2004; Greenfield & Kerr, 2008; Livingston & Callinan, 2015). A self-report measurement of alcohol consumption using '*quantities-frequency*' may not be able to completely capture the heaviest drinking group

(Armor & Polich, 1982). Nevertheless, as noted by researchers, frequency-quantity questionnaires are generally reliable and valid way of measuring alcohol consumption among populations (Del Boca & Darkes, 2003). Future studies should examine a group of mothers who involve in long-term heavy alcohol consumption in relation to their offspring's problem-gambling behaviour.

The MUSP study has not collected information on father's alcohol consumption at each phase of the study. We only asked mothers at the 14-year follow-up about father's alcohol use problems. Therefore, we cannot fully account for the influence of paternal alcohol consumption on offspring gambling. There is a good reason to expect that young adult's alcohol use or substance use may be related to father's alcohol consumption (Haugland et al., 2013; Van Der Vorst et al., 2009). It is possible that the association between mother's alcohol-consumption patterns and their young adult's risk of problem gambling-behaviour may partly reflect paternal influences. This could result in residual confounding involving father's alcohol use levels. More research investigating both the impact of mother and father's alcohol-consumption trajectories on offspring's problem gambling is needed. The current study has not collected data on parental and sibling gambling behaviour, therefore, family gambling problems were not included in examining the association between maternal alcohol consumption trajectories and offspring's risk of problem gambling. Future research should include family and peer gambling problem in its analysis as previous research indicated (Dowling et al., 2016; Shead et al., 2010).

Another limitation is that in our study young adult's gambling behaviour was assessed at the 30-year follow-up, suggesting that it may reflect the prevalence of gambling in the late transition period from adolescence to adulthood. Previous studies indicated that gambling behaviours among young adults are more stable than among adolescents (Delfabbro et al., 2014); however, to have a comprehensive understanding of the association between maternal alcohol consumption and their offspring's patterns of problem-gambling behaviours, future research should examine the role of maternal alcohol-consumption trajectories in their offspring's gambling behaviour. Finally, loss to follow-up may have biased some results. Of the cohort of 3416 mothers and their young-adult offspring at the 21-year follow-up, attrition comprised 50.5% of the sample. Our MI analyses indicated that the results are not likely to have been substantially affected by selection bias.

Conclusion

A cross-gender difference was observed in the associations between maternal drinking trajectories and young-adult problem-gambling behaviours. Membership of the maternal moderate-escalating alcohol consumption trajectory independently predicted a risk of problem gambling for male offspring at 30 years—even after adjustment for a range of potential confounding variables. Patterns of maternal alcohol consumption may have an independent effect on their young adult’s risk of problem-gambling behaviours, with male children being more vulnerable to the effects of maternal alcohol use than female children. Programs intended to address problem-gambling behaviours by young adults may need to focus on the group of males with a co-occurrence of alcohol consumption and problem gambling, as well as alcohol consumption patterns by mothers in addition to other family factors.

Chapter 8: LIFE COURSE OUTCOMES OF WOMEN WHO ARE PERSISTENT DRINKERS: A POPULATION BASED LONGITUDINAL STUDY

Relatively little is known about the consequences for women of sustained higher levels of alcohol consumption. This chapter examines three outcomes (marital relationship, reproductive health, and wellbeing) for women with different alcohol consumption trajectories over 21 years. Data were from a sample of 3337 women. Group-based trajectory modelling measured women's alcohol consumption trajectories spanning 21 years. Outcomes were measured using a self-report questionnaire at the 27-year follow-up. Similar to the results presented in chapter 5, I identified four trajectories of women's alcohol consumption as follow: abstaining, low-stable, moderate-escalating, and heavy-escalating. Abstaining predicts positive outcomes such as being married, never having a divorce, never having multiple partners; and less pregnancy terminations. A heavy-escalating trajectory is a predictor of being unmarried, having multiple partners, having fewer children, having a termination of a previous pregnancy, and reporting lower levels of wellbeing. The escalating-trajectory group is of particular interest as membership of this group is associated with a wide range of adverse life course outcomes by the 27-year follow-up. The consequences of moderate and heavy-escalating alcohol trajectories in a community sample of women have not been adequately addressed in prevention programs. Women with these sustained patterns of alcohol consumption are an appropriate target group for intervention programs.

8.1 Introduction

There has been increasing interest in the consequences of women's alcohol consumption and AUD on life domains associated with interpersonal relationships, physical health, mental health, and wellbeing (Boden et al., 2013; Cranford, 2014; Fergusson et al., 2013; Rehm & Gmel, 1999). Previous research addressing the negative consequences of alcohol use has generally used alcohol consumption or alcohol related problems recorded on one occasion to predict outcomes at a subsequent time. Obviously, an individual's pattern of behaviour may change over time and these changes may have

different effects on later outcomes (Britton et al., 2015; Colder et al., 2002; Piquero et al., 2010). The development of advanced statistical methods (e.g. latent class analysis) allows examination of different trajectories of drinking behaviour over multiple time points (Bobo & Greek, 2011; Brennan et al., 2011; Tran et al., 2015). Relatively little attention has been given to the social and health consequences of consistent patterns of alcohol consumption for community-based samples of women (Colder et al., 2002; Lanza et al., 2013). Our study contributes to this research by extending the scope of previous research by Tran et al., 2015 (Tran et al., 2015) that identified four trajectories of women's alcohol consumption. Specifically, our study examines whether different trajectories of alcohol consumption by women predict three common life course outcomes: marital relationship, reproductive history, and subjective wellbeing.

8.1.1 Alcohol consumption and marital relationship

A number of studies have documented an association between alcohol consumption and the stability of women's marital relationships (Boden et al., 2013; Collins et al., 2007; Cranford, 2014; Keenan, Kenward, et al., 2014; Torvik et al., 2013; Waldron et al., 2011; Williams, Wray-Lake, et al., 2012). This research, however, has tended to focus on experiences of an AUD rather than long-term patterns of alcohol consumption in a community-based sample. While AUD may relate to a specific period in the life course, long-term patterns of alcohol consumption are likely to reflect a lifestyle which includes a particular pattern of alcohol intake. It would be useful and potentially important to know if there is a relationship between patterns of long-term alcohol consumption in a community sample of women and their marital relationship.

8.1.2 Alcohol consumption and reproductive behaviour

There is a general consensus that alcohol intake has the potential to both affect and be affected by reproductive behaviour (Chiodo et al., 2012; Keenan, Grundy, et al., 2014; Pedersen, 2007; Roberts et al., 2015). The available studies suggest that some forms of reproductive behaviour are associated with an increased use of alcohol. Women who report having had a pregnancy termination have higher levels of alcohol use (Coleman, Maxey, et al., 2009; Pedersen, 2007; Reardon et al., 2004; Roberts et al., 2015; Tran et al., 2014). The reverse causal association has also been observed, with alcohol consumption reported as a cause of women's pregnancy termination. Women who

consumed higher quantities of alcohol more frequently were found to have increased rates of termination (Andersen et al., 2012; Chiodo et al., 2012; Keenan, Grundy, et al., 2014). However, these later studies have their limitations as they were conducted during pregnancy (Andersen et al., 2012; Chiodo et al., 2012), or alcohol consumption was measured only at one time point (Keenan, Grundy, et al., 2014). The results, therefore, are not directly relevant to understanding whether persistent alcohol consumption patterns over time predict reproductive behavior. There is a need to answer the question: Do women who drink more over the long term have different patterns of reproductive outcomes including pregnancy termination?

8.1.3 Alcohol consumption and subjective wellbeing

There is little agreement on the association between alcohol consumption and subjective wellbeing in both cross-sectional and longitudinal surveys. While some studies suggest levels of alcohol consumption may have impacts on wellbeing (Chan et al., 2009; Koivumaa-Honkanen et al., 2012; Murphy et al., 2005; Stranges et al., 2006; Strine et al., 2008; Swain et al., 2012; Valencia-Martín et al., 2013), other studies report no such association (Alex Mason & Spoth, 2011; Grant et al., 2009; Martinez et al., 2014). The majority of findings are based upon data where alcohol consumption was measured either at one-time point or assessed by an AUD. Some studies were conducted among adolescents (Alex Mason & Spoth, 2011; Murphy et al., 2005). There remains the question of whether long-term alcohol consumption enhances or detracts from subjective wellbeing.

There is little knowledge about long-term patterns of alcohol consumption and its impact on marital relationships, reproductive behaviour, and subjective wellbeing. In particular, there is very little known about women who consume alcohol at a moderate level and whose consumption does not tend to bring them to the attention of clinical services. To address these gaps, this study had two purposes: (i) to identify trajectories of different alcohol consumption by women over a 21 year period; and (ii) to examine the association between trajectory group membership and marital relationship, reproductive behaviour, and subjective wellbeing outcomes—measured at 27 years.

8.2 Methods

8.2.1 Data source

Data were taken from the Mater-University of Queensland Study of Pregnancy, a prospective pre-birth cohort study of women enrolled at one of the two largest public obstetric hospitals in Brisbane between 1981 and 1984. A total of 6753 women with a mean of approximately 18 weeks gestation were recruited at their first clinic visit (Time 1). Details of the study have been described elsewhere (Najman et al., 2014). The demographic characteristics of women recruited to the study are broadly similar to those of the relevant Brisbane population (Keeping et al., 1989). At recruitment, women were asked about their alcohol consumption over the previous 12 months, socio-demographic characteristics, lifestyle, and health. These women were re-interviewed post-birth at 6 months (Time 2); and then at 5 (Time 3), 14 (Time 4), 21 (Time 5), and 27 years (Time 6).

We used alcohol consumption trajectories from Time 1 (pre-pregnancy) through to Time 5 (21 years after the birth) to predict the outcomes at Time 6 (27-year follow-up). Our control measures are from Time 1. The sample included 3337 consecutive women giving birth in a public hospital who were followed-up over 27 years. Ethics committees from the Mater Hospital and The University of Queensland approved each phase of the study.

8.2.2 Measure of outcome variables

Marital relationship outcomes

Women's marital relationship was assessed at the 27-year follow-up and included marital status which was measured by four categories: single, cohabiting, married, and separated/divorced/ widowed. Due to the low percentage of single respondents (2.6%) and the socio-economic differences between those who reported living together and those who were married (Khoo, 1987; Smock & Manning, 2004), marital status was collapsed into three groups: married, single/cohabiting, and separated/ divorced/widowed. Marital relationship also included marital dissolution which was measured by divorce and the number of partners. Women were asked, "Have you ever been divorced?" with possible responses never and ever. Number of partners was assessed by the question: "How many partners have you lived with for at least three months since the birth of the study child". The answers were categorised into none (no partner), 1 partner, and 2+ partners.

Reproductive history

Women's reproductive history was measured at the 27-year follow-up by two questions: "How many times have you given birth to a live child?" and "How many times have you had a termination?" The responses were grouped as 1–3 children and 4+ children for the number of births; and none and 1+ times for pregnancy termination.

Wellbeing outcomes

Wellbeing was measured by women's subjective assessment of happiness and satisfaction. Women were asked to self-rate their "happiness" by responding to the question, "How would you say you feel these days?". Possible responses were categorised into very happy, happy, and unhappy. Satisfaction was assessed by asking, "How satisfied are you with your life as a whole these days?" The answers were grouped into very satisfied, satisfied, and dissatisfied. These global questions regarding happiness and life satisfaction have been commonly used in previous studies (Fischer et al., 2014; Najman & Levine, 1981).

8.2.3 Measure of main predictor variable

Maternal alcohol consumption

Alcohol consumption was measured using retrospective data at pregnancy and self-report post-birth at 6 months; 5, 14, and 21 years. We used "*frequency–quantity questions*" to measure women's drinking behaviour at each survey. At each survey, women were asked how often they drank alcohol and how much alcohol they consumed (measured in standard drinks containing 10 grams of pure alcohol) on each occasion. Respectively, six pre-specified response options ranging from never to daily alcohol consumption and from none to seven or more standard drinks were provided. In the present study, alcohol consumption was estimated using a method described by Dawson (2003): multiplying the mid-point of frequency by the mid-point of quantity. Consistent with other studies (French et al., 2014; Powers & Young, 2008), respondents' alcohol consumption was categorised as (i) abstainers/ never drink, (ii) occasional drinkers/ <1 drink per week, (iii) moderate drinkers/ from 1 to 14 drinks per week, and (iv) heavy drinkers/ >14 drinks per week.

8.2.4 Covariates

Several covariate factors were employed: maternal age, socio-economic status and mental health symptoms at Time 1, and outcome variables measured at pre-pregnancy. Maternal age at pre-pregnancy was included as a fixed covariate in determining alcohol consumption trajectories over 21 years. We employed a number of baseline measures of outcome variables (e.g. educational level, family income, and symptoms of poor mental health) as covariates.

In addition, we also treated the outcome variables occurring at pre-pregnancy as covariates that may modify the association between alcohol consumption trajectories and social and health consequences at 27 years. This is consistent with the research strategy to assess changes in maternal circumstances since recruitment.

For each outcome at age 27, we controlled for a measure of the same behaviour at pre-pregnancy. This allowed measuring the impact of maternal alcohol consumption trajectories over 21 years on outcomes at 27 years. For marital status, pre-pregnancy measure was married, single, living together and others (including widowed, separated, and divorced). The measure of dissolution at Time 1 was married and never married. Child birth live at Time 1 was measured by the number of live child births before recruitment time. For pregnancy termination at Time 1, measure was no termination and one or more terminations. Satisfaction at Time 1 was measured by very satisfied, satisfied, and dissatisfied. For happiness, the measure was very happy, happy, and unhappy.

8.2.5 Data analysis plan

To identify women's alcohol consumption trajectories over 21 years, we employed semiparametric group-based modeling developed by Nagin and colleagues (Jones & Nagin, 2013; Nagin, 2005). This method has been recently used to examine trajectories of alcohol consumption in this field (Bobo et al., 2013; Britton et al., 2015). Consistent with previous studies (Bobo et al., 2013), square-root transformation was applied to our alcohol data to reduce the effects of the skewed distribution. As alcohol consumption was calculated over five time periods, we used quadratic and cubic polynomial terms in a censored normal model (Britton et al., 2015; Jones & Nagin, 2013) to describe non-linear trajectories. We first used the unadjusted model to identify the optimal number of trajectory groups. The best fitting model was selected using (i) the criteria of Bayesian Information

Criterion (BIC); (ii) the requirement of minimum mean posterior probability of group (0.70 or greater in all groups); and (iii) previous knowledge about women's alcohol consumption patterns. Due to the wide range of women's age at pre-pregnancy (Britton et al., 2015), we included maternal age at Time 1 as a fixed covariate in the adjusted model since age is synchronous with the time variable in our data (Jones & Nagin, 2007; Jones & Nagin, 2012). The BICs and mean posterior probability of unadjusted and adjusted models were compared to select the best fit model for further analyses.

Next, we conducted chi-square analyses to determine if trajectory groups differed for each life course outcome at 27 years. Then, unadjusted and adjusted binary logistic regression and multinomial logistic regressions were applied to examine the association between membership in each trajectory and life course outcomes².

To assess any effects of attrition, we applied multivariate logistic regression with baseline predictors to compare those lost to follow-up with those in the final analyses. We also used MI, a missing data techniques proposed by Little and Rubin (1987) (Little & Rubin, 1987a) to deal with the missing data. To improve a missing at random assumption, we included various covariates (e.g. covariates and other outcome variables which may occur at pre-pregnancy) in MI (Hardt et al., 2012; Sterne et al., 2009). We used 20 and 50 cycles to impute the missing values and repeated our analyses using the data sets (Royston, 2005).

Stata 13.0 was used to perform the analyses where a p -value of <0.05 was adopted as a threshold for significant results. The low-stable alcohol consumption trajectory group was selected as the reference category in all our analyses.

8.3 Results

The 3337 women whose data were available at Time 6, had a mean age (M_{age}) at recruitment of 25.5 years with a standard deviation (SD) of 5 years. At the 27-year follow-up, 65.6% of women were married; 37.0% reported being ever divorced; 47.3% had more than three children; and 19.0% reported ever having had a pregnancy termination.

² It is noted that we were unable to use ordered logistic regression for the outcome variables of happiness and satisfaction as the Brant test indicated the assumption of proportionality is violated. We employed multinomial logistic regression in this case.

Table 8-1 Characteristics of four drinking-trajectory groups, unadjusted and adjusted model

Parameters	Four-group model of maternal alcohol consumption trajectory	
	<i>Unadjusted model</i>	<i>Adjusted model</i>
Frequency	N (%)	N (%)
Abstainers	391 (11.7%)	371 (11.1%)
Low-stable	1957 (58.6%)	1978 (59.3%)
Moderate-escalating	850 (25.5%)	849 (25.4%)
Heavy-escalating	139 (4.2%)	139 (4.2%)
BIC	BIC = -21535.41	BIC = -21524.90
Mean posterior probability		
Abstainers	0.86	0.88
Low-stable	0.92	0.92
Moderate-escalating	0.88	0.88
Heavy-escalating	0.92	0.92

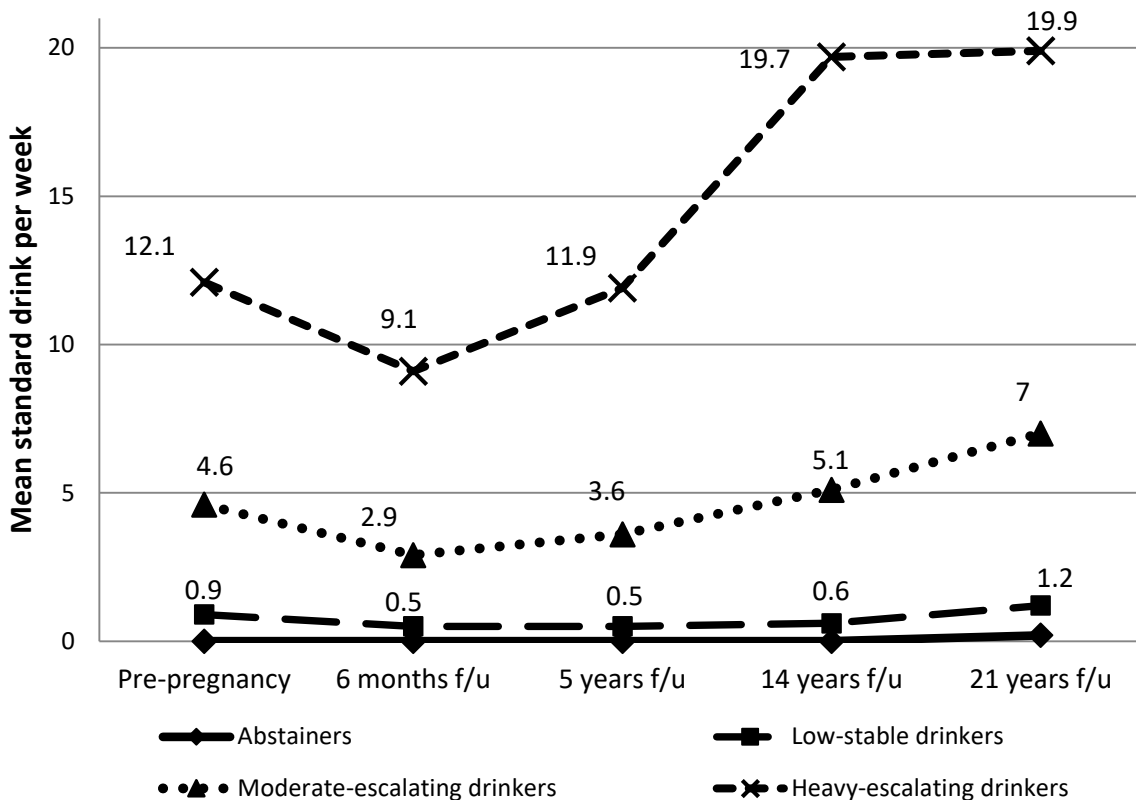
8.3.1 Women’s trajectories of alcohol consumption

In unadjusted analyses, we examined from two to four alcohol consumption trajectory groups. The results suggested that four drinking-trajectory groups with $BIC_{unadjusted} = -21535.41$ was the model that best fitted our sample as its BIC was closest to 0, it met the requirement of mean posterior probability (see more in Appendix Table 8-1). Adjustment for maternal age further improved the model fit ($BIC_{adjusted} = -21524.90$) and slightly changed the number of observations in each trajectory group (Table 1). We selected the four-group model with age as a fixed covariate as our final model for further analyses.

Figure 8-1 shows observed trajectories for the four groups which are labeled and described as follows:

Non-drinkers/abstainers (bottom line in the figure) comprised 11.1% of respondents with mean posterior probability = 0.88. Women in this group reported no alcohol consumption or minimal consumption at each interview.

Figure 8-1 Four group-trajectories of women’s alcohol consumption over 21 years



Low-stable drinkers (the lower-middle line) comprised 59.3% of respondents with average posterior probability of membership = 0.92. Women in this trajectory group consumed an average of nearly a standard drink per week pre-pregnancy. They reduced their consumption to 0.5 drinks per week when they found out they were pregnant; then kept drinking at this level up until 14 years post-birth. At 21 years, their average alcohol consumption was the equivalent to 1.2 standard drinks a week.

Moderate-escalating drinkers (the upper-middle line) comprised 25.4% of women in the sample. These women had a moderate level of alcohol consumption (nearly five drinks per week) pre-pregnancy, and reduced their consumption during pregnancy. After giving birth, they increased their consumption but it still remained at a moderate level of about seven drinks per week at the 21-year follow-up. The mean posterior probability of this group was 0.88.

Heavy-escalating drinkers (the top line) comprised 4.2% of the sample with average posterior probability of 0.92. This group included only a small proportion of the sample; however, the pattern of alcohol consumption among this group changed

substantially over time. Women in this group consumed alcohol at a high-moderate level of 12 standard drinks per week at pre-pregnancy. They reduced their consumption to nine standard drinks a week during pregnancy. However, their alcohol consumption returned to their pre-pregnancy drinking level at 5 years post-birth. From Year 5 to Year 14, these women sharply escalated their alcohol consumption from a high-moderate level (12 drinks per week at Year 5) to a heavy level (20 drinks per week at Year 14). The mean level of alcohol consumption among these women did not change from Year 14 to Year 21.

We performed chi-square analyses to examine the significant differences among alcohol consumption trajectories for each outcome at 27 years. Significant differences in alcohol consumption trajectories were found for marital status [$X^2(6) = 44.5, p < 0.001$], divorce [$X^2(3) = 15.6, p < 0.001$], number of partners [$X^2(6) = 60.7, p < 0.001$], number of live births [$X^2(3) = 45.1, p < 0.001$], number of pregnancy terminations [$X^2(3) = 38.7, p < 0.001$], and happiness [$X^2(6) = 16.0, p < 0.05$]. Group differences in satisfaction with life [$X^2(6) = 3.5, p = 0.75$] were not statistically significant (details in Appendix Table 8-2).

Table 8-2 Multinomial/binary logistic regression models predicting marital relationship and dissolution outcomes at 27 year follow-up

Models	Marital relationship and dissolution at 27 year follow-up				
	Marital status ¹		Divorced ²	No. of partners ³	
	Single/ living together RRR (95% CI)	Separated/ divorced RRR (95% CI)	Ever divorced OR (95% CI)	None RRR (95% CI)	2+ partners RRR (95% CI)
Unadjusted					
Low-stable (ref.)	1.0	1.0	1.0	1.0	1.0
Abstainers	0.5 (0.3–0.8)	1.1 (0.8–1.4)	0.7 (0.6–0.9)	1.6 (1.1–2.3)	0.5 (0.3–0.7)
Moderate-escalating	1.5 (1.2–1.9)	0.9 (0.7–1.1)	1.2 (1.1–1.5)	0.9 (0.7–1.3)	1.5 (1.2–1.8)
Heavy-escalating	2.5 (1.6–4.0)	1.5 (1.0–2.3)	1.2 (0.8–1.7)	1.2 (0.6–2.4)	1.9 (1.3–2.9)
Adjusted*					
Low-stable (ref.)	1.0	1.0	1.0	1.0	1.0
Abstainers	0.6 (0.4–1.1)	1.1 (0.8–1.5)	0.7 (0.6–0.9)	1.7 (1.2–2.4)	0.5 (0.3–0.7)
Moderate-escalating	1.5 (1.1–1.9)	0.9 (0.7–1.1)	1.1 (0.9–1.4)	1.1 (0.8–1.5)	1.2 (1.0–1.8)
Heavy-escalating	2.6 (1.5–4.2)	1.5 (1.0–2.3)	1.2 (0.8–1.7)	1.4 (0.7–2.8)	2.1 (1.4–3.2)

Note: Bold = $p < 0.05$; RRR = relative risk ratio; OR = odds ratio; CI = confidence interval;¹ Reference category is married; ² Reference category is never divorced; ³ Reference category is one partner; * controlled for maternal age, socioeconomic status, mental health symptoms, and outcome variables measured at Time 1.

8.3.2 Multinomial/logistic regressions predicting outcomes at 27-year follow-up

Tables 8-2 to 8-44 show unadjusted and adjusted associations between life course trajectories of alcohol consumption and family life, reproductive, and well-being consequences at the 27-year follow-up. As with the chi-square analyses discussed earlier, women’s life course alcohol consumption trajectories were predictors for all outcomes at 27 years, except for satisfaction with life. These trajectories continued to independently be predictors of these outcomes even after controlling for various covariates at Time 1.

Abstainers: were more likely to be married, be less likely to have had a marital breakdown and/or have more than two partners, and be less likely to report ever terminating a pregnancy (Table 8-2, 8-3).

Moderate-escalating drinkers: were more likely to be unmarried, have had two or more partners in their life, have had fewer children, and more likely to report termination of a pregnancy.

Heavy-escalating drinkers: tended to be unmarried, have had two or more partners, and more likely to report unhappiness at the 27-year follow-up.

Table 8-3 Binary logistic regression models predicting reproductive outcomes at 27-year follow-up

Models	Reproductive outcomes at 27 year follow-up			
	No. of live births		No. of pregnancy terminations	
	3+ live births (ref.)	1–3 live births OR (95% CI)	None (ref.) OR (95% CI)	1+ times OR (95% CI)
Unadjusted				
Low-stable (ref.)	1.0	1.0	1.0	1.0
Abstainers	1.0	0.7 (0.6–0.9)	1.0	0.4 (0.3–0.7)
Moderate-escalating	1.0	1.6 (1.3–2.0)	1.0	1.4 (1.2–1.8)
Heavy-escalating	1.0	1.7 (1.1–2.6)	1.0	1.7 (1.1–2.6)
Adjusted*				
Low-stable (ref.)	1.0	1.0	1.0	1.0
Abstainers	1.0	0.8 (0.6–1.1)	1.0	0.4 (0.2–0.6)
Moderate-escalating	1.0	1.6 (1.3–1.9)	1.0	1.5 (1.1–1.9)
Heavy-escalating	1.0	1.5 (0.9–2.5)	1.0	1.4 (0.8–2.3)

Note: Bold = $p < 0.05$. OR = odds ratio; CI = confidence interval; * controlled for maternal age, socioeconomic status, mental health symptoms, and outcome variables measured at Time 1.

Attrition analyses showed that women who were lost to follow-up were disproportionately young and unmarried with lower incomes and lower education. They also reported lower levels of happiness and a higher rate of anxiety problems (see more in Appendix Table 8-3). In MI analyses, we compared the estimates obtained from the sample of 3337 women to those calculated from 6753 women. We found the same pattern of results, suggesting that our findings are unlikely to be biased under the assumption of missing at random (See more Appendix Table 8-4, 8-5, and 8-6).

8.4 Discussion

Using data from a prospective birth cohort study, we examined women's alcohol consumption trajectories over 21 years, and whether these trajectories predict mid-life outcomes at the 27-year follow-up. Four group-trajectories of alcohol consumption were identified: abstainers, low-stable drinkers, moderate-escalating drinkers, and heavy-escalating drinkers. Over women's reproductive life course, we found evidence of a high level of stability of alcohol consumption for abstainers and low-stable drinkers, but changeability for moderate and heavy-escalating drinkers.

The stability characteristic of women's patterns of alcohol consumption over time are consistent with the findings from previous studies (Brennan et al., 2011; Gee et al., 2007; Geels et al., 2013; Platt et al., 2010) regardless of the differences in their measurement of alcohol consumption and research methodology. The high-escalating trajectory group is of particular interest. However, our findings differ from these studies in that we did not find the decreasing and curvilinear patterns of alcohol consumption reported. This may reflect methodological differences, namely that previous studies tracked the alcohol consumption patterns of respondents who were aged 70 years onwards; while our study respondents ranged from 41 to 74 years of age ($M_{age} = 53$; $SD = 5$) at the 27-year follow-up. We found that for the majority of the population under 70 years, alcohol consumption remains at a relatively stable level. Previous studies suggest those over 70 years of age tend to decrease their level of alcohol consumption (Brennan et al., 2011; Geels et al., 2013). Additionally, the previous studies (Fillmore et al., 1991; Molander et al., 2010; Shaw et al., 2011), which found declining patterns of alcohol consumption among women, assessed drinking-behaviour change based on their whole sample's mean alcohol consumption; therefore, the authors were unable to estimate trajectories of individual variations with growth curve or other dynamic modeling procedures.

Table 8-4 Multinomial logistic regression models predicting wellbeing outcomes at 27-year follow-up

Models	Wellbeing outcomes at 27-year follow-up			
	Life satisfaction ¹		Happiness ²	
	Satisfied RRR (95% CI)	Dissatisfied RRR (95% CI)	Happy RRR (95% CI)	Unhappy RRR (95% CI)
Unadjusted				
Low-stable (ref.)	1.0	1.0	1.0	1.0
Abstainers	0.9 (0.7–1.1)	1.0 (0.7–1.5)	0.8 (0.6–1.0)	0.7 (0.4–1.0)
Moderate-escalating	1.0 (0.8–1.2)	1.0 (0.8–1.4)	0.9 (0.8–1.1)	0.9 (0.7–1.3)
Heavy-escalating	1.1 (0.8–1.6)	1.1 (0.6–2.1)	1.4 (0.9–2.1)	2.0 (1.1–3.6)
Adjusted*				
Low-stable (ref.)	1.0	1.0	1.0	1.0
Abstainers	0.9 (0.7–1.1)	1.0 (0.7–1.5)	0.8 (0.6–1.0)	0.6 (0.4–1.0)
Moderate-escalating	1.0 (0.8–1.1)	1.0 (0.7–1.3)	0.9 (0.7–1.0)	0.9 (0.6–1.2)
Heavy-escalating	1.1 (0.7–1.7)	1.0 (0.5–2.0)	1.5 (0.9–2.3)	1.9 (1.0–3.7)

Note: Bold = $p < 0.05$. RRR = relative risk ratio; CI = confidence interval; ¹ Reference category is very satisfied; ² Reference category is very happy; * controlled for maternal age, socioeconomic status, mental health symptoms, and outcome variables measured at Time 1

Our analyses are consistent with the findings from other longitudinal studies (Boden et al., 2013; Collins et al., 2007; Waldron et al., 2011; Williams, Wray-Lake, et al., 2012) which suggest that those who consume alcohol at higher levels may experience adverse consequences in their marital relationship. While this might be expected in a sample of women who have had an AUD, the current study involves a community sample of women whose drinking is generally not associated with a disorder. Moreover, previously reported associations were based on young population samples and alcohol consumption measured at one-time point (Collins et al., 2007; Williams, Wray-Lake, et al., 2012), we extended the knowledge by confirming the association for a sample of reproductive-aged women. In our study, higher alcohol consumption trajectories are predictors for being unmarried, having ever divorced, and having had multiple partners. Heavier drinkers are likely to experience disruption in their daily tasks, experience increased spouse conflicts, and marital dissatisfaction (Boden et al., 2013; Collins et al., 2007; Torvik et al., 2013). Poor marital quality, in turn, is likely to have led to an increase in the likelihood of divorce and having new partners. There may be a need to more specially address the effects of long-term alcohol consumption even if these levels of consumption are below what are

believed to be clinically harmful levels. Interventions may need attention to the escalating-drinkers groups.

We found that moderate-escalating drinking groups report a number of reproductive behavior consequences: women who consume higher quantities of alcohol tend to have fewer children and report more pregnancy terminations than low-stable drinking women. Our finding on pregnancy termination is consistent with a longitudinal study conducted in Russia (Keenan, Grundy, et al., 2014) which reported similar associations. Alcohol use by women has been associated with more frequent unsafe sexual practices (Pitpitan et al., 2012) and unwanted pregnancies (Naimi et al., 2003; Reardon et al., 2004). Pregnancy terminations are plausible responses to unintended pregnancies.

Women in the heavy-escalating alcohol consumption trajectory reported lower levels of happiness to women in other alcohol consumption trajectory groups. This is consistent with previous research (Koivumaa-Honkanen et al., 2012; Strine et al., 2008) showing that high/heavy alcohol consumption predicted dissatisfaction with wellbeing. Although the number of women in our study consuming at the heavy drinking level was very low (only 4.1%), the group is likely to be experiencing a range of problems.

The findings of this study need to be interpreted in the context of several limitations. First, we only examined the marital relationship, reproductive history, and subjective wellbeing consequences of life time alcohol-consumption trajectories. We did not include other socioeconomic and health outcomes such as employment status, domestic violence, or chronic disease outcomes as have other studies (Devries et al., 2014; Fergusson et al., 2013; Rehm et al., 2010; Rehm & Gmel, 1999). Further research should explore the associations between different drinking trajectories and a broader range of outcomes. Second, in our analyses, we only controlled for proxy outcome variables and some covariates assessed at Time 1. The results might be different if we include residual confounding factors; further research should consider this. Another limitation was that this study may involve in the issue of endogeneity in the sense that these outcomes may occur before and lead women to consume more alcohol. To control for this possibility, in our analyses, we adjusted outcomes that happened at Time 1 (pre-pregnancy). However, these outcome variables and maternal alcohol consumption may coincide due to the impact of other variables that we were unable to manage. More research is needed to examine the possible reverse causal process. Fourth, our study only examined consequences of stable and increasing patterns of alcohol consumption. More longitudinal

research is needed to address the outcomes of decreasing and curvilinear patterns of women's drinking. Next, self-reported alcohol consumption may underestimate actual use of alcohol, particularly among heavy drinkers, which may create bias. However, a self-reported measure of alcohol consumption is generally a reliable and valid way of measuring alcohol consumption among populations (Del Boca & Darkes, 2003). While respondents may have under-reported their level of alcohol consumption, this under-reporting appears to be proportional to the amount of alcohol consumed (Stockwell et al., 2004). Finally, measures of outcome variables (e.g. subjective wellbeing) were obtained via non-validated psychometric scales which tend to attenuate the effect estimates. We acknowledge this weakness; however, happiness and satisfaction measures have considerable face validity and their use is consistent with other studies (Fischer et al., 2014; Koivumaa-Honkanen et al., 2014; Koivumaa-Honkanen et al., 2012; Swain et al., 2012).

Conclusion

Much of the previous research on the adverse consequences of alcohol use has involved those who binge drink or whose drinking meets the criteria for an AUD. In this context the level of alcohol consumption characteristics of women and the harms associated with moderate and heavy levels of alcohol consumption over an extent period of the life course have been given little attention. We found that a life-course trajectory of moderate and heavy-escalating alcohol consumption in a community sample is associated with a wide range of adverse outcomes at the 27-year follow-up. The trajectory-groups have not been previously described and their life-course outcomes have not been well documented. In the meantime, there may be a need to reorient prevention programs to those who exhibit moderate and heavy levels of alcohol consumption despite these levels of consumption being generally considered to be at sub-clinical level.

Chapter 9: CONCLUSION

This study addresses three research aims: the first was to understand more about patterns of alcohol consumption by reproductive- aged women over their life course; the second was to determine the factors influencing changes in alcohol consumption over time; and the third was to investigate the social and health consequences of these patterns for women and their children. These aims were achieved by employing prospective pre-birth cohort data from a sample of 6753 women who gave birth to a live singleton baby at a major public obstetric hospital in Brisbane between 1981 and 1983, and were followed up to 30 years after the birth of their baby. This study has used a life-course perspective as an analytical framework and employed group-based trajectory modelling together with other statistical methods to conduct the analyses and interpret the results. In this chapter I review the main findings and their contribution to what is already known. The strengths and limitations of this study, along with ideas for future research and implications for intervention are also discussed. Before reviewing the main findings, however, it is useful to present what past research tell us about women alcohol consumption, then, place these findings within a conceptual framework of Max Weber's ideal type.

9.1 Knowledge of past research on women and alcohol consumption

All societies have their own cultures and social norms explaining and regulating drinking behaviour. A large body of literature has addressed the importance of cultural diversity of drinking norms and the changes of drinking norms associated with drinking behaviours in different places at different historical periods (Bloomfield et al., 2005; Christie-Mizell & Peralta, 2009; Kerr-Correa et al., 2007; Lyons & Willott, 2008; Room & Makela, 2000; Wilsnack & Wilsnack, 1997).

Research focusing on the cultural diversity of patterns of alcohol consumption is based on the view that each culture or society has different drinking norms; different expectations of social roles for men's and women's drinking. In this light, drinking norms concern rules for who, where, when, and how to drink alcohol (Pyne et al., 2002). Studies throughout the world suggested that in almost all societies, men drink more alcohol than do women (Plant, 2008; Platt et al., 2010; Wilsnack et al., 2009). Yet, there are large cross cultural differences. Men are similar to women in alcohol use in some countries but less so

in others. The reasons for the gender differences in drinking behaviours have been discussed by many scholars. According to them, women often drink less than men because (i) alcohol may more adversely affect women's social behaviour and responsibilities (Blume, 1997); (ii) women's intoxication reduces social control of their sexuality by making women either more sexually disinhibited or more vulnerable to sexual advances (Purcell, 1994; Stewart, 1992); and (iii) intoxicating effects of alcohol may be perceived as incompatible with women's traditional domestic roles and might signal a dangerous failure of social control over women's family relationships and public behaviour (Purcell, 1994; Warner, 1997). In contrast, by drinking more than women, men may use alcohol to express their masculinity (Lyons & Willott, 2008), their strength, self-control, non-conformity, and willingness to take risk (Gotoh, 1994; McDonald, 1994). They may also use it to ignore social differences, gain social support, and form strong personal ties with one another (Hendry, 1994; Macdonald, 1994).

Further the more women enter to the labour market outside their home, the more they accept men's values and behaviours; the greater their freedom and independence (Bloomfield et al., 2001; Holmila & Raitasalo, 2005). As a result, drinking norms could change such that the amount of alcohol consumed by women may increase and approach the level of men's drinking (Martinez et al., 2011; Roche & Deehan, 2002). This suggests that changes in social roles and the social position of women in society can lead to the changes in the volume of alcohol consumption reported by women. In Australian society, there may have been important changes in female drinking behavior because social norms are changing and women's roles have changed, for example most women now enter the workforce.

In addition to cultural diversity and drinking norms, researchers have commonly used social learning theory as a theoretical framework for understanding a range of human behaviours (Borsari et al., 2007; Ford, 2007; Neighbors et al., 2007; Ward, 2011). Social learning theory, which was first mentioned by Bandura (1969) and developed later by Bandura (1977, 2010) and others (Ford, 2007; Ward, 2011) proposed that cultural norms play as social and environmental factors in determining alcohol consumption and drinking patterns. This theory emphasizes the importance of observing and modelling the behaviours, attitudes, and emotional reactions of others. It takes the view that individuals are more likely to imitate and model those individuals they value, such as parents, siblings, and peers.

Durkheim and Weber did not directly mention the role of social norms on alcohol drinking but their works noted the influence of social norms on human behaviors directly and alcohol use and misuse indirectly. Both scholars emphasized the concept of “*self-regulation*” and “*control*”. According to Durkheim, the “religious individualism” of Protestantism produced a culture in which norms emphasized self-sufficiency and self-control, and in which people actually were less regulated by other people (Durkheim, 1964). In the same way, Weber proposed the concept of “worldly asceticism” of Protestantism stressed the importance of self-regulation and self-restraint. Weber argued that the conditions of life in capitalist society required individuals to regulate their activities in order to survive and succeed (Weber, 1976). Protestant cultures or social norms of capitalist society functioned as a way of addressing the central concern with self-discipline and regulation. From this perspective, alcohol abuse became a focus for concerns and anxieties about individual self-control and self-regulation. Indeed, central to a number of protestant religion has been the characterization of alcohol as a social evil. The protestant religion has had a leading role in the temperance movement and efforts to restrict access to alcohol.

In additional to social norms, a prominent body of research has found a significant relationship between peers and college student alcohol consumption (Ford, 2007; Harris Abadi et al., 2011; Wechsler & Nelson, 2008; Weitzman et al., 2003). Weitzmen et al (2003) in a multi- institutional sample of first year students in U.S found that students classified as heavy drinkers were more socially engaged and had more friends who drank heavily as opposed to those who were not classified as heavy drinkers. Some reports have consistently demonstrated the influence of parents may reduce when children go to college or leave home (Bahr et al., 2005; Hoffmann & Johnson, 1998; Windle, 2000), others have suggested that parents continue to influence their children’s drinking through modelling, attitude, monitoring, and interaction (Arria et al., 2008; Bahr et al., 2005; Borsari et al., 2007; Boyle & Boekeloo, 2006; Sessa, 2005; Varvil-Weld et al., 2012; Walls et al., 2009; Wood et al., 2004).

Another explanation of alcohol use generally and alcohol misuse in particular is that it is a means of coping with anxiety. The relationship between anxiety and alcohol consumption has attracted substantial attention from researchers. Anxiety is one of a number of factors leading to alcohol consumption, consistent with self-medication theory which was described by Khantzian (1985). Kantzian argued that socially anxious individuals drink to relieve their physiological and psychological symptoms. Based on this,

Chutuape and de Wit (1995) proposed three main assumptions of self-medication theory that (1) distressing psychiatric symptoms precede alcohol consumption; (2) alcohol consumption alleviates distressing psychiatric symptoms; and (3) respite from negative symptoms leads to continuing and excessive use of alcohol consumption. According to this theory, anxiety driven alcohol consumption leads to the development of alcohol-related problems and alcohol use disorders (Carrigan & Randall, 2003; Menary et al., 2011; Morris et al., 2005). Support for above propositions comes from several lines of evidence being drawn from both clinic and community samples. First, individuals commonly report that alcohol use is effective in reducing social anxiety (Bolton et al., 2009; Carrigan & Randall, 2003; Menary et al., 2011; Morris et al., 2005). Second, several studies have concluded that higher social fears were associated with an increased risk of heavy alcohol consumption (Crum & Pratt, 2001; Menary et al., 2011). Using National Epidemiologic Survey on Alcohol and Related Conditions dataset, a nationally representative survey of U.S. citizens from 2001 - 2002 and 2004 - 2005, Menary et al. (2011) found that people with anxiety disorder and who self-medicate consume significantly more alcohol per day on average than those with anxiety disorder and who do not self-medicate. Third, using alcohol to alleviate anxiety is associated with alcohol-related problems such as lower mental health-related quality of life, alcohol dependence, etc (Buckner et al., 2006; Morris et al., 2005; Robinson et al., 2009). For instance, using the data from the National Epidemiologic Survey on Alcohol and Related Conditions dataset, a nationwide household comorbidity survey of the United States adult population collected in 2001-2002, Robinson et al (2009a) found that within the any anxiety disorder category, there exists a significant trend of decreasing quality of life when moving from no self-medication to self-medication with alcohol.

The previous research have informed our knowledge that alcohol-consumption among women may change due to the changes of drinking norms and be influenced not only by their own socioeconomic status but also the impacts from their social environments. Empirical results have provided evidence showing the patterns of women's drinking behavior may exhibit both stability and changeability over time. However, it seems that there is lacking a theoretical perspective capturing and explaining different trajectories of alcohol consumption by women. The next section will propose and discuss Max Weber's ideal types as typical categorization of drinking behavior.

9.2 Ideal types as the categorisation of drinking behaviour

An ideal type is a methodological construct developed by German sociologist, Max Weber. The concept of ideal type was historically popular among social scientists about 50 years ago. Weber developed the concept in a number of methodological essays and used it across a variety of empirical inquiries, especially in his books *The Protestant Ethic and the Spirit of Capitalism* (Weber, 1905) and *Economy and Society* (Weber, 1922).

An ideal type is constructed via a process of abstracting from empirical reality. Ideal types are rarely found in their pure, exaggerated, and one-sided form in real life. Weber argued that no scientific system has the capacity to fully conceptualise the diversity of particular phenomena. Therefore, he proposed the term 'ideal type', meaning that it is not a description of reality but it aims to give a concrete form of expression to such a description. So, the ideal type, according to Weber, is a concept formulated and constructed on the basis of facts; it also is a model including a class or group distinguished by particular characteristics (Cahnman, 1965; Weber, 1905). In this case, ideal type is used as a methodological tool for systematising, organising and comprehending social behaviour, against which researcher can measure reality. Weber suggested that every social behaviour has an ideal type.

It is argued that if ideal types are constructed for illustrative purposes, then there is a need to know how ideal types correspond with reality—especially when they are being used to explain an agent's social behaviour. Weber answered this question by stating that sociology was a science aiming at 'the interpretative understanding of social behaviour in order to gain an explanation of its causes, its course, and its effects' (Weber, 2009). Weber claimed that ideal types can be used as a research tool to guide social action (Weber, 1949). For Weber, causal explanations are essential to complete the project of the interpretive understanding of social agents.

Weber's concept of the ideal type has influenced many researchers. In some instances the concept of an ideal type has been criticised as too abstract, inconsistent and incapable of dealing with various contemporary problems in the social sciences (Hekman, 1983; Turner, 1977). Structuralists also involved in these debates have suggested that Weber's ideal type is an attempt to provide an explanation via understanding the motives of social actors rather than providing an analysis of how structures determine the places into which 'agents' are inserted by determinate processes (Turner, 1977).

People who follow Weber's methodology have challenged the limitation of ideal types by showing that the concept of ideal types can accommodate a variety of levels of social scientific analyses, especially the link between the analysis of subjective meaning and structural forms (Hagenaars & Halman, 1989; Hekman, 1983). Typically, Hagenaars and Halman (1989) have proposed a connection between the ideal type and the application of latent class analysis. According to them, latent class analysis and ideal types or typologies share similar basic ideas, such as (i) reducing phenomena to just a few discrete types or the types that are defined on the latent level, (ii) variables are measured by nominal scale, and (iii) no restrictions are imposed on the form of the relations between variables (Hagenaars & Halman, 1989).

It is clear that Weber's ideal types provide the best fit to the analytical framework that has guided this study. The main findings in this study contribute and exemplify Weber's ideal types in that women's different drinking trajectories over 21 years are considered to be different typologies which characterise women's drinking behaviour over their reproductive life course. As mentioned by Weber, sociology concerns itself with the interpretive understanding of social action and thereby with a causal explanation of its course and consequences (Weber, 1922). Applying Weber's methodology, this study also seeks an explanation for why there are different drinking trajectories exhibited by reproductive-aged women; and what are the consequences associated with these drinking trajectories. The details of the main findings related to the drinking ideal typologies will be presented in the next section.

9.3 Contributions of main findings

This thesis makes a number of important and significant contributions to our understanding of how and why women's alcohol consumption change over their reproductive life course as well as the social and health consequences for mothers and their offspring associated with these patterns. The key contribution of the current thesis lies in the identification and the development of different trajectories of women drinking alcohol across the reproductive stage of their lives: abstainers, low-stable drinkers; moderate-escalating drinkers, and heavy-escalating drinkers. The thesis demonstrates a high level of stability over time for the first two types of drinking and that the women with higher trajectories had personal negative outcomes across a range of indicators. While such findings are not inconsistent with the cross sectional research studies reviewed in the

comprehensive literature the strength of the present program of research lies in the fact that it is embedded in an exceptionally long ongoing longitudinal study and that the trajectories identified are meaningful. Specifically, the contribution of thesis' findings are summarised and articulated in the following points:

Heterogeneous groups of pregnant women with various patterns of alcohol consumption

Previous studies suggest that most women stop or reduce their alcohol use during pregnancy and many women return to drinking alcohol postpartum and while breastfeeding (Callinan & Room, 2012; Ethen et al., 2009; Giglia & Binns, 2007; Maloney et al., 2011). Most studies, however, provide few details about the amount of alcohol women consume pre and postpartum, mainly because women tend to be asked whether they used alcohol when they were pregnant or breastfeeding compared with when they were not; and specify whether they used more, less, or the same amount of alcohol during this period (Callinan & Room, 2012; Maloney et al., 2011). Even though some studies have reported the amount of alcohol women consumed from the prenatal to postnatal period (Ethen et al., 2009; Giglia & Binns, 2007), they tend not to test the possibility that some women may change their drinking patterns more than others. This is partly because previous studies have examined changing patterns of alcohol consumption based on 'aggregate level change' or a '*variable centred*' focus, assessing alcohol consumption changes by mean alcohol consumption at each time point of survey. Also, women have tended to be treated as a homogenous group. Consequently, it is hard to profile who changed their level of alcohol consumption and who did not.

The main findings in Chapter 4 add and contribute to current knowledge in the following aspects. First, we confirmed some general trends mentioned in previous studies. In addition, our findings revealed that over the pre and postpartum period there are heterogeneous groups of women with different drinking patterns. Specifically, women in our sample can be categorised into three groups, characterised by drinking at different levels (abstainers/minimal consumption, light consumption, and heavy consumption). Second, unlike other studies, by employing group-based trajectory modelling (Nagin, 2005), our study has documented the number of women in each trajectory group and their levels of alcohol consumption during pregnancy. For example, the heavy-consumption group in our study included those who consume alcohol heavily prenatally (2.5 glasses per day); these women reduced their consumption to 0.61 glasses per day during pregnancy; then increased consumption again to 1.25 glasses per day during the breastfeeding

period. Clearly, this finding provides empirical evidence documenting the amount of alcohol the women consumed and changes in consumption over their pregnancy. Third, by identifying different patterns of alcohol consumption, we can characterise the profile of women in each drinking group (more details presented in Chapter 4), making it possible to consider targeting a group of women who engage in persistent, risky drinking behaviour.

Diverse patterns of drinking among women over their reproductive life course: are there diverse ideal types of drinking behaviour?

The identification of multiple drinking trajectories for women from the prenatal to postnatal period raises the question about how alcohol consumption by these women changes over their reproductive life course?

The main findings in our study (Chapter 5) bridge some gaps in the existing literature. First, we identified four distinct and consistent trajectories of alcohol consumption (abstainers, low-stable drinkers, moderate-escalating drinkers, and heavy-escalating drinkers) by women who are in the reproductive age range over 21 years of their life course. Previous studies in this area have tended to focus on the patterns of alcohol consumption among middle-aged and older women or female adolescents rather than reproductive-aged women (Bachman et al., 2013; Bobo et al., 2013; Brennan et al., 2010; Platt et al., 2010). Although some have previously addressed the drinking patterns of reproductive-aged women, these involved clinic-based samples, not community-based ones (Cook et al., 2013). Moreover, these studies have had limited length of following-up, normally 5 to 10 or 12 years (Bobo & Greek, 2011; Brennan et al., 2010; Cook et al., 2013). Hence, our study contributes to the field in identifying changes in women's alcohol consumption over 21 years. We were unable to find other studies which encompass the reproductive period—the period when there are major transitions in women's lives. These transitions include having and raising child/children to adulthood.

Australia is described as a high alcohol-consumption country where women in Australia consume about 7.2 litres of alcohol per person per year (WHO, 2014). Our finding suggests there are quite diverse patterns of drinking among women over the long-term with about 70% abstaining and having low-stable consumption; 25% having moderate-escalating consumption; and only 5% having heavy-escalating consumption. This finding is consistent with the general distribution of alcohol consumption in society.

Second, our four trajectories support and provide the evidence of a high level of stability for abstainers and low-stable drinkers, but changeability for moderate and heavy-escalating drinkers. It is noted that for longitudinal researchers, stability and change are two complementary phenomena in tracking drinking behaviour over time. Our findings, however, are inconsistent with previous studies which found a pattern of declining consumption and a curvilinear pattern (Bobo & Greek, 2011; Bobo et al., 2010; Brennan et al., 2011; Cerda et al., 2008; Cook et al., 2013; Gee et al., 2007; Platt et al., 2010; Powers & Young, 2008). It is probable that previous studies tracked the alcohol consumption patterns of respondents who were elderly, aged 70 years onwards (Brennan et al., 2011; Geels et al., 2013); while in our study respondents were in early to late-middle age.

Third, it may be argued that the multiple trajectories of alcohol consumption in our sample may not represent a true developmental taxonomy of women's drinking. The debate on this matter is ongoing although the group-based trajectory model has been applied in many fields (Nagin & Odgers, 2010a; Piquero, 2008). It is acknowledged that as with other statistical models, trajectory groups—an application of latent class analysis—are not literal depictions of reality; they involve a probability estimation of individuals who follow similar developmental trajectories (Nagin & Tremblay, 2005; Petras & Masyn, 2010). In other words, belonging to a particular latent class instead of to another enhances or diminishes the probability of obtaining a particular scoring pattern on the manifest variables, but does not absolutely determine this pattern. In terms of group division, researchers have argued that there are at least two or more underlying subgroups in a population and each group comprises individuals who are similar on a set of observed variables. Therefore, this study is based upon the supposition that there are analytical, empirical and substantive advantages inherent in using the group-based trajectory model to describe the heterogeneity of alcohol consumption patterns (Lanza et al., 2013; Petras & Masyn, 2010).

Finally, the four distinct trajectories of alcohol consumption should be interpreted as consisted with Weber's concept of ideal types. These ideal types of drinking trajectories were constructed on the basis of drinking behaviour at each time point and based on group-based trajectory modelling, an application of latent class analysis which shares a lot of similar characteristics with the ideal types (Hagenaars & Halman, 1989). Identifying these ideal types of drinking behaviour is a first step in testing a variety of causal explanations of the four drinking trajectories.

Factors associated with different drinking typologies: is there any difference between predicting short-term typologies versus predicting long-term ones?

In the previous section, the different drinking trajectories characteristic of reproductive-aged women were presented. It is possible, however, that factors associated with short-term changes in alcohol consumption may differ from those predicting long-term changes in alcohol consumption, especially during the reproductive years which generally involves transitions in the life of women. Using baseline predictors to predict both the changes of these drinking trajectories over the prenatal to postnatal period and the changes over 21 years, we found that there were both similarities and differences between the short-term and long-term typologies of drinking.

Regarding common factors, lower family income, being married, and high frequency of church attendance predicted membership of the abstaining/minimal-consumption trajectory; while being unmarried, having an unhealthy lifestyle and never going to church predicted membership of the heavier-consumption groups (including moderate and heavy-escalating drinkers). Our findings are consistent with the ones from previous studies which also suggested that changes in alcohol consumption by reproductive-aged women are associated with family-related characteristics such as income, marital status, and religiosity (Ahlström et al., 2001; Bachman et al., 2013; Ethen et al., 2009; Kuntsche et al., 2012; Maloney et al., 2011; Paradis, 2011; Skagerstrom et al., 2011).

In term of different factors associated with the short-term typologies, membership of the abstaining trajectory was predicted by a low level of adversity, an unhealthy lifestyle, remaining married to original partner and having many children. These findings are in line with previous studies (Anderson et al., 2013; Ethen et al., 2009; Giglia & Binns, 2007; Skagerstrom et al., 2011). However, our study provides different results in comparison with others. For example, the study did not find an association between higher income and a heavy-consumption trajectory as others suggested (Chang et al., 2006; Pevalin et al., 2001). We also found an inverse association between parity and the levels of alcohol consumption. Women with more than two children were more likely to be abstainers than those who had one child. It is to be expected that women with more children will have less time available for recreational drinking. This supports the finding from Meschke et al. (2008) but contradicts those from Hotham et al. (2008) and Tamaki et al. (2008).

Because previous studies only examined predictors associated with the changes in pregnancy, or among women middle-aged and older, the findings in our study contribute to

the existing literature by extending the predictors to the whole period of childrearing—a period that may be stressful and lead to higher levels of what is sometimes described as self-medication with alcohol.

It is also noted that the short-term and long-term drinking typologies share some similar baseline predictors. With some variables associated with the short time changes in alcohol consumption, we find no statistical associations with membership of the heavier drinking groups over the long term. It is possible that the baseline social predictors were not useful in explaining the long-term changing phenomenon. This may be due to the low numbers in the heavy-drinking category and subsequent diminished power to detect associations.

Social and health consequences prospectively associated with trajectories of alcohol consumption by women

The analytical framework which underlines the life-course perspective suggests that in addition to identifying the drinking trajectories over the life course, researchers may be able to use these trajectories to predict the social and health consequences associated with these trajectories (Britton et al., 2015; Lanza et al., 2013; Petras & Masyn, 2010). By using the MUSP data we were not only able to identify multiple drinking trajectories among women over 21 years of their reproductive life, we were also able to examine whether the drinking trajectories were associated with harm to the drinker and others.

Maternal alcohol consumption trajectories predict gender differences in offspring's alcohol use disorder and problem-gambling

We found that a maternal trajectory of moderate-escalating alcohol consumption over 14 years independently predicted offspring's lifetime ever AUD at 21 years after adjustment for a range of potential confounders. Our findings contribute to research in this field in the following aspects. First, relatively few studies examining the association between maternal alcohol use and youth alcohol consumption used Australian population samples. Most previous studies involve samples selected overseas (Casswell et al., 2002; Englund et al., 2008) where the rates of adolescent alcohol use may be lower than in Australia (Ministry of Health, 2007; Toumbourou et al., 2009). Second, most existing studies have dealt with the measurement of maternal alcohol consumption at one time point rather than multiple time points (Van Der Vorst et al., 2009; Yeh et al., 2006; Yule et al., 2013; Zhang et al., 1999). Long-term patterns of maternal alcohol consumption are

more likely to reflect the influences of lifestyle than alcohol use measured at a single time point. Arguably, parental alcohol use assessed at a single point in time is a less stable measure of parental influence than a pattern which may be stable over an extended period of time. Finally, previous studies tend to measure adolescent outcomes based upon frequency and quantity estimates of alcohol consumption or alcohol-related problems (Casswell et al., 2002; Koning et al., 2010; Marsden et al., 2005; Poelen et al., 2007).

Our analyses suggested that male children were more vulnerable to the effects of maternal alcohol use than female children. This finding supports a few studies claiming that maternal alcohol consumption is a good predictor of male alcohol use outcomes (Cleveland et al., 2014; Englund et al., 2008). Our study raises the possibility that mothers appear to be more open and possibly closer to their male offspring than their female offspring. The finding on ‘cross-gender influence’ differs somewhat from previous studies indicating that children tend to model their same sex parents’ drinking behavior (Yeh et al., 2006). It appears that a large number of previous studies confirm the association between maternal alcohol consumption and offspring’s alcohol use but they have not provided evidence about whether or not mothers’ alcohol use has more influence on male rather than female offspring. Our study provides empirical evidence from a prospective community-based sample suggesting cross-gender influences on alcohol use.

Similar to the finding on maternal alcohol consumption trajectories and offspring’s AUD, our analysis also found that a maternal trajectory of moderate-escalating alcohol consumption over 21 years is independently associated with a risk of their male offspring’s problem-gambling behaviour at 30 years—even after adjustment for a range of potential confounding variables. This finding is surprising in the sense that no previous studies have addressed the prospective association between mother’s alcohol consumption and their young-adult offspring’s problem-gambling behaviour. Arguably, alcohol use and gambling behaviour are both forms of sensation seeking or risk taking (Hayatbakhsh et al., 2013; Magoon et al., 2005; Vitaro et al., 2001). It may simply be that the offspring of mothers who consume alcohol in a persistent manner are more prone to behave in a risky manner, which includes drinking and gambling.

Do higher alcohol consumption trajectories predict adverse outcomes of marital relationship, reproductive health, and subjective wellbeing at the 27-year follow-up?

In terms of the association between women’s alcohol-consumption trajectories and their consequences, our findings show that being in the abstainers group predicts positive

outcomes such as being married, never having a divorce, never having multiple partners; and having fewer pregnancy terminations; while moderate and heavy-escalating trajectories are a predictor of being unmarried, having multiple partners, having fewer children, having a termination of a previous pregnancy, and reporting lower levels of wellbeing at the 27 year follow-up. Our findings bridge the gap in the current literature because previous studies have generally used alcohol consumption or alcohol-related problems recoded on one occasion to predict outcomes at a subsequent time.

Moreover, much of the previous research on the adverse consequences of alcohol use has involved those who binge drink or whose drinking meets the criteria for an AUD (Boden et al., 2013; Cranford, 2014; Fergusson et al., 2013; Rehm & Gmel, 1999). Our findings suggest that a community sample of women whose drinking is generally not associated with a disorder may experience adverse outcomes which would be expected in a sample of women who have had an AUD.

9.4 General strengths and limitations of the study

Strengths of the thesis

The strength of this study is the longitudinal design of the MUSP. The MUSP and its outcomes is a large and ongoing birth cohort study with 6753 women and their singleton child which began in 1981 in Brisbane and is still continuing. Women have been followed up to 27 years after their first participation in the study while their offspring have been followed up to 30 years after their birth (Najman et al., 2014). This enables us to examine the association between maternal alcohol-consumption trajectories and the consequences for mothers and for their offspring. Few studies have been able to do this as the costs and effort involved are often considered prohibitive.

Second, alcohol consumption was measured prospectively using similar questions (quantity–frequency), making it possible to compare and limit recall bias. The repeated measurement of alcohol consumption created the capacity to track the patterns of maternal alcohol consumption over time.

Third, the MUSP used validated instruments such as the CPGI, the Open Family Communication Scale, YSR, and Breslow’s Lifestyle Index, making it possible to compare the findings with other studies which used the same measures. Also most of the standard

measures had known psychometric characteristics which met generally agreed upon standards of validity and reliability.

Lastly, the application of a group-based trajectory method is rare in the field of sociology, especially in examining drinking-behaviour change; while in criminology, the method is very popular. Successfully applying the method to examine the patterns of alcohol consumption contributed to further understanding of how levels of alcohol consumption change over time. As a result, we were then able to apply a life-course analytical framework to examine predictors and life-course outcomes associated with membership of each trajectory.

Limitation of the thesis

The limitations were discussed in detail in each chapter; however it is important to have a brief discussion of the main caveats.

Like other longitudinal studies, attrition in MUSP is an inevitable problem and may cause bias in the analyses. While the MUSP began with 6753 women and their singleton child, at the 21-year follow-up, 55% of women provided their data for alcohol consumption analyses. Of the 3778 mother–child pairs who provided their information at the 21-year follow-up, only 2531 offspring completed the lifetime version of the CIDI; some 3416 mother–child pairs were followed up at 30 years, but only 1691 offspring provided information on problem-gambling behaviour. Missing data due to attrition and item non-response may create some bias and/or loss of statistical power (Little & Rubin, 1987b; Sterne et al., 2009).

To test the effect of attrition, analyses have been undertaken throughout the thesis. The methods used included multivariate logistic regression and MI. Multivariate logistic regression was employed to compare those who had been lost to follow-up with those available for the final analyses. A number of baseline variables were included in the multivariate logistic regression to compare the characteristics of those who remained in the study and those who were lost to follow up. With MI (Klebanoff & Cole, 2008; Lee & Carlin, 2012; Sterne et al., 2009), the 20 and 50 cycles of regression switching were selected to generate 20 and 50 imputation data sets containing all variables used in the main analyses. The analyses conducted on the missing sample were repeated with the imputed data sets. The results from 20 and 50 cycles of MI were then compared with the ones in the original analyses. However as Sterne and his colleague have noted “missing at random is

an assumption that justifies the analysis, not the property of the data” (Sterne et al., 2009). The assumption is likely to be incorrect, it however is widely used in different software programs which involve multiple imputation.

A second limitation of this study was the quantity–frequency measure of alcohol consumption. Although the quantity–frequency measure has its advantages in terms of simplicity and relative ease of completion, the disadvantage is that it is unable to capture the heavy level of alcohol consumption (Bloomfield et al., 2013; Greenfield & Kerr, 2008; Livingston & Callinan, 2015). So, it may lead to downward bias in estimated volume compared with measures designed to capture unusual heavy drinking. If this is the case, it possibly provides a reason for the low proportion of women who consume alcohol heavily in our study.

Another limitation was that the alcohol consumption measurement was based on self-report data. Self-reported data may underestimate actual consumption, particularly among heavy and binge drinkers, which tends to attenuate the effect estimates. Nevertheless, as noted by researchers, a self-report measurement of alcohol consumption is generally a reliable and valid way of measuring alcohol consumption among populations (Del Boca & Darkes, 2003). While it may be the case that respondents underreport their level of alcohol consumption, this underreporting appears to be proportional to the amount of alcohol consumed (Stockwell et al., 2004).

This study was also limited due to only examining predictors measured at pre-pregnancy/baseline. Arguably, many of these predictor variables are likely to change across the 21 years (e.g. depression, anxiety, adversity, income) or at least may change at some stages (e.g. marital status and education). However, previous studies have suggested that a change in drinking pattern is mainly affected by baseline characteristics (Bernat et al., 2008; Bobo et al., 2013; Molander et al., 2010; Moore et al., 2005). Following previous studies, this study limited its scope to using baseline predictors to predict the developmental trajectories of maternal alcohol consumption over the 21-year follow-up. To some extent, the thesis has to acknowledge the concern of residual confounding in analyses.

Finally, there is the issue of endogeneity. When we asked respondents about the events or consequences (e.g. pregnancy termination) that had occurred, we also asked them about their alcohol consumption in that same period. As a result, we do not know whether or not pregnancy termination leads to heavier alcohol consumption trajectories or

consuming alcohol at higher levels over a long time leads to the termination. In general terms, although we have used a longitudinal methodology to test for causal sequences over time, we confront the reality that it is often difficult to narrowly track some changes and their consequences. Detecting cause and effect associations was the goal, and it is a goal which is rarely attained. Nevertheless, many causal possibilities have been identified which could be tested in further studies.

9.5 Future research

Of course more research is needed. Indeed, if the limitations reviewed above were addressed we would have a better understanding of how and why alcohol consumption by women changes over their reproductive life course, and of the life-course outcomes, associated with particular drinking trajectories, for women and their offspring. Further studies are listed below and could be treated as suggestions for future research.

New birth cohort study should pay more attention to:

First, there is a need for more appropriate lengths-of-time to follow-up. Reviewing existing literature showed that studies have limited their investigations to relatively short follow-up times, normally 5 to 10 or 12 years (Bobo & Greek, 2011; Brennan et al., 2010; Cook et al., 2013) when the reproductive period, with its major transitions, normally involves a much longer period of time.

Second, the intervals between surveys should be addressed in a new birth cohort. Within MUSP, we surveyed and followed-up mothers up to 27 years and their offspring up to 30 years (Najman et al., 2014). Due to financial limitations, the intervals between surveys were quite different. The results, therefore, may not capture some events that could directly affect maternal drinking trajectories.

Third, a new birth cohort should use appropriate measures of alcohol consumption to capture different levels of drinking. As mentioned in the limitations, the disadvantage of the frequency–quantity measure is that the heavy level of alcohol consumption may not be captured (Bloomfield et al., 2013; Greenfield & Kerr, 2008; Livingston & Callinan, 2015). This may lead to downward bias in estimated volume compared with measures designed to capture unusual heavy drinking.

Fourth, the MUSP has not collected information on father's alcohol consumption at each phase of the study. The study only asked mothers at the 14- year follow-up about father's alcohol use problems. Therefore, it is not possible to account for the influence of paternal alcohol consumption on offspring's AUD or problem-gambling behaviour. A new longitudinal study should collect paternal alcohol consumption for further analyses to fully account for the effects of parental alcohol consumption on offspring's AUD and problem-gambling behaviour.

Further analyses for MUSP could be conducted:

First, this study addresses the baseline predictors of maternal alcohol consumption trajectories. We were not able to examine non-baseline predictors or even the changes in predictors from baseline to follow-up surveys. Further work should consider these predictors over the women's reproductive life course. This is likely to require a larger sample as differences between maternal and paternal drinking may need to be considered simultaneously.

Second, our findings from this study support the evidence that moderate and heavy-escalating alcohol consumption trajectories predict male offspring's AUD and problem-gambling behaviour. However, the reverse causal association remains possible—alcohol consumption leads to pregnancy termination (Chiodo et al., 2012; Coleman, Maxey, et al., 2009; Keenan, Grundy, et al., 2014; Pedersen, 2007; Reardon et al., 2004; Roberts et al., 2015; Tran et al., 2014). More analysis is needed on this issue.

Finally, this thesis only examines the life-course outcomes (e.g. marital relationship, reproductive history, and subjective wellbeing) of women who have different alcohol consumption trajectories over 21 years of follow-up. Other socio-economic and health outcomes such as employment status, domestic violence, or chronic disease outcomes, which are examined elsewhere, (Devries et al., 2014; Fergusson et al., 2013; Rehm et al., 2010; Rehm & Gmel, 1999) have not been addressed. Further research should explore the associations between different drinking trajectories and a broader range of outcomes.

9.6 Implications for intervention

This research was based on a prospective pre-birth cohort study of women in Brisbane, Australia. Research findings from this study do support the prevention programs

related to alcohol consumption by reproductive-aged women. The findings also contribute to the evidence-base for prevention programs aimed at adolescents and young adults.

The study showed that about 80% of women in the heavy-consumption trajectory group were breastfeeding their babies during the time they were also consuming alcohol. This finding suggests the need for a public health campaign to educate women about the risks of alcohol use during breastfeeding. It is also noted that high consumption after birth was more prevalent among participants who were unmarried, had one child, never went to church and had a relatively unhealthy lifestyle. Alcohol use is intrinsic to a broader range of health behaviours, all of which need to be considered in framing a public health response.

Regarding the long-term pattern of alcohol consumption, about one in twenty women is characterised by a pattern of escalating alcohol consumption which extends over the reproductive life course. Intervention programs might need to target these women as early as possible, perhaps even during their pregnancy. The focus of such an intervention would be on the period following the birth of their child.

It appears that patterns of maternal alcohol consumption may have an independent effect on offspring's alcohol consumption, with male children being more vulnerable to the effects of maternal alcohol use than are female children. Programs intended to address alcohol consumption by adolescents and young adults may need to focus on the behaviours of both parents early in the child's life course. In addition, another research finding indicated that offspring who had consumed alcohol at the 14-year follow-up were more likely to report having an AUD at 21 years. The result may suggest that prevention addressing alcohol consumption by adolescents and young adults may need to be earlier, even at 14 years or less, as many offspring start using alcohol at a young age.

The analyses indicated that not only is there a significant co-occurrence between alcohol consumption and problem gambling among the general sample but also that this association is considerably stronger in males than in females. Prevention and intervention programs need to target males for this reason.

The data analysis showed that a life-course trajectory of moderate and heavy-escalating alcohol consumption in a community sample is associated with a wide range of adverse outcomes at the 27-year follow-up. There may be a need to reorient prevention programs to those who exhibit moderate and heavy levels of alcohol consumption despite these levels of consumption being generally considered to be at sub-clinical level.

REFERENCES

- Abbott, M., Romild, U., & Volberg, R. (2014). Gambling and Problem Gambling in Sweden: Changes Between 1998 and 2009. *Journal of Gambling Studies*, 30(4), 985-999. doi:10.1007/s10899-013-9396-3
- Abbott, M., Volberg, R., Bellringer, M., & Reith, G. (2004). A review of research on aspects of problem gambling. *London, Responsibility in Gambling Trust*.
- Abbott, M., Williams, M. M., & Volberg, R. A. (2004). A Prospective Study of Problem and Regular Nonproblem Gamblers Living in the Community. *Substance Use & Misuse*, 39(6), 855-884. doi:doi:10.1081/JA-120030891
- Achenbach, T. M. (1991). *Manual for the youth self-report and 1991 profile*: Department of Psychiatry, University of Vermont Burlington, VT.
- Acil Allen Consulting. (2014). *Gambling Industry Trends and Impacts*. Retrieved from Melbourne:
- Adams, W. L., Garry, P. J., Rhyne, R., Hunt, W. C., & Goodwin, J. S. (1990). Alcohol Intake in the Healthy Elderly. *Journal of the American Geriatrics Society*, 38(3), 211-216. doi:10.1111/j.1532-5415.1990.tb03493.x
- Ahlström, S., Bloomfield, K., & Knibbe, R. (2001). Gender differences in drinking patterns in nine European countries: Descriptive findings. *Substance Abuse*, 22(1), 69-85. doi:10.1080/08897070109511446
- Alati, R., Lawlor, D. A., Najman, J. M., Williams, G. M., Bor, W., & O'Callaghan, M. (2005). Is there really a 'J-shaped' curve in the association between alcohol consumption and symptoms of depression and anxiety? Findings from the Mater-University Study of Pregnancy and its outcomes*. *Addiction*, 100(5), 643-651. doi:10.1111/j.1360-0443.2005.01063.x
- Alati, R., Najman, J. M., Kinner, S. A., Mamun, A. A., Williams, G. M., O'Callaghan, M., & Bor, W. (2005). Early Predictors of Adult Drinking: A Birth Cohort Study. *American Journal of Epidemiology*, 162(11), 1098-1107. doi:10.1093/aje/kwi320
- Alex Mason, W., & Spoth, R. (2011). Longitudinal Associations of Alcohol Involvement with Subjective Well-Being in Adolescence and Prediction to Alcohol Problems in Early Adulthood. *Journal of Youth and Adolescence*, 40(9), 1215-1224. doi:10.1007/s10964-011-9632-z
- Alvik, A., Haldorsen, T., & Lindemann, R. (2006). Alcohol consumption, smoking and breastfeeding in the first six months after delivery. *Acta Pædiatrica*, 95(6), 686-693. doi:10.1111/j.1651-2227.2006.tb02316.x
- Andersen, A.-M. N., Andersen, P. K., Olsen, J., Grønbaek, M., & Strandberg-Larsen, K. (2012). Moderate alcohol intake during pregnancy and risk of fetal death. *International Journal of Epidemiology*. doi:10.1093/ije/dyr189

- Anderson, A. E., Hure, A. J., Forder, P., Powers, J. R., Kay-Lambkin, F. J., & Loxton, D. J. (2013). Predictors of antenatal alcohol use among Australian women: a prospective cohort study. *BJOG: An International Journal of Obstetrics & Gynaecology*, *120*(11), 1366-1374. doi:10.1111/1471-0528.12356
- Anderson, P. (2006). Global use of alcohol, drugs and tobacco. *Drug and Alcohol Review*, *25*(6), 489-502. doi:10.1080/09595230600944446
- APA. (2000). *DSM-IV-TR: Diagnostic and statistical manual of mental disorders, text revision*: American Psychiatric Association.
- Armor, D. J., & Polich, J. (1982). Measurement of alcohol consumption. In M. E. Pattison & E. Kaufman (Eds.), *Encyclopedic handbook of alcoholism* (pp. 72-81): Gardner Press.
- Arria, A. M., Kuhn, V., Caldeira, K. M., O'Grady, K. E., Vincent, K. B., & Wish, E. D. (2008). High school drinking mediates the relationship between parental monitoring and college drinking: A longitudinal analysis. *Substance Abuse Treatment, Prevention, and Policy*, *3*(1), 6.
- Attorney-General, Q. D. o. J. a. (2012). *Queensland Household Gambling Survey 2011-2012*. Retrieved from Australian Bureau of Statistics. (1997). *Alcohol and tobacco consumption patterns*. Retrieved from Canberra:
- Australian Bureau of Statistics. (2013). Australian Social Trends. *Cat. no. 4102.0*. Retrieved from <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4102.0Main%20Features30Nov%202013#endnotes>
- Australian Institute of Health and Welfare. (2008). *2007 National Drug Strategy Household Survey: first results*. Retrieved from
- Australian Institute of Health and Welfare. (2011). *2010 National Drug Strategy Household Survey report*. Retrieved from <http://www.aihw.gov.au/publication-detail/?id=32212254712>
- Bachman, J. G., O'Malley, P. M., & Johnston, L. D. (1984). Drug use among young adults: the impacts of role status and social environment. *Journal of Personality and Social Psychology*, *47*(3), 629.
- Bachman, J. G., O'Malley, P. M., Schulenberg, J. E., Johnston, L. D., Bryant, A. L., & Merline, A. C. (2002). *The decline of substance use in young adulthood: Changes in social activities, roles, and beliefs*: Psychology Press.
- Bachman, J. G., Wadsworth, K. N., O'Malley, P. M., Johnston, L. D., & Schulenberg, J. E. (2013). *Smoking, drinking, and drug use in young adulthood: The impacts of new freedoms and new responsibilities*: Psychology Press.
- Bahr, S., Hoffmann, J., & Yang, X. (2005). Parental and Peer Influences on the Risk of Adolescent Drug Use. *The Journal of Primary Prevention*, *26*(6), 529-551. doi:10.1007/s10935-005-0014-8
- Bandura, A. (1969). Social-learning theory of identificatory processes. *Handbook of socialization theory and research*, 213-262.
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191.

- Bandura, A. (2010). *Self-efficacy*: Wiley Online Library.
- Banwell, C., Dance, P., Quinn, C., Davies, R., & Hall, D. (2006). Alcohol, other drug use, and gambling among Australian Capital Territory (ACT) workers in the building and related industries. *Drugs: education, prevention and policy*, 13(2), 167-178.
- Barnes, G. M., Reifman, A. S., Farrell, M. P., & Dintcheff, B. A. (2000). The Effects of Parenting on the Development of Adolescent Alcohol Misuse: A Six-Wave Latent Growth Model. *Journal of Marriage and Family*, 62(1), 175-186. doi:10.1111/j.1741-3737.2000.00175.x
- Barnes, G. M., Welte, J. W., Hoffman, J. H., & Dintcheff, B. A. (2002). Effects of alcohol misuse on gambling patterns in youth. *Journal of Studies on Alcohol*, 63(6), 767-775. Retrieved from <Go to ISI>://WOS:000180155700016
- Barnes, G. M., Welte, J. W., Hoffman, J. H., & Dintcheff, B. A. (2005). Shared Predictors of Youthful Gambling, Substance Use, and Delinquency. *Psychology of Addictive Behaviors*, 19(2), 165-174. doi:10.1037/0893-164X.19.2.165
- Barnes, H. L., & Olson, D. H. (1982). Parent adolescent communication scale. In D. H. O. e. al (Ed.), *Family inventories: Inventories used in a national survey of families across the family life cycle* (pp. 33-48). St. Paul: Family Social Science, University of Minnesota.
- Bazargan, S., Sherkat, D. E., & Bazargan, M. (2004). Religion and Alcohol Use Among African-American and Hispanic Inner-City Emergency Care Patients. *Journal for the Scientific Study of Religion*, 43(3), 419-428. doi:10.1111/j.1468-5906.2004.00244.x
- Bedford, A., & Foulds, G. (1977). Validation of the Delusions-Symptoms-States Inventory. *British Journal of Medical Psychology*, 50(2), 163-171.
- Bedford, A., Foulds, G., & Sheffield, B. (1976). A new personal disturbance scale (DSSI/sAD). *British Journal of Social and Clinical Psychology*, 15(4), 387-394. Retrieved from <http://onlinelibrary.wiley.com/store/10.1111/j.2044-8260.1976.tb00050.x/asset/j.2044-8260.1976.tb00050.x.pdf?v=1&t=iso8wqjj&s=71728e64ca3803cd2c218633b68ea560ca419c19>
- Bedford, A., & Foulds, G. A. (1978). *Delusions-symptoms-states Inventory State of Anxiety and Depression (manual)*: NFER Berkshire, UK.
- Belloc, N. B., & Breslow, L. (1972). Relationship of physical health status and health practices. *Preventive Medicine*, 1(3), 409-421. doi:[http://dx.doi.org/10.1016/0091-7435\(72\)90014-X](http://dx.doi.org/10.1016/0091-7435(72)90014-X)
- Belloc, N. B., Breslow, L., & Hochstim, J. R. (1971). Measurement of physical health in a general population survey. *American Journal of Epidemiology*, 93(5), 328-336. Retrieved from <http://aje.oxfordjournals.org/content/93/5/328.abstract>
- <http://aje.oxfordjournals.org/content/93/5/328.full.pdf>
- Benzies, K. M., Wångby, M., & Bergman, L. R. (2008). Stability and Change in Health-Related Behaviors of Midlife Swedish Women. *Health Care for Women International*, 29(10), 997-1018. doi:10.1080/07399330802269675

- Bernat, D. H., Erickson, D. J., Widome, R., Perry, C. L., & Forster, J. L. (2008). Adolescent Smoking Trajectories: Results from a Population-Based Cohort Study. *Journal of Adolescent Health, 43*(4), 334-340. doi:<http://dx.doi.org/10.1016/j.jadohealth.2008.02.014>
- Biblarz, T. J., & Stacey, J. (2010). How Does the Gender of Parents Matter? *Journal of Marriage and Family, 72*(1), 3-22. doi:10.1111/j.1741-3737.2009.00678.x
- Biederman, J., Faraone, S. V., Monuteaux, M. C., & Feighner, J. A. (2000). Patterns of Alcohol and Drug Use in Adolescents Can Be Predicted by Parental Substance Use Disorders. *Pediatrics, 106*(4), 792-797. Retrieved from <http://pediatrics.aappublications.org/content/106/4/792.abstract>
- <http://pediatrics.aappublications.org/content/106/4/792.full.pdf>
- Billi, R., Stone, C. A., Marden, P., & Yeung, K. (2014). *The Victorian Gambling Study: A longitudinal study of gambling and health in Victoria, 2008–2012*. Retrieved from
- Bjørk, C., Thygesen, L. C., Vinther-Larsen, M., & Grønbaek, M. N. (2008). Time Trends in Heavy Drinking Among Middle-Aged and Older Adults in Denmark. *Alcoholism: Clinical and Experimental Research, 32*(1), 120-127. doi:10.1111/j.1530-0277.2007.00557.x
- Blomeyer, D., Buchmann, A. F., Schmid, B., Jennen-Steinmetz, C., Schmidt, M. H., Banaschewski, T., & Laucht, M. (2011). Age at First Drink Moderates the Impact of Current Stressful Life Events on Drinking Behavior in Young Adults. *Alcoholism: Clinical and Experimental Research, 35*(6), 1142-1148. doi:10.1111/j.1530-0277.2011.01447.x
- Blomgren, J., Martikainen, P., Grundy, E., & Koskinen, S. (2012). Marital history 1971–91 and mortality 1991–2004 in England & Wales and Finland. *Journal of Epidemiology and Community Health, 66*(1), 30-36. doi:10.1136/jech.2010.110635
- Bloomfield, K., Allamani, A., Beck, F., Bergmark, K. H., Csemy, L., Eisenbach-Stangl, I., . . . Mendoza, M. R. (2005). *Gender, Culture and Alcohol Problems: A Multi-national Study*. Retrieved from Institute for Medical Informatics, Biometrics & Epidemiology, Charité Universitätsmedizin Berlin:
- Bloomfield, K., Gmel, G., Neve, R., & Mustonen, H. (2001). Investigating Gender Convergence in Alcohol Consumption in Finland, Germany, The Netherlands, and Switzerland: A Repeated Survey Analysis. *Substance Abuse, 22*(1), 39-53. doi:10.1023/a:1026471809354
- Bloomfield, K., Hope, A., & Kraus, L. (2013). Alcohol survey measures for Europe: A literature review. *Drugs: education, prevention, and policy, 20*(5), 348-360. doi:doi:10.3109/09687637.2011.642906
- Blume, S. (1997). Women and alcohol: Issues in social policy. *Gender and alcohol: individual and social perspectives. New Brunswick, NJ: Rutgers Center of Alcohol Studies, 462-489*.
- Bobo, J. K., & Greek, A. A. (2011). Increasing and decreasing alcohol use trajectories among older women in the US across a 10-year interval. *International Journal of Environmental Research and Public Health, 8*(8), 3263-3276. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3166741/pdf/ijerph-08-03263.pdf>

- Bobo, J. K., Greek, A. A., Klepinger, D. H., & Herting, J. R. (2010). Alcohol use trajectories in two cohorts of US women aged 50 to 65 at baseline. *Journal of the American Geriatrics Society*, 58(12), 2375-2380. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3064493/pdf/nihms251557.pdf>
- Bobo, J. K., Greek, A. A., Klepinger, D. H., & Herting, J. R. (2013). Predicting 10-Year Alcohol Use Trajectories Among Men Age 50 Years and Older. *The American Journal of Geriatric Psychiatry*, 21(2), 204-213. doi:<http://dx.doi.org/10.1016/j.jagp.2012.10.021>
- Boden, J. M., Fergusson, D. M., & Horwood, L. J. (2013). Alcohol misuse and relationship breakdown: Findings from a longitudinal birth cohort. *Drug and Alcohol Dependence*, 133(1), 115-120. doi:<http://dx.doi.org/10.1016/j.drugalcdep.2013.05.023>
- Bolland, K. A., Bolland, J. M., Tomek, S., Devereaux, R. S., Mrug, S., & Wimberly, J. C. (2016). Trajectories of Adolescent Alcohol Use by Gender and Early Initiation Status. *Youth & Society*, 48(1), 3-32. doi:10.1177/0044118x13475639
- Bolton, J. M., Robinson, J., & Sareen, J. (2009). Self-medication of mood disorders with alcohol and drugs in the National Epidemiologic Survey on Alcohol and Related Conditions. *Journal of Affective Disorders*, 115(3), 367-375. doi:10.1016/j.jad.2008.10.003
- Borsari, B., Murphy, J. G., & Barnett, N. P. (2007). Predictors of alcohol use during the first year of college: Implications for prevention. *Addictive Behaviors*, 32(10), 2062-2086. doi:10.1016/j.addbeh.2007.01.017
- Bowie, J. V., Ensminger, M. E., & Robertson, J. A. (2006). Alcohol-use problems in young black adults: effects of religiosity, social resources, and mental health. *Journal of Studies on Alcohol*, 67(1), 44-53.
- Boyle, J. R., & Boekeloo, B. O. (2006). Perceived parental approval of drinking and its impact on problem drinking behaviors among first-year college students. *Journal of American college health : J of ACH*, 54(4), 238-244. doi:10.3200/jach.54.4.238-244
- Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology*, 53(1), 371-399. Retrieved from <http://www.annualreviews.org/doi/pdf/10.1146/annurev.psych.53.100901.135233>
- Brennan, P. L., Schutte, K. K., Moos, B. S., & Moos, R. H. (2011). Twenty-year alcohol-consumption and drinking-problem trajectories of older men and women. *Journal of Studies on Alcohol and Drugs*, 72(2), 308. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3052900/pdf/jsad308.pdf>
- Brennan, P. L., Schutte, K. K., & Moos, R. H. (1999). Reciprocal relations between stressors and drinking behavior: a three-wave panel study of late middle-aged and older women and men. *Addiction*, 94(5), 737-749. doi:10.1046/j.1360-0443.1999.94573712.x
- Brennan, P. L., Schutte, K. K., & Moos, R. H. (2010). Patterns and predictors of late-life drinking trajectories: A 10-year longitudinal study. *Psychology of Addictive Behaviors*, 24(2), 254-264. doi:10.1037/a0018592

- Breslow, L., & Enstrom, J. E. (1980). Persistence of health habits and their relationship to mortality. *Preventive Medicine, 9*(4), 469-483. doi:[http://dx.doi.org/10.1016/0091-7435\(80\)90042-0](http://dx.doi.org/10.1016/0091-7435(80)90042-0)
- Breslow, R. A., Faden, V. B., & Smothers, B. (2003). Alcohol consumption by elderly Americans. *Journal of Studies on Alcohol, 64*(6), 884-892.
- Breslow, R. A., Falk, D. E., Fein, S. B., & Grummer-Strawn, L. M. (2007). Alcohol consumption among breastfeeding women. *Breastfeeding Medicine, 2*(3), 152-157.
- Britton, A., Ben-Shlomo, Y., Benzeval, M., Kuh, D., & Bell, S. (2015). Life course trajectories of alcohol consumption in the United Kingdom using longitudinal data from nine cohort studies. *BMC Medicine, 13*(1), 47.
- Buckner, J. D., Eggleston, A. M., & Schmidt, N. B. (2006). Social Anxiety and Problematic Alcohol Consumption: The Mediating Role of Drinking Motives and Situations. *Behavior Therapy, 37*(4), 381-391. doi:10.1016/j.beth.2006.02.007
- Budescu, M., Taylor, R. D., & McGill, R. K. (2011). Stress and African American Women's Smoking/Drinking to Cope: Moderating Effects of Kin Social Support. *Journal of Black Psychology, 37*(4), 452-484. doi:Journal of Black Psychology
- Bungey, J., & Winter, C. (1986). Alcohol consumption patterns in South Australia: 1983. *The Medical Journal of Australia, 144*(1), 6-9.
- Cahnman, W. J. (1965). Ideal Type Theory: Max Weber's Concept and Some of Its Derivations*. *The Sociological Quarterly, 6*(3), 268-280.
- Callinan, S., & Room, R. (2012). *Alcohol consumption during pregnancy*. Retrieved from
- Carrigan, M. H., & Randall, C. L. (2003). Self-medication in social phobia: A review of the alcohol literature. *Addictive Behaviors, 28*(2), 269-284. doi:10.1016/s0306-4603(01)00235-0
- Casswell, S., Pledger, M., & Pratap, S. (2002). Trajectories of drinking from 18 to 26 years: identification and prediction. *Addiction, 97*(11), 1427-1437. doi:10.1046/j.1360-0443.2002.00220.x
- Castle, D. J., Kulkarni, J., & Abel, K. M. (2006). *Mood and anxiety disorders in women*. Cambridge, UK; New York: Cambridge University Press.
- Cederfjäll, J., Lidfeldt, J., Nerbrand, C., Samsioe, G., & Öjehagen, A. (2004). Alcohol Consumption among Middle-Aged Women: A Population-Based Study of Swedish Women. *European Addiction Research, 10*(1), 15-21. Retrieved from <http://www.karger.com/DOI/10.1159/000073722>
- Cerdá, M., Johnson-Lawrence, V. D., & Galea, S. (2011). Lifetime income patterns and alcohol consumption: Investigating the association between long-and short-term income trajectories and drinking. *Social science & medicine, 73*(8), 1178-1185. Retrieved from http://ac.els-cdn.com/S0277953611004965/1-s2.0-S0277953611004965-main.pdf?_tid=d59859b8-b882-11e3-9b52-00000aab0f02&acdnat=1396235962_6a09a1699e5afeda8fee5d093bb72842

- Cerda, M., Vlahov, D., Tracy, M., & Galea, S. (2008). Alcohol use trajectories among adults in an urban area after a disaster: evidence from a population-based cohort study. *Addiction, 103*(8), 1296-1307. doi:10.1111/j.1360-0443.2008.02247.x
- Chan, A. M., von Mühlen, D., Kritz-Silverstein, D., & Barrett-Connor, E. (2009). Regular alcohol consumption is associated with increasing quality of life and mood in older men and women: The Rancho Bernardo Study. *Maturitas, 62*(3), 294-300. doi:<http://dx.doi.org/10.1016/j.maturitas.2009.01.005>
- Chang, G., McNamara, T. K., Orav, E. J., & Wilkins-Haug, L. (2006). Alcohol use by pregnant women: partners, knowledge, and other predictors. *Journal of Studies on Alcohol, 67*(2), 245. Retrieved from [http://www.jsad.com/jsad/downloadarticle/Alcohol Use by Pregnant Women Partners Knowledge and Other Predictors/1017.pdf](http://www.jsad.com/jsad/downloadarticle/Alcohol%20Use%20by%20Pregnant%20Women%20Partners%20Knowledge%20and%20Other%20Predictors/1017.pdf)
- Chatfield, M. D., Brayne, C. E., & Matthews, F. E. (2005). A systematic literature review of attrition between waves in longitudinal studies in the elderly shows a consistent pattern of dropout between differing studies. *Journal of Clinical Epidemiology, 58*(1), 13-19. doi:<http://dx.doi.org/10.1016/j.jclinepi.2004.05.006>
- Chiodo, L. M., Bailey, B. A., Sokol, R. J., Janisse, J., Delaney-Black, V., & Hannigan, J. H. (2012). Recognized spontaneous abortion in mid-pregnancy and patterns of pregnancy alcohol use. *Alcohol, 46*(3), 261-267. doi:<http://dx.doi.org/10.1016/j.alcohol.2011.11.006>
- Chitwood, D. D., Weiss, M. L., & Leukefeld, C. G. (2008). A Systematic Review of Recent Literature on Religiosity and Substance Use. *Journal of Drug Issues, 38*(3), 653-688. doi:10.1177/002204260803800302
- Christie-Mizell, C. A., & Peralta, R. L. (2009). The Gender Gap in Alcohol Consumption during Late Adolescence and Young Adulthood: Gendered Attitudes and Adult Roles. *Journal of Health and Social Behavior, 50*(4), 410-426. doi:10.1177/002214650905000403
- Clemens, S. L., Matthews, S. L., Young, A. F., & Powers, J. R. (2007). Alcohol consumption of Australian women: results from the Australian Longitudinal Study on Women's Health. *Drug and Alcohol Review, 26*(5), 525-535. doi:10.1080/09595230701499142
- Cleveland, M. J., Reavy, R., Mallett, K. A., Turrisi, R., & White, H. R. (2014). Moderating effects of positive parenting and maternal alcohol use on emerging adults' alcohol use: Does living at home matter? *Addictive Behaviors, 39*(5), 869-878. doi:<http://dx.doi.org/10.1016/j.addbeh.2014.01.028>
- Colder, C. R., Campbell, R. T., Ruel, E., Richardson, J. L., & Flay, B. R. (2002). A finite mixture model of growth trajectories of adolescent alcohol use: Predictors and consequences. *Journal of Consulting and Clinical Psychology, 70*(4), 976. Retrieved from <http://psycnet.apa.org/journals/ccp/70/4/976.pdf>
- Coleman, P., Maxey, C., Spence, M., & Nixon, C. (2009). Predictors and Correlates of Abortion in the Fragile Families and Well-Being Study: Paternal Behavior, Substance Use, and Partner Violence.

International Journal of Mental Health and Addiction, 7(3), 405-422. doi:10.1007/s11469-008-9188-7

- Coleman, P. K., Coyle, C. T., Shuping, M., & Rue, V. M. (2009). Induced abortion and anxiety, mood, and substance abuse disorders: Isolating the effects of abortion in the national comorbidity survey. *Journal of Psychiatric Research*, 43(8), 770-776. doi:10.1016/j.jpsychires.2008.10.009
- Collins, R. L., Ellickson, P. L., & Klein, D. J. (2007). The role of substance use in young adult divorce. *Addiction*, 102(5), 786-794. doi:10.1111/j.1360-0443.2007.01803.x
- Cook, R. L., Plankey, M., Howard, A. A., Sharp, G. B., Richardson, J. L., Cohen, M. H., . . . Wilson, T. E. (2013). Alcohol consumption trajectory patterns in adult women with HIV infection. *AIDS and Behavior*, 17(5), 1705-1712. doi:10.1007/s10461-012-0270-6
- Corti, B., & Ibrahim, J. (1990). Women and alcohol--trends in Australia. *The Medical Journal of Australia*, 152(12), 625-632.
- Cranford, J. A. (2014). DSM-IV alcohol dependence and marital dissolution: evidence from the National Epidemiologic Survey on Alcohol and Related Conditions. *Journal of Studies on Alcohol and Drugs*, 75(3), 520.
- Crum, R. M., & Pratt, L. A. (2001). Risk of heavy drinking and alcohol use disorders in social phobia: a prospective analysis. *American Journal of Psychiatry*, 158(10), 1693-1700.
- Cummins, R. A. (2005). The domains of life satisfaction: An attempt to order chaos *Citation classics from social indicators research* (pp. 559-584): Springer.
- Davidson, T., & Rodgers, B. (2010). *2009 Survey of the nature and extent of gambling, and problem gambling, in the Australian Capital Territory*. Retrieved from <http://www.problemgambling.act.gov.au/Recent%20Research/ACT%20Gambling%20Prevalence%20Study.pdf>.
- Dawson, D. A. (2003). Methodological issues in measuring alcohol use. *Alcohol Research and Health*, 27(1), 18-29.
- De Chazeron, I., Llorca, P.-M., Ughetto, S., Vendittelli, F., Boussiron, D., Sapin, V., . . . Lemery, D. (2008). Is Pregnancy the Time to Change Alcohol Consumption Habits in France? *Alcoholism: Clinical and Experimental Research*, 32(5), 868-873. doi:10.1111/j.1530-0277.2008.00646.x
- Deeg, D. J. H. (2002). Attrition in longitudinal population studies: Does it affect the generalizability of the findings?: An introduction to the series. *Journal of Clinical Epidemiology*, 55(3), 213-215. doi:[http://dx.doi.org/10.1016/S0895-4356\(01\)00472-3](http://dx.doi.org/10.1016/S0895-4356(01)00472-3)
- Del Boca, F. K., & Darkes, J. (2003). The validity of self-reports of alcohol consumption: state of the science and challenges for research. *Addiction*, 98, 1-12. doi:10.1046/j.1359-6357.2003.00586.x
- Delfabbro, P. (2008). *Australasian gambling review (3rd ed.)*. Adelaide: Independent Gambling Authority.
- Delfabbro, P., & King, D. (2012). Gambling in Australia: experiences, problems, research and policy. *Addiction*, 107(9), 1556-1561. doi:10.1111/j.1360-0443.2012.03802.x

- Delfabbro, P., King, D., & Griffiths, M. (2014). From Adolescent to Adult Gambling: An Analysis of Longitudinal Gambling Patterns in South Australia. *Journal of Gambling Studies*, 30(3), 547-563. doi:10.1007/s10899-013-9384-7
- Delfabbro, P., & Thrupp, L. (2003). The social determinants of youth gambling in South Australian adolescents. *Journal of Adolescence*, 26(3), 313-330. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-0038683247&partnerID=40&md5=b4d6cf538ab74317a6e9aeaad9e164f4>
http://ac.els-cdn.com/S0140197103000137/1-s2.0-S0140197103000137-main.pdf?_tid=57061046-718e-11e6-a62f-00000aab0f26&acdnat=1472876864_3b4272c9104b01c7fc3b4ca49cbf9090
- Devries, K. M., Child, C. J., Bacchus, J. L., Mak, J., Falder, G., Graham, K., . . . Heise, L. (2014). Intimate partner violence victimization and alcohol consumption in women: a systematic review and meta-analysis. *Addiction*, 109(3), 379-391. doi:10.1111/add.12393
- Doherty, D. A., Magann, E. F., Francis, J., Morrison, J. C., & Newnham, J. P. (2006). Pre-pregnancy body mass index and pregnancy outcomes. *International Journal of Gynecology & Obstetrics*, 95(3), 242-247. doi:<http://dx.doi.org/10.1016/j.ijgo.2006.06.021>
- Dormann, C. F., Elith, J., Bacher, S., Buchmann, C., Carl, G., Carré, G., . . . Lautenbach, S. (2013). Collinearity: a review of methods to deal with it and a simulation study evaluating their performance. *Ecography*, 36(1), 27-46. doi:10.1111/j.1600-0587.2012.07348.x
- Dowling, N., Shandley, K., Oldenhof, E., Youssef, G., Thomas, S., Frydenberg, E., & Jackson, A. (2016). The intergenerational transmission of problem gambling: The mediating role of parental psychopathology. *Addictive Behaviors*, 59, 12-17. Retrieved from http://ac.els-cdn.com/S0306460316300958/1-s2.0-S0306460316300958-main.pdf?_tid=796d8140-718a-11e6-92e5-00000aab0f26&acdnat=1472875203_1295c93c9c779481d82dac85b6600b7c
- Duncan, G., Wilkerson, B., & England, P. (2006). Cleaning up their act: The effects of marriage and cohabitation on licit and illicit drug use. *Demography*, 43(4), 691-710. doi:10.1353/dem.2006.0032
- Durkheim, E. (1964). *The division of labor in society*. New York U6 - ctx_ver=Z39.88-2004&ctx_enc=info%3Aofi%2Fenc%3AUTF-8&rft_id=info:sid/summon.serialssolutions.com&rft_val_fmt=info:ofi/fmt:kev:mtx:book&rft.genre=book&rft.title=The+division+of+labor+in+society&rft.au=Durkheim%2C+Emile&rft.series=Free+Press+paperbacks&rft.date=1964-01-01&rft.pub=Free+Press+of+Glencoe&rft.externalDBID=n%2Fa&rft.externalDocID=b10773514 U7 - Book U8 - FETCH-uq_catalog_b107735141: Free Press of Glencoe.
- Eigenbrodt, M. L., Mosley, T. H., Hutchinson, R. G., Watson, R. L., Chambless, L. E., & Szklo, M. (2001). Alcohol consumption with age: a cross-sectional and longitudinal study of the Atherosclerosis Risk in Communities (ARIC) study, 1987–1995. *American Journal of Epidemiology*, 153(11), 1102-1111. Retrieved from <http://aje.oxfordjournals.org/content/153/11/1102.full.pdf>

- Elder, G. H. (1994). Time, Human Agency, and Social Change: Perspectives on the Life Course. *Social psychology quarterly*, 57(1), 4-15. Retrieved from <http://www.jstor.org/stable/2786971>
- Elder, G. H., & Giele, J. Z. (2009). *The craft of life course research*: Guilford Press.
- Ellison, C. (1994). Religion, the life stress paradigm, and the study of depression. In JS Levin (Eds.), *Religion in aging and health: theoretical foundations and methodological frontiers*.
- Emslie, C., Hunt, K., & Lyons, A. (2015). Transformation and time-out: The role of alcohol in identity construction among Scottish women in early midlife. *International Journal of Drug Policy*, 26(5), 437-445. doi:<http://dx.doi.org/10.1016/j.drugpo.2014.12.006>
- Englund, M. M., Egeland, B., Oliva, E. M., & Collins, W. A. (2008). Childhood and adolescent predictors of heavy drinking and alcohol use disorders in early adulthood: a longitudinal developmental analysis. *Addiction*, 103, 23-35. doi:10.1111/j.1360-0443.2008.02174.x
- Ethen, M., Ramadhani, T., Scheuerle, A., Canfield, M., Wyszynski, D., Druschel, C., & Romitti, P. (2009). Alcohol Consumption by Women Before and During Pregnancy. *Maternal and child health journal*, 13(2), 274-285. doi:10.1007/s10995-008-0328-2
- Evans, N. J. (1985). Women's development across the life span. *New Directions for Student Services*, 1985(29), 9-27. doi:10.1002/ss.37119852904
- Fergusson, D. M., Boden, J. M., & Horwood, L. J. (2013). Alcohol misuse and psychosocial outcomes in young adulthood: Results from a longitudinal birth cohort studied to age 30. *Drug and Alcohol Dependence*, 133(2), 513-519. doi:<http://dx.doi.org/10.1016/j.drugalcdep.2013.07.015>
- Ferris, J., & Wynne, H. (2001). *The Canadian problem gambling index*. Ottawa, ON: Canadian Centre on Substance Abuse.
- Fillmore, K. M. (1987). Women's Drinking across the Adult Life Course as Compared to Men's. *British Journal of Addiction*, 82(7), 801-811. doi:10.1111/j.1360-0443.1987.tb01547.x
- Fillmore, K. M., Golding, J. M., Leino, E. V., Motoyoshi, M., Shoemaker, C., Terry, H., . . . Ferrer, H. P. (1997). Patterns and trends in women's and men's drinking. In R. W. Wilsnack & S. C. Wilsnack (Eds.), *Gender and Alcohol: Individual and social perspectives*: Rutgers Center of Alcohol Studies.
- Fillmore, K. M., Hartka, E., Johnstone, B. M., Leino, E. V., Motoyoshi, M., & Temple, M. T. (1991). Preliminary results from a meta-analysis of drinking behavior in multiple longitudinal studies*. *British Journal of Addiction*, 86(10), 1203-1210. doi:10.1111/j.1360-0443.1991.tb01700.x
- Fillmore, K. M., Kerr, W. C., & Bostrom, A. (2003). Changes in drinking status, serious illness and mortality. *Journal of Studies on Alcohol*, 64(2), 278-285. Retrieved from <Go to ISI>://WOS:000182065000017
- Fischer, J. A., Najman, J. M., Plotnikova, M., & Clavarino, A. M. (2014). Quality of life, age of onset of alcohol use and alcohol use disorders in adolescence and young adulthood: Findings from an Australian birth cohort. *Drug and Alcohol Review*, n/a-n/a. doi:10.1111/dar.12227

- Fitzgerald, R., Jordan, T. L., Blainey, A. E., Ravkin, C., & Australian Broadcasting, C. (2009). *Under the influence: a history of alcohol in Australia*. Sydney: ABC Books for the Australian Broadcasting Corporation.
- Fleming, J. (1996). The epidemiology of alcohol use in Australian women: findings from a national survey of women's drinking. *Addiction, 91*(9), 1325-1334. doi:10.1046/j.1360-0443.1996.91913257.x
- Ford, J. A. (2007). Alcohol Use among College Students: A Comparison of Athletes and Nonathletes. *Substance Use & Misuse, 42*(9), 1367-1377. doi:doi:10.1080/10826080701212402
- Forrest, D., & McHale, I. (2012). Gambling and Problem Gambling Among Young Adolescents in Great Britain. *Journal of Gambling Studies, 28*(4), 607-622. doi:10.1007/s10899-011-9277-6
- French, D. J., Sargent-Cox, K. A., Kim, S., & Anstey, K. J. (2014). Gender differences in alcohol consumption among middle-aged and older adults in Australia, the United States and Korea. *Australian and New Zealand Journal of Public Health, 38*(4), 332-339. doi:10.1111/1753-6405.12227
- French, M. T., Popovici, I., & Maclean, J. C. (2009). Do alcohol consumers exercise more? Findings from a national survey. *American Journal of Health Promotion, 24*(1), 2-10. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2747097/pdf/nihms74307.pdf>
- Fried, P., Barnes, M., & Drake, E. (1985). Soft drug use after pregnancy compared to use before and during pregnancy. *American Journal of Obstetrics and Gynecology, 151*(6), 787-792.
- Fröberg, F., Hallqvist, J., & Tengström, A. (2012). *Psychosocial health and gambling problems among men and women aged 16–24 years in the Swedish National Public Health Survey*.
- Gee, G. C., Liang, J., Bennett, J., Krause, N., Kobayashi, E., Fukaya, T., & Sugihara, Y. (2007). Trajectories of Alcohol Consumption among Older Japanese Followed from 1987—1999. *Research on Aging, 29*(4), 323-347. doi:10.1177/0164027507300803
- Geels, L. M., Vink, J. M., Van Beek, J. H. D. A., Bartels, M., Willemsen, G., & Boomsma, D. I. (2013). Increases in alcohol consumption in women and elderly groups: Evidence from an epidemiological study. *BMC Public Health, 13*(1), 207. Retrieved from http://uq.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwVZ0xDsMwCEVR9y6V2rkXsGTHONhz1KgHyAWMgTFT76_aUYfmBiz_lxD_AfAMXDArjeakBQfwrU2CeUYjnr3padfx5-brDS6632FbX9vydr9nAE4pkWtBpMIUC_kaWAlyp8RZzfqlwwPPI92Oq1pWH1E05I5biiQHEa2L6AHXOm7G98-RLZMvqCUp_A
- <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3720280/pdf/1471-2458-13-207.pdf>
- Giglia, R., & Binns, C. (2006). Alcohol and lactation: A systematic review. *Nutrition & Dietetics, 63*(2), 103-116. doi:10.1111/j.1747-0080.2006.00056.x
- Giglia, R. C., & Binns, C. W. (2007). Patterns of alcohol intake of pregnant and lactating women in Perth, Australia. *Drug and Alcohol Review, 26*(5), 493-500. doi:10.1080/09595230701499100
- Gmel, G., & Rehm, J. (2004). Measuring alcohol consumption. *Contemp. Drug Probs., 31*, 467.

- Goldman, E., & Najman, J. M. (1984). Lifetime Abstainers, Current Abstainers and Imbibers: A Methodological Note. *British Journal of Addiction*, *79*(4), 309-314. doi:10.1111/j.1360-0443.1984.tb03872.x
- Gotoh, M. (1994). Alcohol dependence of women in Japan. *Addiction*, *89*(8), 953-954.
- Goudriaan, A. E., Slutske, W. S., Krull, J. L., & Sher, K. J. (2009). Longitudinal patterns of gambling activities and associated risk factors in college students. *Addiction*, *104*(7), 1219-1232. doi:10.1111/j.1360-0443.2009.02573.x
- Grant, N., Wardle, J., & Steptoe, A. (2009). The Relationship Between Life Satisfaction and Health Behavior: A Cross-cultural Analysis of Young Adults. *International Journal of Behavioral Medicine*, *16*(3), 259-268. doi:10.1007/s12529-009-9032-x
- Greenfield, T. K. (2000). Ways of measuring drinking patterns and the difference they make: experience with graduated frequencies. *Journal of Substance Abuse*, *12*(1-2), 33-49. doi:[http://dx.doi.org/10.1016/S0899-3289\(00\)00039-0](http://dx.doi.org/10.1016/S0899-3289(00)00039-0)
- Greenfield, T. K., & Kerr, W. C. (2008). Alcohol measurement methodology in epidemiology: recent advances and opportunities. *Addiction*, *103*(7), 1082-1099. Retrieved from <http://onlinelibrary.wiley.com/store/10.1111/j.1360-0443.2008.02197.x/asset/j.1360-0443.2008.02197.x.pdf?v=1&t=ig780qzw&s=067d346294887f1931d238a36c8180bca7c249c8>
- Haastруп, M. B., Pottegård, A., & Damkier, P. (2014). Alcohol and Breastfeeding. *Basic & clinical pharmacology & toxicology*, *114*(2), 168-173. doi:10.1111/bcpt.12149
- Hagenaars, J. A., & Halman, L. C. (1989). Searching for ideal types: The potentialities of latent class analysis. *European Sociological Review*, *5*(1), 81-96.
- Hajema, K.-J., Knibbe, R. A., & Drop, M. J. (1997). Changes in alcohol consumption in a general population in The Netherlands: a 9-year follow-up study. *Addiction*, *92*(1), 49-60. doi:10.1111/j.1360-0443.1997.tb03637.x
- Hall, W., & Hunter, E. (1995). Australia. In D. B. Heath (Ed.), *International handbook on alcohol and culture* Westport, Connecticut: Greenwood Press.
- Hall, W., Teesson, M., Lynskey, M., & Degenhardt, L. (1999). The 12-month prevalence of substance use and ICD-10 substance use disorders in Australian adults: findings from the National Survey of Mental Health and Well-Being. *Addiction*, *94*(10), 1541-1550. Retrieved from <http://onlinelibrary.wiley.com/store/10.1046/j.1360-0443.1999.9410154110.x/asset/j.1360-0443.1999.9410154110.x.pdf?v=1&t=ii591112&s=19cc8712bb8ed3f6ab2541251ecd6afe0c19ed1b>
- Ham, L. S., & Hope, D. A. (2003). College students and problematic drinking: A review of the literature. *Clinical Psychology Review*, *23*(5), 719-759.
- Harcourt, K. T., & Adler-Baeder, F. (2015). Family Mapping: A Cumulative Measure of Family Structure and Instability. *Journal of Divorce & Remarriage*, *56*(3), 199-219. doi:10.1080/10502556.2015.1012697

- Hardt, J., Herke, M., & Leonhart, R. (2012). Auxiliary variables in multiple imputation in regression with missing X: a warning against including too many in small sample research. *BMC Medical Research Methodology*, *12*(1), 184.
- Harford, T. C. (1993). Stability and prevalence of drinking among young adults. *Addiction*, *88*(2), 273-277. Retrieved from <http://onlinelibrary.wiley.com/doi/10.1111/j.1360-0443.1993.tb00811.x/abstract>
- Harris Abadi, M., Shamblen, S. R., Thompson, K., Collins, D. A., & Johnson, K. (2011). Influence of Risk and Protective Factors on Substance Use Outcomes Across Developmental Periods: A Comparison of Youth and Young Adults. *Substance Use & Misuse*, *46*(13), 1604-1612.
doi:doi:10.3109/10826084.2011.598598
- Haruyama, Y., Fukuda, H., Arai, T., & Muto, T. (2012). Change in lifestyle through health promotion program without face-to-face intervention in a large-scale Japanese enterprise. *Journal of occupational health*, *55*(2), 74-83.
- Hasin, D. S., Stinson, F. S., Ogburn, E., & Grant, B. F. (2007). Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States - Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry*, *64*(7), 830-842. doi:10.1001/archpsyc.64.7.830
- Haugland, S., Holmen, T., Ravndal, E., & Bratberg, G. (2013). Parental alcohol misuse and hazardous drinking among offspring in a general teenage population: gender-specific findings from the Young-HUNT 3 study. *BMC Public Health*, *13*(1), 1140. Retrieved from <http://www.biomedcentral.com/1471-2458/13/1140>
- Hayatbakhsh, M. R., Clavarino, A. M., Williams, G. M., Bor, W., & Najman, J. M. (2013). Early life course predictors of young adults' gambling. *International Gambling Studies*, *13*(1), 19-36.
- Heeb, J.-L., & Gmel, G. (2005). Measuring alcohol consumption: A comparison of graduated frequency, quantity frequency, and weekly recall diary methods in a general population survey. *Addictive Behaviors*, *30*(3), 403-413. doi:<http://dx.doi.org/10.1016/j.addbeh.2004.04.022>
- Hekman, S. J. (1983). Weber's Ideal Type: A Contemporary Reassessment. *Polity*, *16*(1), 119-137.
doi:10.2307/3234525
- Hendry, J. (1994). Drinking and gender in Japan. *Gender, drink, and drugs*, *10*, 175.
- Herd, D. (1997). Racial differences in women's drinking norms and drinking patterns: a national study. *Journal of Substance Abuse*, *9*, 137-149.
- Hill, K. G., White, H. R., Chung, I.-J., Hawkins, J. D., & Catalano, R. F. (2000). Early Adult Outcomes of Adolescent Binge Drinking: Person- and Variable-Centered Analyses of Binge Drinking Trajectories. *Alcoholism, Clinical and Experimental Research*, *24*(6), 892-901. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1847635/>
<http://onlinelibrary.wiley.com/store/10.1111/j.1530-0277.2000.tb02071.x/asset/j.1530-0277.2000.tb02071.x.pdf?v=1&t=ihvj5n6q&s=67aaee7c780d682860f2f488c4316cb7d711a44f>

- Hoffmann, J. P., & Johnson, R. A. (1998). A National Portrait of Family Structure and Adolescent Drug Use. *Journal of Marriage and Family*, 60(3), 633-645. Retrieved from <http://www.jstor.org/stable/353534>
- Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research*, 11(2), 213-218. doi:[http://dx.doi.org/10.1016/0022-3999\(67\)90010-4](http://dx.doi.org/10.1016/0022-3999(67)90010-4)
- Holmila, M., & Raitasalo, K. (2005). Gender differences in drinking: why do they still exist? *Addiction*, 100(12), 1763-1769. doi:10.1111/j.1360-0443.2005.01249.x
- Hotham, E., Ali, R., White, J., & Robinson, J. (2008). Pregnancy-related changes in tobacco, alcohol and cannabis use reported by antenatal patients at two public hospitals in South Australia. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, 48(3), 248-254.
- Huckle, T., You, R. Q., & Casswell, S. (2010). Socio-economic status predicts drinking patterns but not alcohol-related consequences independently. *Addiction*, 105(7), 1192-1202. doi:10.1111/j.1360-0443.2010.02931.x
- Humphreys, K., Moos, R. H., & Finney, J. W. (1996). Life domains, alcoholics anonymous, and role incumbency in the 3-year course of problem drinking. *The Journal of nervous and mental disease*, 184(8), 475-481.
- Hutchinson, D., Moore, E. A., Breen, C., Burns, L., & Mattick, R. P. (2013). Alcohol use in pregnancy: Prevalence and predictors in the Longitudinal Study of Australian Children. *Drug and Alcohol Review*, 32(5), 475-482. doi:10.1111/dar.12027
- Hutchison, E. D. (2005). The life course perspective: A promising approach for bridging the micro and macro worlds for social workers. *Families in Society*, 86(1), 143-152.
- Jackson, K. M., Sher, K. J., Cooper, M. L., & Wood, P. K. (2002). Adolescent alcohol and tobacco use: onset, persistence and trajectories of use across two samples. *Addiction*, 97(5), 517-531. doi:10.1046/j.1360-0443.2002.00082.x
- Janssen, T., Larsen, H., Peeters, M., Pronk, T., Vollebergh, W. A. M., & Wiers, R. W. (2014). Interactions between Parental Alcohol-Specific Rules and Risk Personalities in the Prediction of Adolescent Alcohol Use. *Alcohol and Alcoholism*, 49(5), 579-585. doi:10.1093/alcalc/agu039
- Järvinen, M., & Room, R. (2007). *Youth drinking cultures: European experiences*. Burlington, VT; Aldershot, England: Ashgate.
- Jonas, H. A., Dobson, A. J., & Brown, W. J. (2000). Patterns of alcohol consumption in young Australian women: socio-demographic factors, health-related behaviours and physical health. *Australian and New Zealand Journal of Public Health*, 24(2), 185 - 191. Retrieved from <http://onlinelibrary.wiley.com/store/10.1111/j.1467-842X.2000.tb00140.x/asset/j.1467-842X.2000.tb00140.x.pdf?v=1&t=ha4taz7d&s=fc456b91f47418640a71708f6d7ee439efd0de84>

- Jones, B. L., & Nagin, D. S. (2007). Advances in Group-Based Trajectory Modeling and an SAS Procedure for Estimating Them. *Sociological Methods & Research*, 35(4), 542-571.
doi:10.1177/0049124106292364
- Jones, B. L., & Nagin, D. S. (2013). A Note on a Stata Plugin for Estimating Group-based Trajectory Models. *Sociological Methods & Research*, 42(4), 608-613. doi:Retrieved from
<http://www.iub.edu/~wim/docs/Info%20about%20STATA%20plugin.pdf>
- Jones, L. B., & Nagin, S. D. (2012). A Stata plugin for estimating group-based trajectory models: Retrieved from <http://repository.cmu.edu/cgi/viewcontent.cgi?article=1405&context=heinzworks>.
- Karlamangla, A., Zhou, K., Reuben, D., Greendale, G., & Moore, A. (2006). Longitudinal trajectories of heavy drinking in adults in the United States of America. *Addiction*, 101(1), 91-99. doi:10.1111/j.1360-0443.2005.01299.x
- Keenan, K., Grundy, E., Kenward, M. G., & Leon, D. A. (2014). Women's Risk of Repeat Abortions Is Strongly Associated with Alcohol Consumption: A Longitudinal Analysis of a Russian National Panel Study, 1994–2009. *PloS one*, 9(3), e90356. Retrieved from
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3966730/pdf/pone.0090356.pdf>
- Keenan, K., Kenward, M. G., Grundy, E., & Leon, D. A. (2014). The impact of alcohol consumption on patterns of union formation in Russia 1998–2010: An assessment using longitudinal data. *Population Studies*, 68(3), 283-303. doi:10.1080/00324728.2014.955045
- Keeping, J. D., Najman, J. M., Morrison, J., Western, J. S., Andersen, M. J., & Williams, G. M. (1989). A prospective longitudinal study of social, psychological and obstetric factors in pregnancy: response rates and demographic characteristics of the 8556 respondents. *BJOG: An International Journal of Obstetrics & Gynaecology*, 96(3), 289-297. doi:10.1111/j.1471-0528.1989.tb02388.x
- Kerr-Correa, F., Igami, T. Z., Hiroce, V., & Tucci, A. M. (2007). Patterns of alcohol use between genders: A cross-cultural evaluation. *Journal of Affective Disorders*, 102(1-3), 265-275.
doi:10.1016/j.jad.2006.09.031
- Kesmodel, U., Kesmodel, P. S., Larsen, A., & Secher, N. J. (2003). Use of alcohol and illicit drugs among pregnant Danish women, 1998. *Scandinavian Journal of Public Health*, 31(1), 5-11.
doi:10.1080/14034940210134202
- Kesmodel, U. S., Bertrand, J., Støvring, H., Skarpness, B., Denny, C. H., & Mortensen, E. L. (2012). The effect of different alcohol drinking patterns in early to mid pregnancy on the child's intelligence, attention, and executive function. *BJOG: An International Journal of Obstetrics & Gynaecology*, 119(10), 1180-1190. doi:10.1111/j.1471-0528.2012.03393.x
- Keyes, K. M., Hatzenbuehler, M. L., & Hasin, D. S. (2011). Stressful life experiences, alcohol consumption, and alcohol use disorders: the epidemiologic evidence for four main types of stressors. *Psychopharmacology*, 218(1), 1-17.

- Keyes, K. M., Li, G., & Hasin, D. S. (2011). Birth Cohort Effects and Gender Differences in Alcohol Epidemiology: A Review and Synthesis. *Alcoholism: Clinical and Experimental Research*, 35(12), 2101-2112. doi:10.1111/j.1530-0277.2011.01562.x
- Khantzian, E. J. (1985). The self-medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *The American Journal of Psychiatry; The American Journal of Psychiatry*.
- Khoo, S.-E. (1987). Living together as married: a profile of de facto couples in Australia. *Journal of Marriage and the Family*, 49(1), 185-191.
- Klebanoff, M. A., & Cole, S. R. (2008). Use of Multiple Imputation in the Epidemiologic Literature. *American Journal of Epidemiology*, 168(4), 355-357. doi:10.1093/aje/kwn071
- Klimes-Dougan, B., Brand, A. E., Zahn-Waxler, C., Usher, B., Hastings, P. D., Kendziora, K., & Garside, R. B. (2007). Parental Emotion Socialization in Adolescence: Differences in Sex, Age and Problem Status. *Social Development*, 16(2), 326-342. doi:10.1111/j.1467-9507.2007.00387.x
- Koivumaa-Honkanen, H., Honkanen, R., Viinamaeki, H., Heikkilae, K., Kaprio, J., & Koskenvuo, M. (2014). Life satisfaction and suicide: a 20-year follow-up study. *American Journal of Psychiatry*.
- Koivumaa-Honkanen, H., Kaprio, J., Korhonen, T., Honkanen, R. J., Heikkilä, K., & Koskenvuo, M. (2012). Self-reported Life Satisfaction and Alcohol use: A 15-year follow-up of Healthy Adult Twins. *Alcohol and Alcoholism*, 47(2), 160-168. doi:10.1093/alcalc/agr151
- Koning, I. M., Engels, R. C. M. E., Verdurmen, J. E. E., & Vollebergh, W. A. M. (2010). Alcohol-specific socialization practices and alcohol use in Dutch early adolescents. *Journal of Adolescence*, 33(1), 93-100. doi:<http://dx.doi.org/10.1016/j.adolescence.2009.05.003>
- Krause, N. (2003). Race, Religion, and Abstinence from Alcohol in Late Life. *Journal of aging and health*, 15(3), 508-533. doi:10.1177/0898264303253505
- Kreager, D. A., Matsueda, R. L., & Erosheva, E. A. (2010). MOTHERHOOD AND CRIMINAL DESISTANCE IN DISADVANTAGED NEIGHBORHOODS*. *Criminology*, 48(1), 221-258. doi:10.1111/j.1745-9125.2010.00184.x
- Kuntsche, S., Knibbe, R. A., & Gmel, G. (2011). Parents' alcohol use: gender differences in the impact of household and family chores. *The European Journal of Public Health*, ckr145.
- Kuntsche, S., Knibbe, R. A., & Gmel, G. (2012). Parents' alcohol use: gender differences in the impact of household and family chores. *European journal of public health*, 22(6), 894. Retrieved from http://uq.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMw3V1La8MwDDZrT4Mx9n6DT9uhZDRx4ySDHcbYOuhhg7XQW7ATZSu0aQnt_58cuUkl9A_smocx-owsfdZnMSa8x77T8gk60VqIQRpK3J4kbhkYB8hEqjTqZ0KUov4G_VGX7f4r4L-MvluKlxT1v-1tSIH-U7aNq3qiUC1WGXnWWSnfJX5sjqTKUwVlf6CLLGytYZvEbwS0xABaYVPF3OAwheqNNjgIXB_1-Y6hpNErjfKZ1tXjIRRGBdYbLmwlv-UjXK9V22F1jg0SzSq1MGC2fUm2HAD5XPQJOIR1yUDPBnLgCNmfNt205zWWY9PnhtQluXVtNqaSgQlmpHtvLIFpLNk_Qy5M_nusA7mclbY-

[ZzW1UBB2Vesms3uhKMMPMZH7NAamL8Q0sdsD ITdkDG5mTsUzaxqD9wizIHGJ84lc4biPNZzhFxToj
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ei3dsu662MCdESb AQZHW68](https://doi.org/10.1007/s10995-011-0925-3)

- Laborde, N. D., & Mair, C. (2012). Alcohol use patterns among postpartum women. *Maternal and child health journal*, 16(9), 1810-1819. Retrieved from http://download.springer.com/static/pdf/656/art%253A10.1007%252Fs10995-011-0925-3.pdf?auth66=1394330629_b32675ece9928ed27f0ba99298dddc4&ext=.pdf
- LaBrie, R. A., Shaffer, H. J., LaPlante, D. A., & Wechsler, H. (2003). Correlates of college student gambling in the United States. *Journal of American College Health*, 52(2), 53-62. Retrieved from <Go to ISI>://WOS:000188364100001
<http://www.tandfonline.com/doi/pdf/10.1080/07448480309595725>
- Lanza, S. T., Tan, X., & Bray, B. C. (2013). Latent class analysis with distal outcomes: A flexible model-based approach. *Structural equation modeling: a multidisciplinary journal*, 20(1), 1-26. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4240499/pdf/nihms591510.pdf>
- Lee, J. W., Morton, K. R., Walters, J., Bellinger, D. L., Butler, T. L., Wilson, C., . . . Fraser, G. E. (2009). Cohort Profile: The biopsychosocial religion and health study (BRHS). *International Journal of Epidemiology*, 38(6), 1470-1478. doi:10.1093/ije/dyn244
- Lee, K. J., & Carlin, J. B. (2012). Recovery of information from multiple imputation: a simulation study. *Emerg Themes Epidemiol*, 9(3).
- Leelakulthanit, O., & Day, R. (1993). Cross cultural comparisons of quality of life of Thais and Americans. *Social Indicators Research*, 30(1), 49-70.
- Lewis, M. J. (1992). *A rum state: Alcohol and state policy in Australia, 1788-1988*: Australian Government Pub Service.
- Li, Q., Wilsnack, R., Wilsnack, S., & Kristjanson, A. (2010). Cohabitation, Gender, and Alcohol Consumption in 19 Countries: A Multilevel Analysis. *Substance Use & Misuse*, 45(14), 2481-2502. doi:doi:10.3109/10826081003692106
- Lisha, N. E., Martens, M., & Leventhal, A. M. (2011). Age and gender as moderators of the relationship between physical activity and alcohol use. *Addictive Behaviors*, 36(9), 933-936. doi:<http://dx.doi.org/10.1016/j.addbeh.2011.04.003>
- Little, R., & Rubin, D. (1987a). *Multiple Imputation for Nonresponse in Surveys*: New York: John Wiley & Sons.
- Little, R. J. A., & Rubin, D. B. (1987b). *Statistical Analysis with Missing Data* (Vol. null).

- Liu, W., Mumford, E., & Petras, H. (2014). Maternal Patterns of Postpartum Alcohol Consumption by Age: A Longitudinal Analysis of Adult Urban Mothers. *Prevention Science*, 1-11. doi:10.1007/s11121-014-0522-y
- Livingston, M., & Callinan, S. (2015). Underreporting in alcohol surveys: whose drinking is underestimated? *Journal of Studies on Alcohol and Drugs*, 76(1), 158-164.
- Lonardo, R. A., Manning, W. D., Giordano, P. C., & Longmore, M. A. (2010). Offending, Substance Use, and Cohabitation in Young Adulthood. *Sociological Forum*, 25(4), 787-803. doi:10.1111/j.1573-7861.2010.01212.x
- Lorains, F. K., Cowlshaw, S., & Thomas, S. A. (2011). Prevalence of comorbid disorders in problem and pathological gambling: systematic review and meta-analysis of population surveys. *Addiction*, 106(3), 490-498. Retrieved from <http://onlinelibrary.wiley.com/store/10.1111/j.1360-0443.2010.03300.x/asset/j.1360-0443.2010.03300.x.pdf?v=1&t=idpcab0h&s=0d596b68046bc40771628f5d52f90594e360a103>
- Lyons, A. C., & Willott, S. A. (2008). Alcohol consumption, gender identities and women's changing social positions. *Sex Roles*, 59(9), 694-712.
- Lytton, H., & Romney, D. M. (1991). Parents' differential socialization of boys and girls: A meta-analysis. *Psychological Bulletin*, 109(2), 267-296. doi:10.1037/0033-2909.109.2.267
- Macdonald, S. (1994). Whisky, women and the Scottish drink problem. A view from the Highlands'. *Gender, Drink and Drugs, Oxford, Berg*, 125-144.
- Maggs, J. L., & Schulenberg, J. E. (2004). Trajectories of alcohol use during the transition to adulthood. *Alcohol Research and Health*, 28(4), 195.
- Magoon, M. E., Gupta, R., & Derevensky, J. (2005). Juvenile delinquency and adolescent gambling Implications for the Juvenile Justice System. *Criminal Justice and Behavior*, 32(6), 690-713.
- Maloney, E., Hutchinson, D., Burns, L., Mattick, R. P., & Black, E. (2011). Prevalence and Predictors of Alcohol Use in Pregnancy and Breastfeeding Among Australian Women. *Birth*, 38(1), 3-9. doi:10.1111/j.1523-536X.2010.00445.x
- Mares, S. H. W., van der Vorst, H., Engels, R. C. M. E., & Lichtwarck-Aschoff, A. (2011). Parental alcohol use, alcohol-related problems, and alcohol-specific attitudes, alcohol-specific communication, and adolescent excessive alcohol use and alcohol-related problems: An indirect path model. *Addictive Behaviors*, 36(3), 209-216. doi:<http://dx.doi.org/10.1016/j.addbeh.2010.10.013>
- Marmorstein, N. (2008). Longitudinal associations between depression and alcohol use-related problems: The effect of comorbid delinquency. *Alcoholism-Clinical and Experimental Research*, 32(6), 236A-236A. Retrieved from <Go to ISI>://WOS:000256497200904
- Marsden, J., Boys, A., Farrell, M., Stillwell, G., Hutchings, K., Hillebrand, J., & Griffiths, P. (2005). Personal and social correlates of alcohol consumption among mid-adolescents. *British Journal of Developmental Psychology*, 23(3), 427-450. doi:10.1348/026151005X26020

- Martinez, P., Lien, L., Landheim, A., Kowal, P., & Clausen, T. (2014). Quality of life and social engagement of alcohol abstainers and users among older adults in South Africa. *BMC Public Health*, *14*(1), 316. Retrieved from <http://www.biomedcentral.com/1471-2458/14/316>
- <http://www.biomedcentral.com/content/pdf/1471-2458-14-316.pdf>
- Martinez, P., Røislien, J., Naidoo, N., & Clausen, T. (2011). Alcohol abstinence and drinking among African women: data from the World Health Surveys. *BMC Public Health*, *11*, 160. doi:10.1186/1471-2458-11-160
- Mason, C. H., & Perreault Jr, W. D. (1991). Collinearity, power, and interpretation of multiple regression analysis. *Journal of Marketing Research*, 268-280.
- Mathers, M., Toumbourou, J. W., Catalano, R. F., Williams, J., & Patton, G. C. (2006). Consequences of youth tobacco use: a review of prospective behavioural studies. *Addiction*, *101*(7), 948-958. doi:10.1111/j.1360-0443.2006.01438.x
- McDonald, M. (1994). Drinking and social identity in the west of France. *Gender, Drink and Drugs*, 99-124.
- McNair, A. (1993). *National Campaign Against Drug Abuse Social Issues Survey, 1993*: Social Science Data Archives, Australian National University.
- Melotti, R., Lewis, G., Hickman, M., Heron, J., Araya, R., & Macleod, J. (2013). Early life socio-economic position and later alcohol use: birth cohort study. *Addiction*, *108*(3), 516-525. doi:10.1111/add.12018
- Menary, K. R., Kushner, M. G., Maurer, E., & Thuras, P. (2011). The prevalence and clinical implications of self-medication among individuals with anxiety disorders. *Journal of Anxiety Disorders*, *25*(3), 335-339. doi:10.1016/j.janxdis.2010.10.006
- Meschke, L. L., Hellerstedt, W., Holl, J. A., & Messelt, S. (2008). Correlates of prenatal alcohol use. *Maternal and child health journal*, *12*(4), 442-451. Retrieved from http://download.springer.com/static/pdf/752/art%253A10.1007%252Fs10995-007-0261-9.pdf?auth66=1398488096_687c3e239ab1840133c7a6335c636209&ext=.pdf
- Mewton, L., Teesson, M., Slade, T., & Grove, R. (2011). *The Epidemiology of DSM-IV Alcohol Use Disorders amongst Young Adults in the Australian Population* (Vol. 46).
- Meyer-Leu, Y., Lemola, S., Daepfen, J.-B., Deriaz, O., & Gerber, S. (2011). Association of Moderate Alcohol Use and Binge Drinking During Pregnancy with Neonatal Health. *Alcoholism: Clinical and Experimental Research*, *35*(9), 1669-1677. doi:10.1111/j.1530-0277.2011.01513.x
- Ministry of Health. (2007). *Alcohol Use in New Zealand: Analysis of the 2004 New Zealand Health Behaviours Survey – Alcohol Use*. Retrieved from Wellington:
- Mishra, G. D., Cooper, R., & Kuh, D. (2010). A life course approach to reproductive health: Theory and methods. *Maturitas*, *65*(2), 92-97. doi:10.1016/j.maturitas.2009.12.009

- Molander, R. C., Yonker, J. A., & Krahn, D. D. (2010). Age-Related Changes in Drinking Patterns From Mid- to Older Age: Results From the Wisconsin Longitudinal Study. *Alcoholism: Clinical and Experimental Research, 34*(7), 1182-1192. doi:10.1111/j.1530-0277.2010.01195.x
- Montgomery, D. C. (2008). *Design and analysis of experiments*: John Wiley & Sons.
- Moore, A. A., Gould, R., Reuben, D. B., Greendale, G. A., Carter, M. K., Zhou, K., & Karlamangla, A. (2005). Longitudinal Patterns and Predictors of Alcohol Consumption in the United States. *American Journal of Public Health, 95*(3), 458-464. doi:10.2105/ajph.2003.019471
- Morris, E. P., Stewart, S. H., & Ham, L. S. (2005). The relationship between social anxiety disorder and alcohol use disorders: A critical review. *Clinical Psychology Review, 25*(6), 734-760. doi:10.1016/j.cpr.2005.05.004
- Murphy, J. (2000). *Imagining the fifties: private sentiment and political culture in Menzies*: UNSW Press, Sydney.
- Murphy, J. G., McDevitt-Murphy, M. E., & Barnett, N. P. (2005). Drink and Be Merry? Gender, Life Satisfaction, and Alcohol Consumption Among College Students. *Psychology of Addictive Behaviors, 19*(2), 184-191. doi:10.1037/0893-164X.19.2.184
- Musick, M. A., Blazer, D. G., & Hays, J. C. (2000). Religious Activity, Alcohol Use, and Depression in a Sample of Elderly Baptists. *Research on Aging, 22*(2), 91-116. doi:10.1177/0164027500222001
- Muthén, B., & Asparouhov, T. (2002). Latent variable analysis with categorical outcomes: Multiple-group and growth modeling in Mplus. *Mplus web notes, 4*(5), 1-22.
- Muthén, B., & Muthén, L. K. (2000). Integrating person-centered and variable-centered analyses: Growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical and Experimental Research, 24*(6), 882-891. Retrieved from <http://onlinelibrary.wiley.com/store/10.1111/j.1530-0277.2000.tb02070.x/asset/j.1530-0277.2000.tb02070.x.pdf?v=1&t=if7qwdec&s=58ef5e46fe3f750ae2cca9942bd662aa46a73e93>
- Muthén, L. K., & Muthén, B. O. (2012). Mplus. *The comprehensive modelling program for applied researchers: User's guide, 5*.
- Nagin, D. S. (2005). *Group-Based Modeling of Development*.
- Nagin, D. S., & Odgers, C. L. (2010a). Group-based trajectory modeling (nearly) two decades later. *Journal of quantitative criminology, 26*(4), 445-453. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2994902/pdf/10940_2010_Article_9113.pdf
- Nagin, D. S., & Odgers, C. L. (2010b). Group-Based Trajectory Modeling in Clinical Research. *Annual Review of Clinical Psychology, 6*(1), 109-138. doi:doi:10.1146/annurev.clinpsy.121208.131413
- Nagin, D. S., & Tremblay, R. E. (2005). What Has Been Learned from Group-Based Trajectory Modeling? Examples from Physical Aggression and Other Problem Behaviors. *The ANNALS of the American Academy of Political and Social Science, 602*(1), 82-117. doi:10.1177/0002716205280565

- Naimi, T. S., Lipscomb, L. E., Brewer, R. D., & Gilbert, B. C. (2003). Binge Drinking in the Preconception Period and the Risk of Unintended Pregnancy: Implications for Women and Their Children. *Pediatrics*, *111*(Supplement 1), 1136-1141. Retrieved from http://pediatrics.aappublications.org/content/111/Supplement_1/1136.abstract
- Najman, J., Bor, W., O'Callaghan, M., Williams, G., Aird, R., & Shuttlewood, G. (2005). Cohort Profile: The Mater-University of Queensland Study of Pregnancy (MUSP). *International Journal of Epidemiology*, *34*(5), 992-997. doi:10.1093/ije/dyi119
- Najman, J. M., Aird, R., Bor, W., O'Callaghan, M., Williams, G. M., & Shuttlewood, G. J. (2004). The generational transmission of socioeconomic inequalities in child cognitive development and emotional health. *Social science & medicine*, *58*(6), 1147-1158. doi:[http://dx.doi.org/10.1016/S0277-9536\(03\)00286-7](http://dx.doi.org/10.1016/S0277-9536(03)00286-7)
- Najman, J. M., Alati, R., Bor, W., Clavarino, A., Mamun, A., McGrath, J. J., . . . Wray, N. (2014). Cohort Profile Update: The Mater-University of Queensland Study of Pregnancy (MUSP). *International Journal of Epidemiology*. doi:10.1093/ije/dyu234
- Najman, J. M., Andersen, M. J., Bor, W., O'Callaghan, M. J., & Williams, G. M. (2000). Postnatal depression – myth and reality: maternal depression before and after the birth of a child. *Social Psychiatry and Psychiatric Epidemiology*, *35*(1), 19-27. doi:10.1007/s001270050004
- Najman, J. M., & Levine, S. (1981). Evaluating the impact of medical care and technologies on the quality of life: A review and critique. *Social Science & Medicine. Part F: Medical and Social Ethics*, *15*(2-3), 107-115. doi:[http://dx.doi.org/10.1016/0271-5392\(81\)90012-5](http://dx.doi.org/10.1016/0271-5392(81)90012-5)
- Nehlin, C., Grönbladh, L., Fredriksson, A., & Jansson, L. (2013). Alcohol and drug use, smoking, and gambling among psychiatric outpatients: a 1-year prevalence study. *Substance Abuse*, *34*(2), 162-168. Retrieved from <http://www.tandfonline.com/doi/pdf/10.1080/08897077.2012.728991>
- Neighbors, C., Lee, C. M., Lewis, M. A., Fossos, N., & Larimer, M. E. (2007). Are social norms the best predictor of outcomes among heavy-drinking college students? *Journal of Studies on Alcohol and Drugs*, *68*(4), 556.
- Neve, R. J. M., Diederiks, J. P. M., Knibbe, R. A., & Drop, M. J. (1993). Developments in drinking behavior in the Netherlands from 1958 to 1989, a cohort analysis. *Addiction*, *88*(5), 611-621. doi:10.1111/j.1360-0443.1993.tb02073.x
- Neve, R. J. M., Drop, M. J., Lemmens, P. H., & Swinkels, H. (1996). Gender differences in drinking behaviour in the Netherlands: convergence or stability? *Addiction*, *91*(3), 357-373. doi:10.1046/j.1360-0443.1996.9133576.x
- Neve, R. J. M., Lemmens, P. H., & Drop, M. J. (2000). Changes in alcohol use and drinking problems in relation to role transitions in different stages of the life course. *Substance Abuse*, *21*(3), 163-178. doi:10.1080/08897070009511430

- NHMRC. (2009). *Australian guidelines to reduce health risks from drinking alcohol*: National Health and Medical Research Council.
- Noguchi, Y., Ueda, K., Fukumoto, K., Harada, K., Ueda, A., & Wei, C.-N. (2015). Relationship between Perceived Health Status and Health Practices in the General Adult Population in Japan. *Open Journal of Preventive Medicine*, 5(06), 280.
- Nykjaer, C., Alwan, N. A., Greenwood, D. C., Simpson, N. A. B., Hay, A. W. M., White, K. L. M., & Cade, J. E. (2013). Maternal alcohol intake up to and during pregnancy and risk of adverse birth outcomes: evidence from a British cohort. *The Lancet*, 382, Supplement 3(0), S79.
doi:[http://dx.doi.org/10.1016/S0140-6736\(13\)62504-0](http://dx.doi.org/10.1016/S0140-6736(13)62504-0)
- Orford, J., Wardle, H., & Griffiths, M. (2012). What proportion of gambling is problem gambling? Estimates from the 2010 British Gambling Prevalence Survey. *International Gambling Studies*, 13(1), 4-18.
doi:10.1080/14459795.2012.689001
- Orlando, M., Tucker, J. S., Ellickson, P. L., & Klein, D. J. (2005). Concurrent Use of Alcohol and Cigarettes from Adolescence to Young Adulthood: An Examination of Developmental Trajectories and Outcomes. *Substance Use & Misuse*, 40(8), 1051-1069. doi:10.1081/JA-200030789
- Osterman, R. L. (2011). Decreasing Women's Alcohol Use During Pregnancy. *Alcoholism Treatment Quarterly*, 29(4), 436-452. doi:10.1080/07347324.2011.608589
- Page, R., Ellison, C., & Lee, J. (2009). Does Religiosity Affect Health Risk Behaviors in Pregnant and Postpartum Women? *Maternal and child health journal*, 13(5), 621-632. doi:10.1007/s10995-008-0394-5
- Paradis, C. (2011). Parenthood, drinking locations and heavy drinking. *Social science & medicine*, 72(8), 1258-1265.
- Pedersen, W. (2007). Childbirth, abortion and subsequent substance use in young women: a population-based longitudinal study. *Addiction*, 102(12), 1971-1978. doi:10.1111/j.1360-0443.2007.02040.x
- Perkin, M. R., Bland, J. M., Peacock, J. L., & Anderson, H. R. (1993). The effect of anxiety and depression during pregnancy on obstetric complications. *BJOG: An International Journal of Obstetrics & Gynaecology*, 100(7), 629-634. doi:10.1111/j.1471-0528.1993.tb14228.x
- Perreira, K. M., & Sloan, F. A. (2001). Life events and alcohol consumption among mature adults: A longitudinal analysis. *Journal of Studies on Alcohol*, 62(4), 501-508. Retrieved from [http://www.jsad.com/jsad/downloadarticle/Life Events and Alcohol Consumption among Mature Adults A Longitudinal Ana/1489.pdf](http://www.jsad.com/jsad/downloadarticle/Life_Events_and_Alcohol_Consumption_among_Mature_Adults_A_Longitudinal_Analysis/1489.pdf)
- Peters, B., & Stringham, E. (2006). No booze? You may lose: Why drinkers earn more money than nondrinkers. *Journal of Labor Research*, 27(3), 411-421. doi:10.1007/s12122-006-1031-y
- Petras, H., & Masyn, K. (2010). General Growth Mixture Analysis with Antecedents and Consequences of Change. In A. R. Piquero & D. Weisburd (Eds.), *Handbook of Quantitative Criminology* (pp. 69-100): Springer New York.

- Petts, R. J. (2009). Family and Religious Characteristics' Influence on Delinquency Trajectories from Adolescence to Young Adulthood. *American Sociological Review*, 74(3), 465-483.
doi:10.1177/000312240907400307
- Pevalin, D., Wade, T., Brannigan, A., & Sauve, R. (2001). Beyond biology: The social context of prenatal behaviour and birth outcomes. *Sozial- und Praventivmedizin*, 46(4), 233-239.
doi:10.1007/BF01593178
- Piquero, A. R. (2008). Taking stock of developmental trajectories of criminal activity over the life course *The long view of crime: A synthesis of longitudinal research* (pp. 23-78): Springer.
- Piquero, A. R., Farrington, D. P., Nagin, D. S., & Moffitt, T. E. (2010). Trajectories of offending and their relation to life failure in late middle age: Findings from the Cambridge Study in Delinquent Development. *Journal of Research in Crime and Delinquency*, 47(2), 151-173.
- Pitpitan, E. V., Kalichman, S. C., Eaton, L. A., Sikkema, K. J., Watt, M. H., & Skinner, D. (2012). Gender-based violence and HIV sexual risk behavior: Alcohol use and mental health problems as mediators among women in drinking venues, Cape Town. *Social science & medicine*, 75(8), 1417-1425.
doi:<http://dx.doi.org/10.1016/j.socscimed.2012.06.020>
- Plant, M., Miller, P., Plant, M., Kuntsche, S., Gmel, G., Ahlström, w. S., . . . Vidal, A. (2008). Marriage, cohabitation and alcohol consumption in young adults: an international exploration. *Journal of Substance Use*, 13(2), 83-98. doi:doi:10.1080/14659890701820028
- Plant, M. L. (2008). The role of alcohol in women's lives: a review of issues and responses. *Journal of Substance Use*, 13(3), 155-191. doi:doi:10.1080/14659890802040880
- Platt, A., Sloan, F. A., & Costanzo, P. (2010). Alcohol-consumption trajectories and associated characteristics among adults older than age 50. *Journal of Studies on Alcohol and Drugs*, 71(2), 169. Retrieved from
<http://uq.summon.serialssolutions.com/link/0/eLvHCXMwY2BQMEsyMrNMMjS3SEkC1udJZgZpZm nAWjl50cAi0TwtORFlrAOpNHcTZQh1cw1x9tCF3gOgm24I2j1iDux1J6WkpppZJCanGZuYpRpZJqdYGC Yngk93MzJPMbe0SASWqiamKSnJKYapSUKmBiagk80MTVKTE01MDcUYWIB96VQ-RocF26t - FycYaL3e63RSU0Ax0IttQ>
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2841726/pdf/jsad169.pdf>
- Pocock, B. (2003). *The Work/Life Collision: What work is doing to Australians and what to do about it:* Federation Press.
- Poelen, E. A. P., Scholte, R. H. J., Willemsen, G., Boomsma, D. I., & Engels, R. C. M. E. (2007). Drinking by parents, siblings, and friends as predictors of regular alcohol use in adolescents and young adults: a longitudinal twin-family study. *Alcohol and Alcoholism*, 42(4), 362-369. doi:10.1093/alcalc/agm042
- Pohorecky, L. A. (1991). Stress and Alcohol Interaction: An Update of Human Research. *Alcoholism: Clinical and Experimental Research*, 15(3), 438-459. doi:10.1111/j.1530-0277.1991.tb00543.x
- Powell, K. (1988). Alcohol and the eastern colonies 1788-1901. *Drug and Alcohol Review*, 7(4), 403-411.

- Powers, J. R., & Young, A. F. (2008). Longitudinal analysis of alcohol consumption and health of middle-aged women in Australia. *Addiction*, *103*(3), 424-432. doi:10.1111/j.1360-0443.2007.02101.x
- Prager, S. W., Steinauer, J. E., Foster, D. G., Darney, P. D., & Drey, E. A. (2007). Risk factors for repeat elective abortion. *American Journal of Obstetrics and Gynecology*, *197*(6), 575.e571-575.e576. doi:<http://dx.doi.org/10.1016/j.ajog.2007.04.007>
- Purcell, N. (1994). Women and wine in ancient Rome. *Gender, Drink and Drugs*, 191-208.
- Pyne, H. H., Claeson, M., & Correia, M. (2002). *Gender dimensions of alcohol consumption and alcohol-related problems in Latin America and the Caribbean*: World Bank Publications.
- Reardon, D. C., Coleman, P. K., & Cogle, J. R. (2004). Substance Use Associated with Unintended Pregnancy Outcomes in the National Longitudinal Survey of Youth. *The American journal of drug and alcohol abuse*, *30*(2), 369-383. doi:10.1081/ADA-120037383
- Rehm, J., Baliunas, D., Borges, G. L. G., Graham, K., Irving, H., Kehoe, T., . . . Taylor, B. (2010). The relation between different dimensions of alcohol consumption and burden of disease: an overview. *Addiction*, *105*(5), 817-843. doi:10.1111/j.1360-0443.2010.02899.x
- Rehm, J., & Gmel, G. (1999). Patterns of alcohol consumption and social consequences. Results from an 8-year follow-up study in Switzerland. *Addiction*, *94*(6), 899-912. doi:10.1046/j.1360-0443.1999.94689912.x
- Roberts, S. C. M., Delucchi, K., Wilsnack, S. C., & Foster, D. G. (2015). Receiving Versus Being Denied a Pregnancy Termination and Subsequent Alcohol Use: A Longitudinal Study. *Alcohol and Alcoholism*. Retrieved from <http://alcalc.oxfordjournals.org/content/early/2015/03/17/alcalc.agv021.abstract>
- Robinson, J., Sareen, J., Cox, B. J., & Bolton, J. M. (2011). Role of self-medication in the development of comorbid anxiety and substance use disorders: A longitudinal investigation. *Archives of General Psychiatry*, *68*(8), 800-807. doi:10.1001/archgenpsychiatry.2011.75
- Robinson, J. A., Sareen, J., Cox, B. J., & Bolton, J. M. (2009). Correlates of Self-Medication for Anxiety Disorders: Results From the National Epidemiologic Survey on Alcohol and Related Conditions. *The Journal of nervous and mental disease*, *iii-x*(12), 873-878
810.1097/NMD.1090b1013e3181c1299c1092. Retrieved from http://journals.lww.com/ionmd/Fulltext/2009/12000/Correlates_of_Self_Medication_for_Anxiety.1.aspx
- Roche, A., Bywood, P., Borlagdan, J., Lunnay, B., Freeman, T., Lawton, L., . . . Nicholas, R. (2007). Young people and alcohol: the role of cultural influences. *Adelaide: National Centre for Education and Training on Addiction*.
- Roche, A. M., & Deehan, A. (2002). Women's alcohol consumption: emerging patterns, problems and public health implications. *Drug and Alcohol Review*, *21*(2), 169-178.

- Rodriguez, L. M., Neighbors, C., & Knee, C. R. (2014). Problematic alcohol use and marital distress: An interdependence theory perspective. *Addiction Research & Theory*, 22(4), 294-312.
doi:doi:10.3109/16066359.2013.841890
- Room, R. (1988). The dialectic of drinking in Australian life: from the Rum Corps to the wine column. *Australian Drug and Alcohol Review*, 7(4), 413-437.
- Room, R., & Makela, K. (2000). Typologies of the cultural position of drinking. *Journal of Studies on Alcohol*, 61(3), 475-483. Retrieved from
http://www.jsad.com/jsad/article/Typologies_of_the_Cultural_Position_of_Drinking/775.html
- Rossow, I., Felix, L., Keating, P., & McCambridge, J. (2015). Parental drinking and adverse outcomes in children: A scoping review of cohort studies. *Drug and Alcohol Review*, n/a-n/a.
doi:10.1111/dar.12319
- Royston, P. (2005). Multiple imputation of missing values: update. *Stata Journal*, 5(2), 188.
- Ryan, S. M., Jorm, A. F., & Lubman, D. I. (2010). Parenting Factors Associated with Reduced Adolescent Alcohol Use: A Systematic Review of Longitudinal Studies. *Australian and New Zealand Journal of Psychiatry*, 44(9), 774-783. doi:10.1080/00048674.2010.501759
- Sacco, P., Bucholz, K. K., & Harrington, D. (2014). Gender Differences in Stressful Life Events, Social Support, Perceived Stress, and Alcohol Use Among Older Adults: Results From a National Survey. *Substance Use & Misuse*, 49(4), 456-465. doi:doi:10.3109/10826084.2013.846379
- Sandra, J. C., & Christopher, M. A. (2014). The role of family, friends and peers in Australian adolescent's alcohol consumption. *Drug and Alcohol Review*, 33(3), 304-313. doi:10.1111/dar.12111
- Sartor, C. E., Lynskey, M. T., Heath, A. C., Jacob, T., & True, W. (2007). The role of childhood risk factors in initiation of alcohol use and progression to alcohol dependence. *Addiction*, 102(2), 216-225.
doi:10.1111/j.1360-0443.2006.01661.x
- Saunders, P. (1996). Poverty and deprivation in Australia. *Year Book Australia 1996*.
- Schmidt, L. A. (2014). The equal right to drink. *Drug and Alcohol Review*, 33(6), 581-587.
doi:10.1111/dar.12215
- Schoenborn, C. A. (1986). Health habits of US adults, 1985: the "Alameda 7" revisited. *Public Health Reports*, 101(6), 571.
- Scholes-Balog, K. E., Hemphill, S. A., Dowling, N. A., & Toumbourou, J. W. (2014). A prospective study of adolescent risk and protective factors for problem gambling among young adults. *Journal of Adolescence*, 37(2), 215-224. doi:<http://dx.doi.org/10.1016/j.adolescence.2013.12.006>
- Scott, K. M., Wells, J. E., Angermeyer, M., Brugha, T. S., Bromet, E., Demyttenaere, K., . . . Jin, R. (2010). Gender and the relationship between marital status and first onset of mood, anxiety and substance use disorders. *Psychological Medicine*, 40(09), 1495-1505.

- Sessa, F. M. (2005). The Influence of Perceived Parenting on Substance Use during the Transition to College: A Comparison of Male Residential and Commuter Students. *Journal of College Student Development, 46*(1), 13.
- Shaw, B. A., Krause, N., Liang, J., & McGeever, K. (2011). Age Differences in Long-Term Patterns of Change in Alcohol Consumption Among Aging Adults. *Journal of aging and health, 23*(2), 207-227. doi:10.1177/0898264310381276
- Shed, N. W., Derevensky, J. L., & Gupta, R. (2010). Risk and protective factors associated with youth problem gambling. *International Journal of Adolescent Medicine and Health, 22*(1), 39.
- Shek, D. T., & Leung, H. (2013). Positive youth development, life satisfaction, and problem behaviors of adolescents in intact and non-intact families in Hong Kong. *Frontiers in pediatrics, 1*.
- Sheridan, T., & Stretton, P. (2004). Mandarins, ministers and the bar on married women. *The Journal of Industrial Relations, 46*(1), 84-101.
- Skagerstrom, J., Chang, G., & Nilsen, P. (2011). Predictors of drinking during pregnancy: a systematic review. *J Womens Health (Larchmt), 20*(6), 901-913. doi:10.1089/jwh.2010.2216
- Smock, P. J., & Manning, W. D. (2004). Living together unmarried in the United States: Demographic perspectives and implications for family policy. *Law & Policy, 26*(1), 87-117.
- Sobell, L., & Sobell, M. (1992). Timeline Follow-Back. In R. Litten & J. Allen (Eds.), *Measuring Alcohol Consumption* (pp. 41-72): Humana Press.
- Sproston, K., Hing, N., & Palankay, C. (2012). Prevalence of gambling and problem gambling in New South Wales. *Sydney: NSW Office of Liquor, Gaming and Racing*.
- Staff, J., Greene, K. M., Maggs, J. L., & Schoon, I. (2014). Family transitions and changes in drinking from adolescence through mid-life. *Addiction, 109*(2), 227-236. doi:10.1111/add.12394
- Staff, J., Schulenberg, J. E., Maslowsky, J., Bachman, J. G., O'Malley, P. M., Maggs, J. L., & Johnston, L. D. (2010). Substance use changes and social role transitions: Proximal developmental effects on ongoing trajectories from late adolescence through early adulthood. *Development and Psychopathology, 22*(04), 917-932.
- Stall, R. (1987). Research issues concerning alcohol consumption among aging populations. *Drug and Alcohol Dependence, 19*(3), 195-213. doi:[http://dx.doi.org/10.1016/0376-8716\(87\)90040-8](http://dx.doi.org/10.1016/0376-8716(87)90040-8)
- Steinberg, J. R., & Finer, L. B. (2011). Examining the association of abortion history and current mental health: A reanalysis of the National Comorbidity Survey using a common-risk-factors model. *Social science & medicine, 72*(1), 72-82. doi:<http://dx.doi.org/10.1016/j.socscimed.2010.10.006>
- Sterne, J. A., White, I. R., Carlin, J. B., Spratt, M., Royston, P., Kenward, M. G., . . . Carpenter, J. R. (2009). Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. 338. doi:10.1136/bmj.b2393
- Stewart, M. (1992). 8 'I can't drink beer, I've just drunk water'. *Alcohol, gender and culture, 137*.

- Stockwell, T., Donath, S., Cooper-Stanbury, M., Chikritzhs, T., Catalano, P., & Mateo, C. (2004). Under-reporting of alcohol consumption in household surveys: a comparison of quantity–frequency, graduated–frequency and recent recall. *Addiction*, *99*(8), 1024-1033. doi:10.1111/j.1360-0443.2004.00815.x
- Strachan, G. (2010). Still Working for the Man?: Women's Employment Experiences in Australia since 1950.
- Stranges, S., Notaro, J., Freudenheim, J. L., Calogero, R. M., Muti, P., Farinero, E., . . . Trevisan, M. (2006). Alcohol drinking pattern and subjective health in a population-based study. *Addiction*, *101*(9), 1265-1276. doi:10.1111/j.1360-0443.2006.01517.x
- Strine, T. W., Chapman, D. P., Balluz, L. S., Moriarty, D. G., & Mokdad, A. H. (2008). The associations between life satisfaction and health-related quality of life, chronic illness, and health behaviors among US community-dwelling adults. *Journal of Community Health*, *33*(1), 40-50. Retrieved from http://download.springer.com/static/pdf/981/art%253A10.1007%252Fs10900-007-9066-4.pdf?auth66=1426041985_26ca0d3eab4a1f13c6a6bff0cc60066d&ext=.pdf
- Summers, A. (1994). *Damned whores and God's police*: Penguin Books.
- Swain, N. R., Gibb, S. J., Horwood, L. J., & Fergusson, D. M. (2012). Alcohol and cannabis abuse/dependence symptoms and life satisfaction in young adulthood. *Drug and Alcohol Review*, *31*(3), 327-333. doi:10.1111/j.1465-3362.2011.00339.x
- Sydén, L., Wennberg, P., Forsell, Y., & Romelsjö, A. (2014). Stability and change in alcohol habits of different socio-demographic subgroups-a cohort study. *BMC Public Health*, *14*(1), 525.
- Tamaki, T., Kaneita, Y., Ohida, T., Harano, S., Yokoyama, E., Osaki, Y., . . . Hayashi, K. (2008). Alcohol consumption behavior of pregnant women in Japan. *Preventive Medicine*, *47*(5), 544-549. doi:10.1016/j.ypmed.2008.07.013
- Tamers, S. L., Okechukwu, C., Bohl, A. A., Guéguen, A., Goldberg, M., & Zins, M. (2014). The Impact of Stressful Life Events on Excessive Alcohol Consumption in the French Population: Findings from the GAZEL Cohort Study. *PloS one*, *9*(1), e87653.
- Taylor, R. J., & Chatters, L. M. (1986). Church-based informal support among elderly blacks. *The Gerontologist*, *26*(6), 637-642. Retrieved from <http://gerontologist.oxfordjournals.org/content/26/6/637.full.pdf>
- Teesson, M., Hall, W., Lynskey, M., & Degenhardt, L. (2000). Alcohol-and drug-use disorders in Australia: Implications of the National Survey of Mental Health and Wellbeing. *Australian and New Zealand Journal of Psychiatry*, *34*(2), 206-213. Retrieved from <http://anp.sagepub.com/content/34/2/206.full.pdf>
- The Social Research Centre. (2013). *Gambling Prevalence in South Australia (2012)*. Retrieved from http://www.problemgambling.sa.gov.au/professionals/news_and_events/news-items/release-of-the-2012-gambling-prevalence-study-in-south-australia/?a=13625.

- Thundal, K.-L., Spak, F., & Allebeck, P. (2000). Drinking patterns among Swedish women: results from a 5-year follow-up of a population-based study. *Alcohol and Alcoholism*, 35(5), 520-524. Retrieved from <http://alcalc.oxfordjournals.org/content/alcalc/35/5/520.full.pdf>
- Torvik, F. A., Røysamb, E., Gustavson, K., Idstad, M., & Tambs, K. (2013). Discordant and Concordant Alcohol Use in Spouses as Predictors of Marital Dissolution in the General Population: Results from the Hunt Study. *Alcoholism: Clinical and Experimental Research*, 37(5), 877-884. doi:10.1111/acer.12029
- Toumbourou, J. W., Hemphill, S. A., McMorris, B. J., Catalano, R. F., & Patton, G. C. (2009). Alcohol use and related harms in school students in the USA and Australia. *Health Promotion International*, 24(4), 373-382. doi:10.1093/heapro/dap037
- Tran, N. T., Najman, J. M., & Hayatbakhsh, R. (2014). Predictors of maternal drinking trajectories before and after pregnancy: evidence from a longitudinal study. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, n/a-n/a. doi:10.1111/ajo.12294
- Tran, N. T., Williams, G. M., Alati, R., & Najman, J. M. (2015). Trajectories and predictors of alcohol consumption over 21 years of mothers' reproductive life course. *SSM - Population Health*, 1, 40-47. doi:<http://dx.doi.org/10.1016/j.ssmph.2015.11.002>
- Turner, B. S. (1977). The Structuralist Critique of Weber's Sociology. *The British Journal of Sociology*, 28(1), 1-16. doi:10.2307/589705
- Twisk, J., & de Vente, W. (2002). Attrition in longitudinal studies: How to deal with missing data. *Journal of Clinical Epidemiology*, 55(4), 329-337. doi:[http://dx.doi.org/10.1016/S0895-4356\(01\)00476-0](http://dx.doi.org/10.1016/S0895-4356(01)00476-0)
- Valencia-Martín, J. L., Galán, I., Guallar-Castillón, P., & Rodríguez-Artalejo, F. (2013). Alcohol drinking patterns and health-related quality of life reported in the Spanish adult population. *Preventive Medicine*, 57(5), 703-707. doi:<http://dx.doi.org/10.1016/j.ypmed.2013.09.007>
- Van Der Vorst, H., Engels, R. C. M. E., Meeus, W., & Deković, M. (2006). The impact of alcohol-specific rules, parental norms about early drinking and parental alcohol use on adolescents' drinking behavior. *Journal of Child Psychology and Psychiatry*, 47(12), 1299-1306. doi:10.1111/j.1469-7610.2006.01680.x
- Van Der Vorst, H., Vermulst, A. A., Meeus, W. H. J., Deković, M., & Engels, R. C. M. E. (2009). Identification and Prediction of Drinking Trajectories in Early and Mid-Adolescence. *Journal of Clinical Child and Adolescent Psychology*, 38(3), 329-341. doi:10.1080/15374410902851648
- Van Zundert, R. M., Van Der Vorst, H., Vermulst, A. A., & Engels, R. C. (2006). Pathways to alcohol use among Dutch students in regular education and education for adolescents with behavioral problems: the role of parental alcohol use, general parenting practices, and alcohol-specific parenting practices. *Journal of Family Psychology*, 20(3), 456. Retrieved from <http://psycnet.apa.org/journals/fam/20/3/456.pdf>

- Varvil-Weld, L., Mallett, K. A., Turrisi, R., & Abar, C. C. (2012). Using Parental Profiles to Predict Membership in a Subset of College Students Experiencing Excessive Alcohol Consequences: Findings From a Longitudinal Study. *Journal of Studies on Alcohol and Drugs*, 73(3), 434.
- Veenstra, M. Y., Lemmens, P. H., Friesema, I. H., Garretsen, H. F., Knottnerus, J. A., & Zwietering, P. J. (2006). A literature overview of the relationship between life-events and alcohol use in the general population. *Alcohol and Alcoholism*, 41(4), 455-463. Retrieved from <http://alcalc.oxfordjournals.org/content/41/4/455.full.pdf>
- Vitaro, F., Brendgen, M., Ladouceur, R., & Tremblay, R. (2001). Gambling, Delinquency, and Drug Use During Adolescence: Mutual Influences and Common Risk Factors. *Journal of Gambling Studies*, 17(3), 171-190. doi:10.1023/A:1012201221601
- Volberg, R. A., Gupta, R., Griffiths, M. D., Ólason, D. T., & Delfabbro, P. (2010). An international perspective on youth gambling prevalence studies. *International Journal of Adolescent Medicine and Health*, 22(1), 3-38.
- Wagenaar, A. C., Salois, M. J., & Komro, K. A. (2009). Effects of beverage alcohol price and tax levels on drinking: a meta-analysis of 1003 estimates from 112 studies. *Addiction*, 104(2), 179-190. doi:10.1111/j.1360-0443.2008.02438.x
- Waldron, M., Heath, A. C., Lynskey, M. T., Bucholz, K. K., Madden, P. A. F., & Martin, N. G. (2011). Alcoholic Marriage: Later Start, Sooner End. *Alcoholism: Clinical and Experimental Research*, 35(4), 632-642. doi:10.1111/j.1530-0277.2010.01381.x
- Walker, D. M., Clark, C., & Folk, J. L. (2012). The relationship between gambling behavior and binge drinking, hard drug use, and paying for sex. *UNLV Gaming Research & Review Journal*, 14(1), 2.
- Walls, T. A., Fairlie, A. M., & Wood, M. D. (2009). Parents do matter: a longitudinal two-part mixed model of early college alcohol participation and intensity. *Journal of Studies on Alcohol and Drugs*, 70(6), 908-918. Retrieved from http://ug.summon.serialssolutions.com/link/0/eLvHCXMwY2BQMDZMsAwS05ONk1MTjVISzEH1mMjXkamyYkmyQaW4NlcrIwileZuogyhbq4hzh660HsAdNOBnQVLXUvzpGQD8zTQ2XlpJkZp5inAVJdkkmyYCKzMgMOXA8PE5GRDw8RUI8tks2TDZCOzFFMjs6ACYONjs2SgEwzFGHgTQevF80rA-8pS-J7uXVch_cS3YHZ5wOJdjwqdAGKKMjY
- Ward, B. W. (2011). Identifying Environmental Effects on Alcohol Use and Social-Norms: The Socio-environmental Context Model. *Journal of Human Behavior in the Social Environment*, 21(5), 502-520. doi:10.1080/10911359.2011.566802
- Wardle, H., Moody, A., Spence, S., Orford, J., Volberg, R., Jotangia, D., . . . Dobbie, F. (2011). British Gambling Prevalence Survey 2010 Retrieved from Retrieved from <http://www.gamblingcommission.gov.uk/PDF/British%20Gambling%20Prevalence%20Survey%20010.pdf>. Retrieved from

<http://www.gamblingcommission.gov.uk/PDF/British%20Gambling%20Prevalence%20Survey%20010.pdf>

- Warner, J. (1997). The sanctuary of sobriety: the emergence of temperance as a feminine virtue in Tudor and Stuart England. *Addiction*, *92*(1), 97-111.
- Weber, M. (1905). *The Protestant ethic and the spirit of capitalism*. New York: Scribner's.
- Weber, M. (1922). *Economy and Society*: Univ of California Press.
- Weber, M. (1949). *The methodology of the social sciences*.
- Weber, M. (1976). *The Protestant ethic and the spirit of capitalism*. New York: Scribner's.
- Weber, M. (2009). *The theory of social and economic organization*: Simon and Schuster.
- Wechsler, H., & Nelson, T. F. (2008). What we have learned from the Harvard School of Public Health College Alcohol Study: Focusing attention on college student alcohol consumption and the environmental conditions that promote it. *Journal of Studies on Alcohol and Drugs*, *69*(4), 481-490.
- Weden, M. M., & Miles, J. N. V. (2011). Intergenerational Relationships Between the Smoking Patterns of a Population-Representative Sample of US Mothers and the Smoking Trajectories of Their Children. *American Journal of Public Health*, *102*(4), 723-731. doi:10.2105/ajph.2011.300214
- Weitzman, E. R., Nelson, T. F., & Wechsler, H. (2003). Taking up binge drinking in college: the influences of person, social group, and environment. *Journal of Adolescent Health*, *32*(1), 26-35. doi:10.1016/s1054-139x(02)00457-3
- Welte, J., Barnes, G., Wieczorek, W., Tidwell, M. C., & Parker, J. (2001). Alcohol and gambling pathology among US adults: Prevalence, demographic patterns and comorbidity. *Journal of Studies on Alcohol*, *62*(5), 706-712. Retrieved from <Go to ISI>://WOS:000171733900019
- Wetzels, J., Kremers, S. P., Vitoria, P. D., & De Vries, H. (2003). The alcohol–tobacco relationship: a prospective study among adolescents in six European countries. *Addiction*, *98*(12), 1755-1763. Retrieved from <http://onlinelibrary.wiley.com/store/10.1111/j.1360-0443.2003.00553.x/asset/j.1360-0443.2003.00553.x.pdf?v=1&t=ihlhkur2&s=6af1a93645b0cff3fcc699e53d284b6123607d70>
- White, H. R., Johnson, V., & Buyske, S. (2000). Parental modeling and parenting behavior effects on offspring alcohol and cigarette use: a growth curve analysis. *Journal of Substance Abuse*, *12*(3), 287-310. doi:[http://dx.doi.org/10.1016/S0899-3289\(00\)00056-0](http://dx.doi.org/10.1016/S0899-3289(00)00056-0)
- White, V., & Bariola, E. (2012). *Australian secondary school students' use of tobacco, alcohol and over-the-counter and illicit substances in 2011*. Retrieved from Centre for Behavioural Research in Cancer:
- WHO. (1993). *Composite International Diagnostic Interview (CIDI): Interviewer's Manual*: World Health Organization.
- WHO, W. H. O. (2014). *Global status report on alcohol and health-2014*: World Health Organization.

- Williams, L. R., Wray-Lake, L., Loken, E., & Maggs, J. L. (2012). The Effects of Adolescent Heavy Drinking on the Timing and Stability of Cohabitation and Marriage. *Families in Society: The Journal of Contemporary Social Services*, 93(3), 181-188.
- Williams, R. J., Hann, R., Schopflocher, D., West, B., McLaughlin, P., White, N., . . . Flexhaug, T. (2015). Quinte longitudinal study of gambling and problem gambling Retrieved from Retrieved from <https://www.uleth.ca/dspace/bitstream/handle/10133/3641/QLS-OPGRC-2015.pdf?sequence=3>. Retrieved from <https://www.uleth.ca/dspace/bitstream/handle/10133/3641/QLS-OPGRC-2015.pdf?sequence=3>
- Williams, R. J., West, B. L., & Simpson, R. I. (2012). *Prevention of problem gambling: A comprehensive review of the evidence and identified best practices*. Retrieved from
- Wilsnack, R. W., & Wilsnack, S. C. (1997). *Gender and alcohol: Individual and social perspectives*: Rutgers Center of Alcohol Studies.
- Wilsnack, R. W., Wilsnack, S. C., & Klassen, A. D. (1984a). Women's drinking and drinking problems: patterns from a 1981 national survey. *American Journal of Public Health*, 74(11), 1231-1238.
- Wilsnack, R. W., Wilsnack, S. C., Kristjanson, A. F., Vogeltanz-Holm, N. D., & Gmel, G. (2009). Gender and alcohol consumption: patterns from the multinational GENACIS project. *Addiction (Abingdon, England)*, 104(9), 1487-1487. doi:10.1111/j.1360-0443.2009.02696.x
- Wilsnack, S. C. (2012). The GENACIS project: a review of findings and some implications for global needs in women-focused substance abuse prevention and intervention. *Substance Abuse*, 3, 5-15.
- Wilsnack, S. C., Wilsnack, R. W., & Klassen, A. D. (1984b). Drinking and drinking problems among women in a US national survey. *Alcohol Health and Research World*.
- Windle, M. (2000). Parental, sibling, and peer influences on adolescent substance use and alcohol problems. *Applied Developmental Science*, 4(2), 98-110.
- Wood, M. D., Read, J. P., Mitchell, R. E., & Brand, N. H. (2004). Do Parents Still Matter? Parent and Peer Influences on Alcohol Involvement Among Recent High School Graduates. *Psychology of Addictive Behaviors*, 18(1), 19-30. doi:10.1037/0893-164x.18.1.19
- World Health Organization. (2000). *Obesity: preventing and managing the global epidemic*: World Health Organization.
- Xie, H., Drake, R., & McHugo, G. (2006). Are there Distinctive Trajectory Groups in Substance Abuse Remission over 10 years? An Application of the Group-Based Modeling Approach. *Administration and Policy in Mental Health and Mental Health Services Research*, 33(4), 423-432. doi:10.1007/s10488-006-0048-0
- Yeh, M.-Y., Chiang, I. C., & Huang, S.-Y. (2006). Gender differences in predictors of drinking behavior in adolescents. *Addictive Behaviors*, 31(10), 1929-1938. doi:<http://dx.doi.org/10.1016/j.addbeh.2005.12.019>

- Young, A. F., Whewey, V., Brotherston, R., Powers, J., & Sc, B. (2005). *Australian Women and Alcohol Consumption: 1996-2003*: Department of Health and Ageing.
- Yule, A. M., Wilens, T. E., Martelon, M. K., Simon, A., & Biederman, J. (2013). Does exposure to parental substance use disorders increase substance use disorder risk in offspring? A 5-year follow-up study. *The American Journal on Addictions, 22*(5), 460-465. doi:10.1111/j.1521-0391.2013.12048.x
- Zhang, L., Welte, J. W., & Wieczorek, W. F. (1999). The influence of parental drinking and closeness on adolescent drinking. *Journal of Studies on Alcohol and Drugs, 60*(2), 245.
- Ziebarth, N., & Grabka, M. (2009). In Vino Pecunia? The Association Between Beverage-Specific Drinking Behavior and Wages. *Journal of Labor Research, 30*(3), 219-244. doi:10.1007/s12122-009-9064-7

APPENDICES

Appendix Table 4-1 Breastfeeding by different trajectories from the prenatal to postnatal period

Breastfeeding up to 6 months follow-up survey	Trajectories of alcohol consumption prenatal to postnatal period						Total	
	Abstainers		Light consumption		Heavy consumption		n	%
	n	%	n	%	n	%		
Yes	2667	76.57	2106	81.60	371	77.13	5144	78.59
No	816	23.43	475	18.40	110	22.87	1401	21.41
Total	3483	100	2581	100	481	100	6545	100

Appendix Table 4-2 Alcohol consumption before, during and after pregnancy among women in Perth, Australia

	Before pregnancy		During pregnancy		4 months postpartum		6 months postpartum		12 months postpartum	
	n	%	n	%	n	%	n	%	n	%
Alcohol consumption										
Yes	395	67.3	208	35.4	220	37.5	239	40.7	221	37.6
No	192	32.7	379	64.6	367	62.5	348	59.3	366	62.4
Standard drinks/week										
0-2	189	47.8	171	82.2	122	55.5	127	53.1	104	47.1
2.1-6.9	109	27.6	29	13.9	66	30.0	69	28.9	74	33.5
7.0 or more	97	24.6	8	3.8	32	14.5	43	18.0	43	19.5

(Source: Giglia RC, Binns CW. Patterns of alcohol intake of pregnant and lactating women in Perth, Australia. Drug and Alcohol Review 2007.26(5):493-500)

Appendix Table 6-1 Characteristics of three-group drinking trajectories in unadjusted and adjusted model

Parameters	Three-group model of maternal alcohol consumption trajectory	
	<i>Unadjusted model</i>	<i>Adjusted model</i>
Frequency - N (%)		
Group 1	337 (13.3%)	349 (13.8%)
Group 2	1731 (68.4%)	1718 (67.9%)
Group 3	463 (18.3%)	464 (18.3%)
BIC	BIC= -19402.03	BIC= -18531.29
Mean posterior probability		
Group 1	0.86	0.84
Group 2	0.93	0.93
Group 3	0.92	0.81

Appendix Table 6-2 Maternal alcohol consumption trajectories and offspring's alcohol use disorder at 21 year follow-up (unadjusted and adjusted analyses)

Maternal alcohol consumption trajectories ^a	Offspring's alcohol use disorder (21y), Odds Ratio (95% CI)					
	Unadjusted	Adjusted				
		Model 1 ^b	Model 2 ^c	Model 3 ^d	Model 4 ^e	Model 5 ^f
Abstainers (ref.)	1.0	1.0	1.0	1.0	1.0	1.0
Low stable drinkers	1.4 (1.1 - 1.8)	1.4 (1.1 - 1.8)	1.4 (1.1 - 1.8)	1.4 (1.0 - 1.8)	1.4 (1.0 - 1.8)	1.3 (1.0 - 1.8)
Moderate escalating drinkers	1.7 (1.2 - 2.3)	1.6 (1.2 - 2.2)	1.6 (1.2 - 2.2)	1.6 (1.1 - 2.1)	1.6 (1.2 - 2.2)	1.5 (1.1 - 2.1)

Note: Bold = $p < 0.05$; ^a Assessed over 14 year follow-up; ^b Controlled for maternal age, marital status, and income at 14 year; ^c Controlled for model 1 plus the quality of mother and child communication at 14 year; ^d Controlled for model 2 plus maternal illicit drug use at 5 year and paternal alcohol problems at 14 year; ^e Controlled for model 3 plus children antisocial behaviours at 14 year; ^f Controlled for model 4 plus children smoking at 14 year.

Appendix Table 6-3 Maternal alcohol consumption trajectories and offspring's alcohol use disorder at 21 year follow-up by gender of the child (unadjusted and adjusted analyses)

Maternal alcohol consumption trajectories ^a	Offspring's alcohol use disorder (21y), Odds Ratio (95% CI)					
	Unadjusted	Adjusted				
		Model 1 ^b	Model 2 ^c	Model 3 ^d	Model 4 ^e	Model 5 ^f
Female offspring						
Abstainers (ref.)	1.0	1.0	1.0	1.0	1.0	1.0
Low stable drinkers	1.3 (0.8 - 1.8)	1.2 (0.8 - 1.9)	1.2 (0.8 - 1.9)	1.2 (0.8 - 1.8)	1.2 (0.7 - 1.8)	1.2 (0.7 - 1.8)
Moderate escalating drinkers	1.5 (1.0 - 2.5)	1.5 (0.9 - 2.4)	1.5 (0.9 - 2.4)	1.4 (0.9 - 2.3)	1.4 (0.9 - 2.3)	1.4 (0.8 - 2.2)
Male offspring						
Abstainers (ref.)	1.0	1.0	1.0	1.0	1.0	1.0
Low stable drinkers	1.6 (1.1 - 2.3)	1.6 (1.1- 2.3)	1.6 (1.1- 2.3)	1.6 (1.1- 2.3)	1.6 (1.1- 2.3)	1.5 (1.1- 2.2)
Moderate escalating drinkers	1.9 (1.3 - 2.9)	1.9 (1.2- 2.9)	1.9 (1.2- 2.9)	1.8 (1.2- 2.8)	1.9 (1.2- 2.8)	1.8 (1.2- 2.7)

Note: Bold = p <0.05; a Assessed over 14 year follow-up; b Controlled for maternal age, marital status, and income at 14 year; c Controlled for model 1 plus the quality of mother and child communication at 14 year; d Controlled for model 2 plus maternal illicit drug use at 5 year and paternal alcohol problems at 14 year; e Controlled for model 3 plus children antisocial behaviours at 14 year; f Controlled for model 4 plus children smoking at 14 year.

Appendix Table 8-1 Parameters of different maternal alcohol consumption trajectory models over 21 years

Different group models of maternal alcohol consumption trajectory	Parameters of trajectory models		
	BIC	Mean posterior probability	N (%)
Two group-model			
Group 1	-22461.62	0.96	2466 (73.9)
Group 2		0.92	871 (26.1)
Three group-model			
Group 1	-21882.15	0.94	1943 (58.2)
Group 2		0.89	1163 (34.8)
Group 3		0.91	231 (6.9)
Four group-model			
Group 1	-21535.41	0.86	391 (11.7)
Group 2		0.92	1957 (58.6)
Group 3		0.88	850 (25.5)
Group 4		0.92	139 (4.2)

Note: In the present study, maternal alcohol consumption trajectories were identified by Stata plugin software application. We applied polynomial functions with linear, quadratic, cubic and quartic as alcohol consumption was measured over five time points. By analysing a different order of such polynomial types, we identified from two to four trajectory classes by using the same order (3 3 3 3). The four drinking-trajectory groups was selected as the best fitted model as its BIC was closest to 0 and it met the criteria of mean posterior probability.

Appendix Table 8-2 Prevalence (per cent) of outcome variables for women's alcohol consumption trajectories over 21 years

	Abstainers	Low- stable	Moderate- escalating	Heavy- escalating	X² p value
Marital status					
Married	68.7	66.4	64.8	52.2	44.5
Single/living together	5.2	10.0	14.9	19.9	$p < 0.001$
Divorced/separated	26.1	23.6	20.3	27.9	
Divorce					
No	70.0	63.9	58.8	59.6	15.6
Yes	30.0	36.1	41.2	40.4	$p < 0.001$
No. of partners					
None	13.4	7.9	7.0	8.2	60.7
1 partner	77.0	73.8	67.9	61.9	$p < 0.001$
2+ partners	9.6	18.2	25.1	29.9	
No. live births					
1–3 children	59.5	67.0	76.9	77.3	45.1
3+ children	40.5	33.0	23.1	22.7	$p < 0.001$
No. pregnancy termination					
None	91.1	81.9	76.0	72.6	38.7
1+ times	8.9	18.1	24.0	27.4	$p < 0.001$
Satisfaction with life					
Very satisfied	40.0	37.3	38.0	33.3	3.5
Satisfied	49.2	53.1	52.3	54.8	$p = 0.75$
Dissatisfied	10.9	9.5	9.7	11.8	
Happiness					
Very happy	42.8	36.8	38.8	27.4	16.0
Happy	50.4	55.2	53.7	58.5	$p < 0.05$
Not too happy	6.8	8.0	7.5	14.1	

Appendix Table 8-3 Multivariate attrition analyses predicting those who were lost to follow-up at 27 years

Predictors ¹	Odds of being lost to follow-up	
	Unadjusted	Adjusted ²
	OR (95% CI)	OR (95% CI)
Maternal age		
Young women (≤25) (ref.)	1.0	1.0
Older women (26+)	0.8 (0.7–0.9)	0.9 (0.8–0.9)
Marital status		
Married (ref.)	1.0	1.0
Single	1.9 (1.6–2.3)	1.5 (1.2–1.8)
Living together/divorced	2.0 (1.7–2.3)	1.9 (1.6–2.2)
Maternal education		
Post high school (ref.)	1.0	1.0
Complete high school	1.3 (1.1–1.5)	1.2 (1.1–1.4)
Incomplete high school	2.1 (1.8–2.5)	1.8 (1.5–2.2)
Family income		
\$10 400 or more (ref.)	1.0	1.0
\$10 390 or less	1.8 (1.6–2.0)	1.4 (1.3–1.6)
Termination of pregnancy		
No (ref.)	1.0	1.0
Yes (1+ times)	1.2 (1.0–1.5)	1.1 (0.9–1.4)
Maternal depression		
Non depressed (ref.)	1.0	1.0
Depressed	1.8 (1.4–2.2)	1.1 (0.8–1.4)
Maternal anxiety		
Non anxious (ref.)	1.0	1.0
Anxious	1.7 (1.4–1.9)	1.3 (1.1–1.6)
Satisfaction with life		
Very satisfied (ref.)	1.0	1.0
Satisfied	1.2 (1.1–1.3)	1.0 (0.9–1.2)
Dissatisfied	1.6 (1.3–2.0)	0.8 (0.7–1.1)
Happiness		
Very happy (ref.)	1.0	1.0
Happy	1.2 (1.1–1.4)	1.1 (0.9–1.2)
Unhappy	2.1 (1.6–2.7)	1.5 (1.0–2.1)

Note: Bold = $p < 0.05$; ¹Predictors were measured at baseline; ²Model was adjusted for all factors listed. These factors were used in main analyses.

Appendix Table 8-4 Multiple imputations (20 cycles) of multinomial/binary logistic regression models predicting family life outcomes at 27 year follow-up (n = 6753)

Models	Family life outcomes at 27 year follow-up				
	Marital status ¹		Divorced ²	No. of partners ³	
	Single/ living together RRR (95% CI)	Separated/divorced RRR (95% CI)	Ever divorced OR (95% CI)	None RRR (95% CI)	2+ partners RRR (95% CI)
Unadjusted					
Low-stable (ref.)	1.0	1.0	1.0	1.0	1.0
Abstainers	0.5 (0.3–0.8)	1.1 (0.9–1.3)	0.7 (0.6–0.9)	1.6 (1.1–2.3)	0.5 (0.3–0.7)
Moderate-escalating	1.4 (1.1–1.8)	0.9 (0.7–1.1)	1.3 (1.1–1.5)	0.9 (0.7–1.4)	1.5 (1.2–1.9)
Heavy-escalating	2.4 (1.5–3.9)	1.6 (1.0–2.4)	1.2 (0.8–1.8)	1.3 (0.7–2.4)	1.8 (1.2–2.9)
Adjusted					
Low-stable (ref.)	1.0	1.0	1.0	1.0	1.0
Abstainers	0.6 (0.3–1.1)	1.1 (0.9–1.4)	0.8 (0.6–0.9)	1.6 (1.1–2.3)	0.5 (0.3–0.7)
Moderate-escalating	1.4 (1.1–1.9)	0.9 (0.7–1.1)	1.2 (1.0–1.5)	1.0 (0.7–1.4)	1.5 (1.2–1.9)
Heavy-escalating	2.4 (1.4–5.0)	1.5 (0.9–2.4)	1.2 (0.8–1.8)	1.3 (0.7–2.4)	1.9 (1.2–2.9)

Note: Bold = $p < 0.05$; RRR = relative risk ratio; OR = odds ratio; CI = confidence interval; ¹ Reference category is married; ² Reference category is never divorced; ³ Reference category is one partner.

Appendix Table 8-5 Multiple imputations (20 cycles) of multinomial logistic regression models predicting reproductive outcomes at 27 year follow-up (n = 6753)

Models	Reproductive outcomes at 27 year follow-up			
	No. live child births		No. of pregnancy terminations	
	3+ live births (ref.)	1–3 live births OR (95% CI)	None (ref.)	1+ times OR (95% CI)
Unadjusted				
Low-stable (ref.)	1.0	1.0	1.0	1.0
Abstainers	1.0	0.7 (0.5–0.9)	1.0	0.5 (0.3–0.6)
Moderate-escalating	1.0	1.6 (1.3–1.9)	1.0	1.4 (1.1–1.7)
Heavy-escalating	1.0	1.4 (0.9–2.4)	1.0	1.7 (1.0–2.9)
Adjusted				
Low-stable (ref.)	1.0	1.0	1.0	1.0
Abstainers	1.0	0.9 (0.7– 1.2)	1.0	0.4 (0.2–0.5)
Moderate-escalating	1.0	1.5 (1.2–1.8)	1.0	1.4 (1.1–1.8)
Heavy-escalating	1.0	1.5 (0.9–2.5)	1.0	1.5 (0.7–2.9)

Note: Bold = p <0.05; OR = odds ratio; CI = confidence interval.

Appendix Table 8-6 Multiple imputations (20 cycles) of multinomial logistic regression models predicting well-being outcomes at 27 year follow-up (n = 6753)

Models	Well-being outcomes at 27 year follow-up			
	Life satisfaction ¹		Happiness ²	
	Satisfied OR (95% CI)	Dissatisfied OR (95% CI)	Happy OR (95% CI)	Unhappy OR (95% CI)
Unadjusted				
Low-stable (ref.)	1.0	1.0	1.0	1.0
Abstainers	0.9 (0.7–1.1)	1.0 (0.7–1.6)	0.8 (0.6–1.0)	0.7 (0.4–1.1)
Moderate-escalating	1.0 (0.8–1.2)	1.0 (0.8–1.3)	0.9 (0.8–1.1)	0.9 (0.7–1.3)
Heavy-escalating	1.2 (0.7–1.9)	1.5 (0.7–2.9)	1.5 (0.9–2.3)	2.5 (1.4–4.5)
Adjusted				
Low-stable (ref.)	1.0	1.0	1.0	1.0
Abstainers	0.9 (0.7–1.1)	1.0 (0.7–1.7)	0.8 (0.6–1.0)	0.7 (0.4–1.1)
Moderate-escalating	1.0 (0.8–1.2)	1.0 (0.8–1.3)	0.9 (0.8–1.1)	0.9 (0.6–1.2)
Heavy-escalating	1.1 (0.7–1.9)	1.4 (0.6–2.9)	1.4 (0.9–2.3)	2.4 (1.3–4.4)

Note: Bold = p <0.05; RRR = relative risk ratio; OR = odds ratio; CI = confidence interval;

¹Reference category is very satisfied; ² Reference category is never very happy.