LIFECOURSE TRAJECTORIES OF ALCOHOL USE IN A NEW ZEALAND BIRTH

COHORT: A LATENT CLASS ANALYSIS OF PREDICTORS AND OUTCOMES.

By

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Abstract

The development of an alcohol use disorder (AUD) is associated with antecedent risk factors such as parental alcohol problems and conduct disorder (Chassin et al., 2002; Lee et al., 2010). Many previous studies have reported that AUD is also associated with an elevated risk of adverse psychosocial outcomes including offending and substance use disorders (SUD) (Fergusson et al., 2013; Grant et al., 2015). There is limited research available which examines the extent factors predict alcohol use behaviors over the life course and what extent they contribute to associations found between alcohol use patterns and outcomes in adulthood. The current study used latent trajectory analyses of data from a long-term New Zealand longitudinal birth cohort study (N = 1065) to identify a finite set of trajectory groups based up their alcohol use behaviors from ages 15-35. The study identified childhood and adolescent factors which predicted alcohol trajectory class membership and examined associations between class membership and adverse outcomes at age 30-35. Findings indicated that five latent classes were required to describe drinking patterns of participants. A diverse range of childhood and adolescent factors predicted alcohol use trajectories. Latent class membership strongly predicted outcomes at ages 30-35 across the domains of substance dependence, mental health, socio-economic, family functioning, and offending. After controlling for covariates, only a small number of outcomes were still related to latent class membership: unemployment of 3+ months, home ownership, unemployment, welfare dependence, investment value, weekly income, life stress, and cohabiting with a partner. Membership to trajectories characterised by higher rates of AUD were associated with elevated rates of adverse outcomes including higher rates of life stress and less likely to cohabit with a partner. This research further informs our understanding of New Zealand factors and outcomes associated with alcohol use behaviours.

1. INTRODUCTION

1.1 Overview

Alcohol misuse is an important issue within society as it is prevalent worldwide, affecting nearly all areas of the world (Rehm et al., 2009). Excessive use of alcohol such as drunkenness has become increasingly of concern as there has been a steady increase in prevalence amongst adolescents in western countries (Currie et al., 2009). It is estimated that AUD accounts for 3.8% of all deaths globally and contributes to 4.6% of the global burden of disease through a range of health, economic, and social consequences (Baumberg, 2006; Rehm et al., 2009). AUD is associated with many adverse outcomes which include offending, intimate partner violence, and SUD (Fergusson et al., 2013; Grant et al., 2015; Patton et al., 2007). New Zealand data shows 50% of alcohol drinkers had drunk to intoxication within the past 12 months with 8.4% drinking to intoxication frequently (Ministry of Health [MOH], 2015). The World Health Organization (WHO, 2014) reports of the New Zealand population over the age of 15, 4.5% of males and 2% of females had an AUD. Therefore, it is important to identify how factors contribute to harmful alcohol consumption patterns and to investigate adverse outcomes which may result from these patterns later in life.

1.2 Age Trends

It could be argued alcohol use in western countries is developmentally normative for youth based on evidence which shows a consistent population level increase in alcohol use during adolescence (Brown et al., 2008). In the 2011 European School Survey Project on Alcohol and Other Drugs (ESPAD), on average 87% of students had initiated alcohol use by age 15-16 years old (Hibell et al., 2012). A recent Australian study also found that by age 16, 83.4%

of students had tried alcohol with 24.7% consuming alcohol weekly (White & Bariola, 2012). In comparison, a New Zealand study by Wells et al. (2004) found over the past 12 months, 87.5% of a longitudinal cohort had used alcohol by age 16. Additionally, the New Zealand Health Survey notes the majority of New Zealanders initiated alcohol use by age 17 (MOH, 2015).

Chen and Kandel (1995) identified adolescence as a major period of risk for initiating alcohol use. The developmental period of adolescence is defined by key events including leaving the parental home and obtaining autonomy from adults which are associated with increases in alcohol use (Bachman et al., 1997; Chassin et al., 2002). Neurobiological studies can also be applied to explain the wide-spread increase in alcohol use during the period of adolescence (Casey & Jones, 2010). Research has identified adolescents could be increasingly vulnerable to the neurobiologically motivating properties of alcohol in this age period due to an imbalance between the development of early emerging "bottom-up" motivational systems which peaks in adolescence whilst later emerging "top-down" cognitive systems continue to develop into adulthood (Casey & Jones, 2010: Gladwin et al., 2011).

Most adolescents who experiment with alcohol will do so without significant consequence however, a smaller portion will go on to use alcohol in a dangerous manner which may lead to pathological symptomology and eventually AUD, a serious medical disease (Chen & Kandel, 1995). Problematic alcohol consumption tends to follow strong epidemiological trajectories in which pathological alcohol use primarily increases during adolescence, reaches its highest rates in emerging adulthood, and then declines into older ages (Bates & Labouvie, 1997; Sher & Gotham, 1999; Vega et al., 2002). The age of onset for AUD typically peaks between 19-22 years old (Chassin et al., 2004; Christie et al., 1988; Lyons-Reardon et al., 2003). The majority of young adults then "mature out" of pathological alcohol use into older ages due to a

broad range of reasons which include increased responsibilities associated with adulthood such as parenthood, work, and marriage (Bachman et al., 1997; Borschmann et al., 2019; Maggs & Schulenberg, 2005; Sher & Gotham, 1999). However, not all individuals develop out of alcohol misuse and recent research by Towers et al. (2018) has shown that 40% of older New Zealanders (50+ years) remained hazardous drinkers into old age. Regardless, even developmentally limited AUD is associated with risk to the health of individuals due to acute alcohol related outcomes such as injuries and unplanned sex (CASA, 1994; Wechsler, 1994).

1.3 Predictive Factors

The process where individuals deviate from normative alcohol use patterns and develop into AUD, is influenced by a range of genetic, individual, and environmental factors which can put individuals at a greater risk including parental alcoholism and drug use, peer drinking, impulsivity, conduct disorder, and high amounts of externalizing behavior in adolescence (Chassin et al., 2002; Hawkins et al., 1992; Lee et al., 2010; Poikolainen, 2000).

Genetics: Adolescents with a familial history of alcohol misuse are at a greater risk of developing an AUD (Marshall, 2014). Twin studies have determined that there is a genetic vulnerability to AUD (Rose et al., 2011; Viken et al., 1999).

Gender: Males are also at a greater risk of developing AUD than females (Nolen-Hoeksema, 2004; Kahn et al., 2011). Gender may manifest as a risk factor through biological differences such as a greater heritability of AUD amongst males than females (King et al., 2005).

Attention problems: Attention problems may manifest as a risk factor through increased impulsivity which in turn leads to behavioral problems such as alcohol and other drug use (King et al., 2011).

Parental attitudes: Previous research by Brody et al. (2000) demonstrated that parental alcohol-use attitudes were linked indirectly, through child norms, with the children's own drinking behavior and this may represent an independent risk on subsequent alcohol use depending on if the parents defined adolescent alcohol use as acceptable.

Epidemiological research has demonstrated the development of adult AUD can be predicted from childhood and adolescent factors (Lee et al., 2010; Maggs et al., 2008; Wells et al., 2004). A review of longitudinal studies which predicted problem drinking behaviors in adulthood from antecedent factors concluded that predictors in childhood and adolescence could account for up to 20-50% of the variance in alcohol consumption end-points (Zucker, 2008). Merline et al. (2008) found that risk taking and parental drinking at age 18 was predictive of AUD symptoms at age 35. Another study by Englund et al. (2008) found that externalizing problems at age 9 were predictive of AUD to age 28. Recent literature by Boden et al. (2019a) report that parental attitudes towards alcohol use and novelty seeking predicted emergent binge drinking and heaving drinking trajectory membership from ages 18 – 35. Individuals with membership to these latent trajectory classes were significantly more likely to meet DSM-IV criteria for AUD and experience AUD symptoms. This demonstrates the importance that early life factors have on developmental trajectories for AUD which remained predictive to adulthood. Additional research is needed as there are limited long-term studies utilizing longitudinal data in a New Zealand context to investigate factors associated with developmental trajectories of alcohol use behaviors over the life-course.

1.4 New Zealand and Māori

Indigenous Māori were the first inhabitants of Aotearoa (New Zealand) arriving between the 12th and 14th century (King & Filer, 2007). European settlers proceeded to colonize NZ in the 1800's, joining the indigenous Māori population (King & Filer, 2007). Prior to European contact and colonization, Māori did not have alcohol, tobacco, or cannabis (Broughton, 1996; Cook, 2013; Hutt, 1999) and as such were devoid of SUD. Historically, Māori had good mental health and early research in the 1940's concerned why there was an absence of mental health disorders within Māori communities (Kingi, 2005). This is no longer the case and Māori are currently over-represented in mental health and addiction services (Ministry of Health, 2018). Research by Reid et al. (2014) contextualizes health disparities experienced by Māori and presents a model for how ethnicity may manifest as a vulnerability for mental health disorders as a consequence of intergenerational trauma inflicted during colonization in New Zealand. The model demonstrates how the various mechanisms of the colonization process such as marginalization, displacement, and loss of resources inflicted trauma which is transmitted across generations through systems such as structural poverty and externalized as adverse mental health outcomes.

1.5 Outcomes

High risk patterns of alcohol consumption such as AUD can shape psychosocial outcomes later in life such as offending, violence, and obesity in addition to other impacts on social, health, and economic wellbeing (Fergusson et al., 2013; Oesterle et al., 2004). The 5th edition of the DSM (American Psychiatric Association, 2013) defines AUD as a problematic pattern of alcohol use leading to clinically significant impairment or distress and requires an individual to have 2 or more symptoms as outlined in the DSM-5 within a 12 month time period

to meet criteria for an AUD. Grant et al. (2015) report that those who met criteria for AUD experienced significantly higher rates of mental health outcomes evidenced by a higher prevalence of major depressive disorders, anxiety disorders, and SUD. Other long-term studies have demonstrated associations between AUD and the adverse adult outcomes of intimate partner violence, assault, violent offending, motor vehicle accidents, and cigarette smoking (Boden et al., 2012; Boden et al., 2013; Fergusson et al., 2013; Oesterle et al., 2004; Patton et al., 2007).

Latent trajectory modelling is an approach which identifies groups of individuals with similar trajectories of behavior and assigns individuals to a number of latent trajectory classes based upon their most probable group. This can then be used to model associations between different trajectories and subsequent outcomes. Longitudinal studies utilizing latent class trajectory analyses have demonstrated efficacy for identifying groups of alcohol users at risk of later adverse adult outcomes (Hill et al., 2000; Oesterle et al., 2004; Wells et al., 2004). These studies have revealed a consistent pattern where those in the latent trajectory classes characterized by pervasive alcohol misuse and disorder are associated with higher rates of adverse outcomes in adulthood across a range of domains (Fergusson et al., 2000; Hill et al., 2000). Therefore, it is important to distinguish problematic alcohol use trajectories which are associated with adverse outcomes. Current international research on alcohol use trajectories primarily focuses on the developmental period of adolescence into early adulthood (Chassin et al., 2002; Patton et al., 2007). Alcohol consumption does not cease beyond this age period so it is important to investigate drinking behaviors into older ages. Additional research is needed to determine the extent childhood and adolescent factors predict alcohol use trajectory membership

over the life course and to what extent they contribute to differential associations found between trajectories and outcomes in adulthood.

1.6 Current Study

This study will extend on existing research by using data from a longitudinal birth cohort studied to age 35 to investigate outcomes which will enable the longer term consequences of alcohol use trajectories to be investigated.

The present study utilized latent trajectory modelling approaches to investigate adolescent factors and adult outcomes associated with a range of alcohol use trajectories within a longitudinal New Zealand cohort. The objectives of the current study were to:

1. Classify participants to a set of latent alcohol use trajectory groups from adolescence to adulthood based on alcohol use patterns.
2. Investigate childhood and adolescent factors which contribute to AUD.
3. Identify groups at risk of AUD from a range of family functioning, socio-demographic, abuse exposure, and individual factors.
4. Estimate associations between trajectories and outcomes, after accounting for potential confounding by predictors.

Based upon evidence from previous literature, the current study hypothesized that:

1. The childhood and adolescent factors of socio-economic status, parental drug use, and childhood adversity would predict the trajectories of alcohol use over the life course.
2. Offending variables (arrest, conviction and intimate partner violence) and socio-economic variables (Socio-economic index, unemployment and welfare dependence) will

be predicted by alcohol use trajectory assignment both before and after adjustment for

covariate factors.

2. METHOD

To ensure consistency with existing Christchurch Health and Development Study (CHDS) literature, parts of the methods section have been replicated from references provided by the CHDS.

2.1 Data Source

The CHDS is a longitudinal study of 1265 children born in Christchurch NZ who have been studied from birth to age 35 in 2012. The sample was recruited during mid 1977 by contacting mothers of all children born in public and private hospitals within the urban Christchurch region. Of the 1310 live births between the 15th April and 5th August 1977, 96% of the parents in seven maternity units of the time agreed to participate with 97% of the children being entered into the study (due to twins).

The children and their families have been studied at birth, 4 months, 1 year, at yearly intervals until age 16, 18, 21, 25, 30, and at 35 years old. The data collected covers a range of domains including health, wellbeing, and development. Data collected has been gathered with signed and informed consent from the individuals and/or their parents. Ethics approval has been obtained from the Canterbury (NZ) Regional Ethics Committee.

2.2 Sample Characteristics

The sample size of the study varied slightly depending on the year of follow up. At the 35 year follow up, 962 participants were assessed which represented 76% of the original cohort. The gender of the cohort was recorded at birth, 50.6% of the sample identified as being males and 49.4% as females. The ethnicity of the cohort was reported by the participants at ages 14, 21, and 25. Parents were asked at the 14 year follow up "Which of these categories best describes your child's cultural identification?" and participants were asked at 21 and 25 years old

"Which of the following ethnic groups do you belong to or identify with?". If the answer indicated their ethnic identity or descent was Māori or part Māori at any time point, then the participant was classified as Māori for the purpose of this study. If the participant did not ever report Māori ethnicity or descent, they were classified as non-Māori. According to these classifications 176 cohort members' self-reported Māori ethnic identity or descent at any age. Using this way of classifying ethnicity over time, 16.4% of the assessed cohort at any age was identified as being Māori and 83.6% were identified as belonging to an ethnic group other than Māori (non-Māori). There were not enough participants of other minority ethnicities to allow comparative analysis so the study limited ethnicity analysis to Māori and non-Māori. At age 35, there were 961 participants from the cohort with ethnicity data available. There was one participant assessed without a reported ethnicity.

Previous research has examined the CHDS attrition and analyzed possible bias in the participants who were lost to follow up. Research found a small selection bias where the sample retained under-represented children from low socio-economic backgrounds characterized by single parent families, low socioeconomic status and low parental education (Fergusson et al., 1991; Fergusson & Horwood, 2001). To address potential attrition bias due to sample loss, analyses were repeated utilizing the data weighting methods described by Carlin et al. (1999) to examine potential implications of selection effects arising from the pattern of missing data. The conclusions from these analyses were essentially the same pattern of results to those reported prior to adjustment, suggesting that the conclusions of this study were unlikely to have been influenced by selection bias.

2.3 Data collection

Data for the CHDS was collected from parental and child interviews. For the parent interviews, mothers or single parent fathers answered interviews on a wide range topics related to their child's development. From age eight onwards, children were also interviewed.

All data was collected subject to informed consent from participants and ethics approval from the Canterbury (NZ) Regional Ethics Committee. Participants were informed they could withdraw consent at any time. Parent and child interviews were conducted separately with responses remaining confidential to the respective respondent.

2.4 Measures

A comprehensive set of measures which were possibly associated with alcohol use was selected from the CHDS database. The factors were selected on the basis of past CHDS studies in which they had demonstrated a relationship to alcohol consumption or other drug use (Fergusson et al., 1995; Fergusson & Boden, 2008).

2.4.1 Alcohol use

Disorder and symptomology. At ages 15, 16, 18, 21, 25, 30, and 35 years cohort members were questioned concerning their use of alcohol and experience of problems associated with alcohol use since the previous assessment. Questioning concerning alcohol-related problems was based on items from the Composite International Diagnostic Interview (CIDI: WHO, 1993) relating to AUD. On the basis of this information, sample members were assessed on standardised diagnostic criteria for AUD using DSM-IV criteria since the previous assessment period (American Psychiatric Association, 1994). From the introduction of DSM-V in 2013, alcohol abuse/dependence has been renamed "alcohol use disorder" which is the terminology used throughout this manuscript.

In order to examine both dimensional and categorical approaches to measuring AUD criteria, responses were categorised based on the number of symptoms as follows; category one which consisted of participants with zero symptoms, category two which was comprised of participants with one to two symptoms, and category three comprised participants with three or more symptoms during the period since the previous assessment. This enabled researchers to study symptom severity using a dimensional approach. Additionally, another variable was created measuring if they met criteria for an AUD during the period since the previous assessment.

Alcohol use frequency. Participants were asked over the past 12 months, how frequently they drank alcohol. The responses were classified into categories as either; never, very occasionally, <monthly, at least monthly, at least weekly or almost every day. The responses were then re-categorised into three frequency categories; category one which was comprised of "never" to "very occasionally", category two comprised of "<monthly" to 'at least monthly" and category three comprised of "at least weekly" to "almost every day".

2.4.2 Predictive Factors

Socio-economic status variables:

Family socioeconomic status (at birth). Family socioeconomic status (SES) was assessed at birth using the Elley-Irving (Elley & Irving, 1976) scale of SES for New Zealand. This scale classified SES into six levels on the basis of paternal occupation, ranging from one = professional to six = unskilled/unemployed.

Parental education. Maternal and paternal education levels were assessed at the time of the survey child's birth using a three point scale which reflected the highest level of educational achievement attained. This scale was: one = parent lacked formal educational qualifications; two

= parent had secondary level educational qualifications; three = parent had tertiary level

qualifications.

Family living standards (0-10 years). At each assessment year, a rating of the material

living standards of the family was obtained by means of an interviewer rating. Ratings were

made on a five point scale that ranged from "very good" to "very poor". These ratings were

summed over the 10 year period and divided by 10 to give a measure of typical family living

standards during this period.

Averaged family income (1 to 10 years). At each assessment year, estimates of the

families' gross income were obtained from parental reports. These income estimates for each

year were recorded into decile categories, and resulting measures were then averaged over the

10-year period to produce a measure of the families' averaged income into decile rank.

Family functioning variables:

Parental alcoholism/alcohol problems, criminal offending, and illicit drug use. When

sample members were aged 11, their parents were questioned about their use of illicit drugs. At

the 15 year assessment parents were further questioned concerning their history of alcoholism or

alcohol problems and criminal offending.

Parental intimate partner violence (0-16 years). At age 18, sample members were

questioned concerning their experience of parental intimate partner violence (IPV) during their

childhood (prior to age 16 years). The questioning was based on a series of eight items derived

from the Conflict Tactics Scale (Straus, 1979). The items were chosen on the basis that the

behaviors could have been readily observed and reported on by the participant, and also to span

the potential range of violent behavior from verbal abuse to physical assault. The eight items

used included: a) threaten to hit or throw something at the other parent; b) push, grab, or shove other parent; c) slap, hit, or punch other parent; d) throw, hit, kick, or smash something (in the other parent's presence); e) kick other parent; f) choke or strangle other parent; g) threaten other parent with a knife, gun, or other weapon; h) call other parent names or criticize other parent (put other parent down). Participants were asked to rate the frequency with which they observed each behavior on a three point scale (never, occasionally and frequently). Separate questioning was conducted for violence initiated by the father against the mother and for violence initiated by the mother against the father. The paternal and maternal scale scores were combined to provide an overall assessment of the level of parental intimate partner violence (Fergusson & Horwood, 1998).

   Parental Attachment (age 14). Parental attachment was assessed at age 14 years using the parental attachment scales developed by Armsden and Greenberg (1987). The full parental attachment scale (28 items) was used in this analysis.

   Parental Bonding (Maternal and Paternal Care and Protection). To measure parental bonding, the maternal and paternal care and protection scales of the 50-item Parental Bonding Instrument (PBI) (Parker et al, 1979) were administered to the young people at the age of 16 years. The young person was asked to rate their mother and father on the PBI items describing the quality of maternal and paternal care and protection throughout their childhood. The care scale measures the extent to which the parents provide support, affection and nurturing with a high score indicating high levels of care. The protection scale measures the extent to which parents exhibit tendencies to over protection or over control with a high score indicating tendencies to over control.

Changes of parents (0-15 years). At each assessment from birth to 15 years, comprehensive information was gathered on changes in the child's family situation since the previous assessment. Using this information an overall measure of family instability was constructed on the basis of a count of the number of changes of parents experienced by the child prior to age 15. Changes of parents included all changes resulting from parental separation/divorce, reconciliation, remarriage, death of a parent, fostering, and other changes of custodial parents.

Parental attitudes toward child's alcohol consumption (age 15). At age 15 years, cohort members were asked to describe their parent's views on adolescent alcohol consumption on a five-point scale ranging from strongly opposed to unconcerned.

Parental history of depression/anxiety. At age 15 years the young person's parents were asked if they had a history of anxiety disorders or depressive disorders. Participants whose parent reported that either parent had experienced depression or anxiety were classified as having a parental history of depression/anxiety. On the basis of responses to this questioning 29.9% of the sample were classified as having a parental history of anxiety disorders or depressive disorders.

Maternal age at cohort member's birth. At the birth of each participant, the mother's age was recorded in whole years.

Abuse exposure variables:

Parental use of physical punishment (childhood physical abuse). At ages 18 and 21 cohort youth were asked to describe the extent to which their parents used physical punishment during childhood (Fergusson & Lynskey, 1997). Separate questioning was conducted for

mothers and fathers. This information was used to create a four level scale reflecting the most severe form of physical punishment reported for either parent: parents never used physical punishment; parents rarely used physical punishment; at least one parent used physical punishment on a regular basis; at least one parent used physical punishment too often or too severely, or treated the respondent in a harsh or abusive manner.

Childhood sexual abuse. At ages 18 and 21 years cohort youth were questioned about their experience of sexual abuse during childhood (<16 years) (Fergusson et al., 1996). Questioning spanned an array of abusive experiences from episodes involving non-contact abuse (e.g. indecent exposure) to episodes involving attempted or completed intercourse. Cohort youth who reported an abusive episode were then questioned further about the nature and context of the abuse. Using the information from cohort youth, a four level scale was devised reflecting the most extreme form of sexual abuse reported by the young person at either age. This classification was: no sexual abuse; non-contact abuse only; contact sexual abuse not involving attempted or completed intercourse; attempted/completed oral, anal, or vaginal intercourse.

Individual variables:

Gender. Cohort members' gender was recorded at birth as a binary variable (female; male).

IQ (ages 8-9). Child cognitive ability was assessed at ages eight and nine using the Revised Wechsler Intelligence Scale for Children (Wechsler, 1974). Total scores were computed on the basis of results on four verbal and four performance subscales. For the purposes of these analyses the observed WISC-R total IQ scores at age eight and nine were combined by averaging over the two administrations.

Grade point average (GPA; ages 11-13). GPA was measured at each assessment from age 11-13 years. The child's class teacher was asked to rate the child's performance in each of five areas of the curriculum (reading, handwriting, written expression, spelling, mathematics) using a five point scale ranging from very good to very poor. To provide a global measure of the child's educational achievement over the interval from 11-13 years, the teacher ratings were summed across years and curriculum areas and then averaged to provide a teacher rating grade point average for each child. The reliability of this measure was $\alpha = .96$.

Extraversion (age 14). At age 14, trait measures of extraversion were assessed using a short form version (24 items) of the Eysenck Personality Inventory (Eysenck & Eysenck, 1964). The reliability of this measure was $\alpha = .86$.

Neuroticism (age 14). Neuroticism was assessed using a short form subscale version of the neuroticism scale of the Eysenck Personality Inventory (Eysenck & Eysenck, 1964), which was administered when the participants were aged 14 years. The items were scored on a three-point Likert scale: one = not like me, two = a bit like me, three = a lot like me. The reliability of this measure was $\alpha = .88$.

Self-esteem (age 15). Self-esteem was assessed at age 15 using the global measure from the Coopersmith Self Esteem Inventory (Coopersmith, 1981). The overall measure of self-esteem was generated by summing of the four subscale scores (general, academic, social, and home). The full scale score used in these analyses was found to be internally consistent ($\alpha = 0.87$).

Childhood behaviour variables:

Child behavior problems (anxious/withdrawn behavior, conduct and attentional problems; ages 7-9). At annual intervals from age seven to nine years, information on child behavior problems was obtained from parental and teacher reports. Parental reports were obtained from an interview with the child's mother using a behavior questionnaire that combined items from the Rutter et al. (1970) and Conners (1969) parental questionnaires. The child's class teacher was also asked to complete a combined version of the Rutter et al. (1970) and Conners (1969) teacher questionnaires.

Child anxiety/withdrawal assessed the extent to which the child displayed symptoms relating to shy, anxious or withdrawn behaviors. All items were scored on a three point scale ranging from 'not at all' to 'a great deal'. Confirmatory factor analysis of the selected items for each domain and each source (parents, teachers) showed that, in each case, the items could be scaled as unidimensional scales representing the extent of child anxiety/withdrawal as reported by parents and teachers. Scale scores representing the extent of behavior problems were created by summing the parent and teacher item scores at each age. These scale scores were then averaged over the interval from seven to nine years to provide overall measures reflecting the severity of anxiety/withdrawal in middle childhood. The alpha reliability of this scale was 0.87.

Factor analysis of the item-level report data showed that it was possible to select items from these reports that formed uni-dimensional scales reflecting the extent of parent-reported and teacher-reported behavior problems in two domains of behavior (Fergusson et al., 1991): (a) conduct problems: the extent to which the child exhibited aggressive, oppositional, or conduct disordered behaviors; and (b) attentional problems: the extent to which the child exhibited restless, inattentive, or hyperactive behaviors. For the purposes of the present analysis, the

parent and teacher reports were summed for each year and averaged over years to produce two scale score measures reflecting the extent of the child's tendencies to conduct problems and attentional problems at age's seven to nine. The alpha reliabilities of these scales were .97 and .93 respectively.

Novelty seeking (age 16). At age 16, participants were administered the novelty seeking (NS) items of the Tridimensional Personality Questionnaire (TPQ) (Cloninger, 1987). Higher scores on the NS scale reflect the extent to which the individual is "impulsive, exploratory, excitable, disorderly and distractible". Scores on the NS scale ranged from 2-31 (mean 18.3), with moderately good internal consistency ($\alpha = .76$).

2.4.3 Outcome measures (ages 30-35 years)

Mental health outcomes:

SUD (ages 30-35). At age 35 years cohort members were questioned about their substance use behaviors and problems associated with substance use (cannabis, tobacco, alcohol) since the 30 year assessment. These measures were based on the Composite International Diagnostic Interview (CIDI) (Smeets & Dingemans, 1993) in order to obtain information pertaining to DSM-IV (American Psychiatric Association, 1994) symptoms of: cannabis use disorder (CUD) and AUD; for the period 30-35 years. Items for nicotine dependence (ND) were custom-written and based on the one month period prior to the assessment at age 35. Using this information cohort members were classified as to whether they met DSM-IV criteria for SUD during the interval 30-35 years (for nicotine dependence, the measure refers to current ND at age 35 years).

Mental health disorders (ages 30-35). Cohort members were questioned about potential symptoms of mental health disorders (major depression; anxiety disorders; suicidal ideation;

psychotic symptomatology). For major depressive and anxiety disorders, these measures were

based on CIDI items pertaining to DSM-IV symptoms of major depression and anxiety disorders

(including generalized anxiety disorder, social phobia, specific phobia, panic disorder,

agoraphobia). On the basis of these reports, cohort members who met DSM-IV symptom criteria

for major depression, were classified as having major depression and if they met criteria for one

or more anxiety disorders they were classified as having an anxiety disorder.

For suicidal ideation, cohort members were asked whether they had thought about killing

themselves at any point during the period 30-35 years. Suicidal ideation was classified as any

report of suicidal ideation having occurred.

For psychotic symptomatology, cohort members were questioned about psychotic

symptoms using DSM IV criteria from the Diagnostic Interview Schedule (Robins et al., 2000),

assessing two classes of psychotic experiences: symptoms of abnormal thought (delusions of

persecution or guilt, bizarre delusions, delusions of reference, passivity and thought control) and

symptoms of abnormal perception (auditory, visual, olfactory, gustatory and tactile

hallucinations). Cohort members who reported at least one symptom were classified as having

experienced psychotic symptomatology during the period 30-35 years.

Life stress (ages 30-35). Stressful life events were assessed for each 12-month period

during ages 18–35 years using a 30-item inventory based on the Social Readjustment Rating

Scale (Holmes & Rahe, 1967) supplemented by custom-written survey items. These items

spanned several domains, including, for example, death and illness, relationship problems and

difficulties, and crime victimization. All items were scored on a zero to four scale (zero = no

event, one = not upset or distressed, two = a little upset or distressed, three = moderately upset or

distressed, and four = very distressed, based on prior recommendations). Using this information,

a measure of exposure to stressful life events was computed by summing the scores for each item for each 12-month period, and then summing over each assessment period, resulting in a total life events distress score for the period 30–35 years.

Socioeconomic outcomes:

Socioeconomic status (age 35). At age 35, information on the participant's current or most recent occupation was used to classify current socioeconomic status using the 2006 version of New Zealand Socioeconomic Index (NZSEI) (Milne & Byun, 2013). The NZSEI ranks occupational status on a scale that ranges in value from 10-90, with a higher score implying higher socioeconomic status.

Personal net weekly income (age 35). At age 35, cohort members were asked to report on their net personal weekly income from all sources. Incomes reported in currencies other than New Zealand dollars (NZD) were converted to NZD using Purchasing Power Parities (Organisation for Economic Co-operation & Development, 2012) for the year 2012 (when the age 35 data were collected).

Value of savings/investments (age 35). Also at age 35, cohort members were asked to report on the total value of their savings and investments. As with income, foreign currency values were converted to NZD using Purchasing Power Parities for the year 2012.

Home ownership (age 35). As part of the age 35 assessment, cohort members were asked a series of questions about their housing status, including whether they owned their own home (even if there was a mortgage on the home). Cohort members who reported owning their own home were classified as homeowners at age 35.

Welfare dependence (ages 30-35). Cohort members were also asked a series of questions about their receipt of social welfare benefits at the age 35 assessment. These benefits included unemployment benefit, domestic purposes benefit, sickness/invalids benefit, student allowance, or other benefit. Cohort members who reported receiving one or more forms of social welfare benefit at any time during the period 30-35 years were classified as being welfare dependent during that period.

Unemployment (ages 30-35). At age 35 cohort members were asked about their employment since the previous assessment, including any periods of unemployment. Cohort members who reported any instance of unemployment during the assessment period were classified as having been unemployed during the period 30-35 years.

Unemployment of at least 3 months (ages 30-35 years). At each assessment at ages 30 and 35 years, cohort members were asked a series of questions concerning their history and patterns of employment and unemployment since the previous assessment. One set of questions examined whether cohort members had been unemployed and looking for work for three or more months during any calendar year since the previous assessment. For the purposes of the present study, this information was used to classify participants during the assessment period (30–35 years) as to whether they had been unemployed for three or more months during any calendar year since the previous assessment.

Life satisfaction (age 35). At age 35 years information about life satisfaction was collected in face-to-face interviews using a custom-written questionnaire which required participants to rate their current satisfaction with each of 11 areas of their life: work; leisure time; partner relationships; relationships with people of the same sex; relationships with people of the opposite sex; social life; money; independence; daily interactions with others; the future; and life

as a whole. Participants responded on a four-point scale where 'one' was very unhappy; 'two'

was unhappy; 'three' was happy; and 'four' was very happy. The resulting scales were of

moderate to high internal consistency ($\alpha = 0.84$ to $\alpha = 0.89$).

Social/family outcomes:

Cohabiting partner, dependent children (age 35). As part of the assessment at age 35,

cohort members were asked a series of questions about their household and family composition.

This information was used to classify participants as to whether they were currently living in a

cohabiting partner relationship, and whether they had a dependent child(ren) at age 35.

Physical intimate partner violence (age 35 years). At age 35, cohort members who

reported an intimate partnership were asked a series of questions derived from the Conflict

Tactics Scale (CTS2) (Straus et al., 1996) assessing their experience with intimate partner

violence in the previous 12 months. Questioning including both perpetration of physical violence

and being the victim of physical violence by a partner. Cohort members who reported at least

one instance of physical violence with their partner during the 12 month period were classified as

having experienced physical intimate partner violence.

Arrest/conviction (age 30-35 years). As part of the interview at age 35, cohort members

were asked a series of questions about any involvement with law enforcement and courts that

they may have experienced since the previous assessment. Cohort members who reported at

least one instance of either being arrested by the police or being convicted of an offence by a

court were classified as having been arrested/convicted during the period 30-35 years. Cannabis

related arrests/convictions were excluded from the classification.

2.5 Statistical analysis

The current study researched how different factors contribute to alcohol use patterns over the life-course and subsequent adverse outcomes later in life based upon previous CHDS research. In this paper three main analyses were performed in order to examine the relationship between alcohol use, predictive factors, and adult outcomes. These analyses included latent trajectory modelling to characterise alcohol use profiles, examining childhood and adolescent predictive factors of trajectory groups, and determining associations between trajectory classes and adult outcomes.

Latent group based trajectory modelling. Firstly, a group based approach to trajectory modelling was used to examine longitudinal alcohol use patterns throughout the study period based on Nagin's (1999; 2005) group based approach to analysing developmental trajectories by fitting the AUD data (if they met criteria for an AUD) and high frequency drinking data ('at least weekly' to 'almost every day' drinking) from ages 15-35 to determine an appropriate model. A latent trajectory model statistical analysis was chosen as it enabled comparisons to be made at several time points using the longitudinal data and allowed models to demonstrate complicated changes in trajectory patterns which the latent classes may follow. This modelling technique could then be used to identify classes within the study who may be at a greater risk of an adverse trajectory and compare psychosocial variables of sub-populations to determine factors which may predict trajectory membership.

Analyses were conducted using the Mplus 8.0 (Muthén & Muthén, 1998-2017). The models fitted measures of alcohol use data from ages 15-35 using Bolck, Croon, & Hagenaar's (2004) three step approach for estimating latent variables. This approach first defines a

measurement model and estimates the models parameters. Then individual latent scores are computed or predicted from the model parameters. Finally, the predicted latent scores are treated as observed scores and are used to estimate structural parts of the model. This approach limits systematic bias which arises when using predicted latent scores to estimate the structural part of models. A series of models with latent class counts between three and six classes was produced to determine which best fit the data. This range was chosen based on previous CHDS research by Wells et al. (2004) and initial modelling of the data. A model was selected based on if it provided theoretical and practical groupings, had a minimum class size of 5%, as well as an entropy criterion close to one as this enabled a clear seperation of classes. Model selection criteria was based on research by Celeux & Soromenho (1996) who proposed an entropy criterion of closest to one and Nagin (1999) who proposed the model should provide probability distributions which are suitably specified to describe the data. Additionally, Bayesion Information Criterion (BIC) & Akaike Information Criterion (AIC) were considered when selecting the model with the preferred number of trajectories. The model with the lowest practical BIC & AIC value was preferred as this would provide the best fitting model based on the likelihood function measure and taking into consideration the number of parameters within the model. The Results section presents the preferred model solution.

Prediction of latent class assignment and multinomial logistic regression. The second stage of analysis involved individually testing childhood behaviour, family, socio-economic, and individual factors to examine which factors predicted latent class membership using a chi square test of independence. The covariate factors which were significantly associated with latent class assignment at the bivariate level based on the chi square test were then used as predictors in a

multinomial logistic regression as blocks of related variables with the non-drinkers trajectory class as the reference category. The blocks included sociodemographic variables (maternal age, maternal/paternal education, SES, average living standards, average income), family functioning variables (parental illicit drug use, parental alcohol problems, parental attitudes towards alcohol consumption, parental offending, changes of parents, parental attachment, parental history of depression/anxiety, maternal and paternal care and overprotection), abuse exposure variables (physical abuse, sexual abuse, parental intimate partner violence), individual variables (gender, ethnicity, IQ, gpa, neuroticism, extraversion, novelty seeking, self-esteem), and childhood behavior variables (anxious/withdrawn behaviour, conduct and attention problems). Variables which were not significant at p<.05 level for the comparison between at least two latent classes were removed from the multinomial logisitc regression. Another multinomial logistic regression was performed using the revised set of significant variables. The process was repeated until all variables remained significant as blocks of variables for the comparison between at least two latent classes at p<.05. Following this, a final combined multivariate multinomial logistic regression was performed containing all variables that were statistically significant at the bivariate level. This produced a final set of significant factors which predicted latent class assigment between at least two latent classes.

Associations between alcohol use trajectory and adult outcomes. The third analysis examined associations btween adult outcomes (age 30-35) and alcohol use trajectory classes. The strength of outcome associations were tested using measures of effect sizes for continuous variables and odds ratios for dichotomous variables using the non-drinkers latent class as the reference category.

Initial baseline models were fitted of the form:

$$G(Y_{it}) = B0 + B1\ SEX_i + \sum B_j\ CLASS_{ij} + \sum B_k\ AGE_{kt}$$

where $G(Y_{it})$ was either the log odds of outcome Y for the ith participant at time t (for dichotomous outcomes) or the mean of outcome Y (for continuous measures); $CLASS_{ij}$ (j=2,3,4, 5) were a set of dummy variables representing membership of the four alcohol use latent classes with the non-drinker class defined as the reference class; and AGE_{kt} were a set of dummy variables representing the assessment waves.

In order to adjust the associations estimated in the equation above for potential confounding factors, the models above were augmented by inclusion of the term $\sum B_q Conf_{di}$, which represented the sum of all potential confounding factors (which were identified in the earlier analysis of predictors) entered into each model for individual i. Potential confounding variables were entered into the model in forwards and backwards stepwise fashion in order to obtain stable and parsimonious models.

For dichotomous outcomes, estimates of the odds ratio (OR) of disorder and 95% confidence interval (CI) for each category of alcohol use latent class (relative to the non-drinker latent class) were obtained by exponentiation of the model parameters B_j ($e^{B_j \pm 1.96\ SE(B_j)}$). For continuous measures, estimates of Cohen's *d* were obtained using covariate-adjusted means. In each case a test of the overall effect of alcohol use in the fitted model was derived from a test of the joint hypothesis that the parameters B_j (j=2,3,4,5) were simultaneously zero. All models were fitted using Mplus 8.0 (Muthén & Muthén, 1998-2017) and all models assumed an unstructured correlation matrix of the repeated measures of each outcome over time.

Sample size and missing data. Sample size varied at each age of assessment with between n = 953 and n = 1025 participants depending on assessment year. By age 35, 303 participants had been lost to follow up. Sample retention at age 35 was 76% of the original cohort and 78.6% of the surviving cohort. Reasons for loss included 41.6% (n=126) who refused to participate, 40.3% (n=122) no longer in New Zealand, 13.9% (n=42) deaths, and 4.3% (n=13) untraced.

Missing data was assumed to be random and all available data was used at each stage of analysis to minimize bias. The analysis of alcohol use utilized a total sample size of n = 1065 participants who had either partial or complete data available on their alcohol use from ages 15-35. The analysis of adult outcomes utilized a sample size of n = 962 at age 35. Missing data was found to have a slight over-representation of individuals belonging to disadvantaged families compared to the cohort retained (children from single parent families, low socioeconomic status, low parental education, maternal smoking) or to be male at 35 (Fergusson & Horwood, 2001; Boden et al., 2019b). The first approach to minimize any potential bias from sample attrition was to include all the measures available under the assumption the data was missing at random. To address the possible bias in estimation due to sample loss processes, analyses were repeated using the data weighting methods described by Carlin et al. (1999) to examine the possible implications of selection effects arising from the pattern of missing data. These analyses produced essentially the same pattern of results to those reported here, suggesting that the conclusions of this study were unlikely to have been influenced by selection bias.

3. RESULTS

3.1 Descriptives

Alcohol use measures (ages 15-35 years).

Disorder. There was a rapid increase in those meeting criteria for AUD between the ages 15-18 (Table 1). AUD rates peaked at age 21 and from there there was a gradual decline in those who met criteria for AUD.

Table 1.

Percentage meeting criteria for AUD at each age.

Percentage	Age 15	Age 18	Age 21	Age 25	Age 30	Age 35
Non-disorderd	96.5	80.6	77.6	86.4	91.0	91.3
AUD	3.5	19.4	22.4	13.6	9.0	8.7

When examining rates of disorder across gender, rates of AUD followed a similar pattern for both males and females where there was a rapid increase in those meeting criteria for disorder from ages 15-18. Female rates peaked slightly earlier at age 18 whereas male rates peaked at age 21 (Table 2). From age 18 female rates declined and from 21 male rates declined. There was a visible gender disparity from age 18 onwards where males were more likely to have AUD than females. The disparity in prevalence of AUD between males and females continued into adulthood and remained notable at age 35.

Table 2.

Percentage meeting criteria for an AUD at each age by gender; Male (M) and Female (F).

Frequency	Age 15		Age 18		Age 21		Age 25		Age 30		Age 35	
	M	F	M	F	M	F	M	F	M	F	M	F
Non-disorderd	97.5	95.5	78.0	83.1	69.2	85.8	82.4	90.3	86.2	95.5	86.2	96.0
AUD	2.5	4.5	22.0	16.9	30.8	14.2	17.6	9.7	13.8	4.5	13.8	4.0

When examining rates of disorder across ethnicity, rates of AUD for both Non-Māori and Māori followed a similar pattern to those found above where rates rapidly increased during adolescence before they peaked at age 21 and began to steadily decline into adulthood (Table 3). An ethnicity disparity was present from early adolescence through to early adulthood where Māori rates of AUD exceeded non-Māori rates. The ethnicity disparity diminished by age 30 and rates remained similar for both non-Māori and Māori until age 35.

Table 3.

Percentage meeting criteria for an AUD at each age by ethnicity; Non-Māori (N-M) and Māori (M).

Frequency	Age 15		Age 18		Age 21		Age 25		Age 30		Age 35	
	N-M	M	N-M	M	N-M	M	N-M	M	N-M	M	N-M	M
Non-disordered	96.8	94.8	82.5	70.9	79.4	68.5	87.5	81.1	90.5	93.6	91.3	91.1
AUD	3.2	5.2	17.5	29.1	20.6	31.5	12.5	18.9	9.5	6.4	8.7	8.9

Frequency. There was a sharp uptake in frequent drinking ("at least weekly" to "daily" drinking) between age 15 and age 18 which continued to increase until it peaked relatively late at age 30 (Table 4). The percentage of non-drinkers within the cohort rapidly decreased between age 15 and 18 and remained low with most of the cohort either infrequent or frequently drinking from age 18 onwards.

Table 4.

Percentage of alcohol consumption frequency by groups defined as non-drinkers, infrequent drinking ("once or twice" to "at least monthly"), and frequent drinking ("at least weekly" to "daily drinking") at each age.

Percentage	Age 15	Age 18	Age 21	Age 25	Age 30	Age 35
Non-drinker	28.4	6.9	4.4	4.1	5.8	7.4
Infrequent drinking	64.9	55.2	48.1	45.3	38.5	40.6
Frequent drinking	6.7	37.9	47.6	50.6	55.7	52.0

When examining frequency of drinking across gender, rates of non-drinking followed a similar rapid decrease from age 15-18 with most of the males or females from the cohort consuming alcohol either infrequently or frequently from age 18 to 35 (Table 5). There was comparable rates of non-drinkers between genders. Males reported frequent drinking at a higher rate than females at every age whereas females reported infrequent drinking at a higher rate than males.

Table 5.

Percentage of alcohol consumption frequency by groups defined as non-drinkers, infrequent drinking ("once or twice" to "at least monthly"), and frequent drinking ("at least weekly" to "daily drinking") at each age by gender; Male (M) and Female (F).

Frequency	Age 15		Age 18		Age 21		Age 25		Age 30		Age 35	
	M	F	M	F	M	F	M	F	M	F	M	F
Non-drinker	29.2	27.6	8.9	5.0	5.0	3.7	4.7	3.5	4.6	6.9	7.1	7.6
Infrequent drinking	62.6	67.1	47.9	62.3	36.5	59.2	38.3	51.8	29.7	46.8	28.7	51.7
Frequent drinking	8.1	5.3	43.2	32.7	58.5	37.1	57.0	44.7	65.7	46.4	64.1	40.7

When examining frequency of drinking across ethnicity, Māori began drinking slightly earlier than non-Māori but by age 18 non-Māori rates of infrequent and frequent alcohol consumption caught up. Non-Māori and Māori rates of frequent drinking were then similar from

early adolescence until early adulthood where non-Māori rates exceeded those of Māori and
remained higher until age 35. In adulthood, Māori are more likely to report infrequent drinking
rates than non-Māori.

Table 6.

*Percentage of alcohol consumption frequency by groups defined as non-drinkers,
infrequent drinking ("once or twice" to "at least monthly"), and frequent drinking ("at
least weekly" to "daily drinking") at each age by ethnicity; Non-Māori (N-M) and Māori
(M).*

Frequency	Age 15		Age 18		Age 21		Age 25		Age 30		Age 35	
	N-M	M	N-M	M	N-M	M	N-M	M	N-M	M	N-M	M
Non-drinker	29.8	20.8	6.9	7.3	4.2	4.9	3.8	5.5	7.6	6.3	7.6	6.3
Infrequent drinking	63.5	72.1	55.3	55.8	47.8	49.4	43.7	53.0	37.5	56.3	37.5	56.3
Frequent drinking	6.7	7.1	37.9	37.0	47.9	45.7	52.4	41.5	54.9	37.3	54.9	37.3

3.2 Latent trajectory modelling

Classification of alcohol use disorder trajectories (15-35).

A series of latent class trajectory models, between three and six classes, were fitted to the
AUD and high frequency drinking data from ages 15-35 to determine an appropriate model
based upon fit indices and practical discrimination of groups. Table 7 displays the fit indices of
the latent trajectory models investigated. The fit indices (AIC, BIC, adjusted BIC, and entropy)
suggested less latent classes provided a better fit than more classes. While the three and four
class models demonstrated higher fit indices, when examined visually, they failed to adequately
discriminate practical groupings. A five class model was chosen as the preferred solution as this
option maintained sufficient fit indices, class proportions of over 5%, and discriminated an
additional latent class which was not visible within the four class model. This additional class
exhibited a unique practical grouping of high rates of frequent drinking ('at least weekly' to

'daily drinking') from early adulthood yet mostly did not meet criteria for AUD throughout the study period. Model entropy was .731. The inclusion of covariates did not improve model entropy. The five classes were defined as follows:

Class 1 (Non-drinkers: n = 98, 9.2% of the cohort): This trajectory consisted of a group of individuals who primarily did not use alcohol from age 15-35 based upon the AUD and drinking frequency data.

Class 2 (Non-disordered: n = 370, 34.7% of the cohort): This group was made up of individuals who experienced moderate rates of frequent alcohol consumption and low rates of AUD.

Class 3 (Adulthood drinkers: n = 269, 25.3% of the cohort): Individuals in this group were characterized by low levels of AUD throughout the study period but experienced a steady increase in frequent alcohol use rates beginning in adolescence which persisted throughout adulthood to age 35. By the time this group reached adulthood, their alcohol use was extremely frequent.

Class 4 (Adolescent onset disordered, desisting: n =115, 10.8% of the cohort): This group showed a rapid early onset of AUD which peaked at age 18 before their rates of AUD declined steadily into adulthood. Similarly, this group experience a rapid increase in rates of high frequency drinking to age 18 from which rates declined steadily.

Class 5 (Late onset disordered, chronic: n = 213, 20% of the cohort): This class experienced a large increase in AUD starting from age 15 and rates of AUD peaked slightly later at age 21 in early adulthood. From age 21 rates of AUD declined slightly yet remained chronically high. This group continued to consume alcohol very frequently from their adolescence to age 35.

Table 7.

Latent trajectory models fitted by classes.

Number of classes	AIC	BIC	Sample size adjusted BIC	Proportion in smallest class	Entropy
3	16654	17007	16781	.113	.760
4	16385	16857	16555	.117	.757
5	16279	16870	16492	.092	.731
6	16246	16956	16502	.019	.750

AIC – Akaike Information Criterion; BIC – Bayesian Information Criterion

Figure 1 graphs the rates of meeting criteria for an AUD from ages 15 through to 35 based upon latent class membership using the five trajectory model. Table A11 within the thesis appendix presents this data in an alternative table form for ease of readability.

Figure 1.

Rates of AUD from ages 15-35 for a 5 class trajectory model.
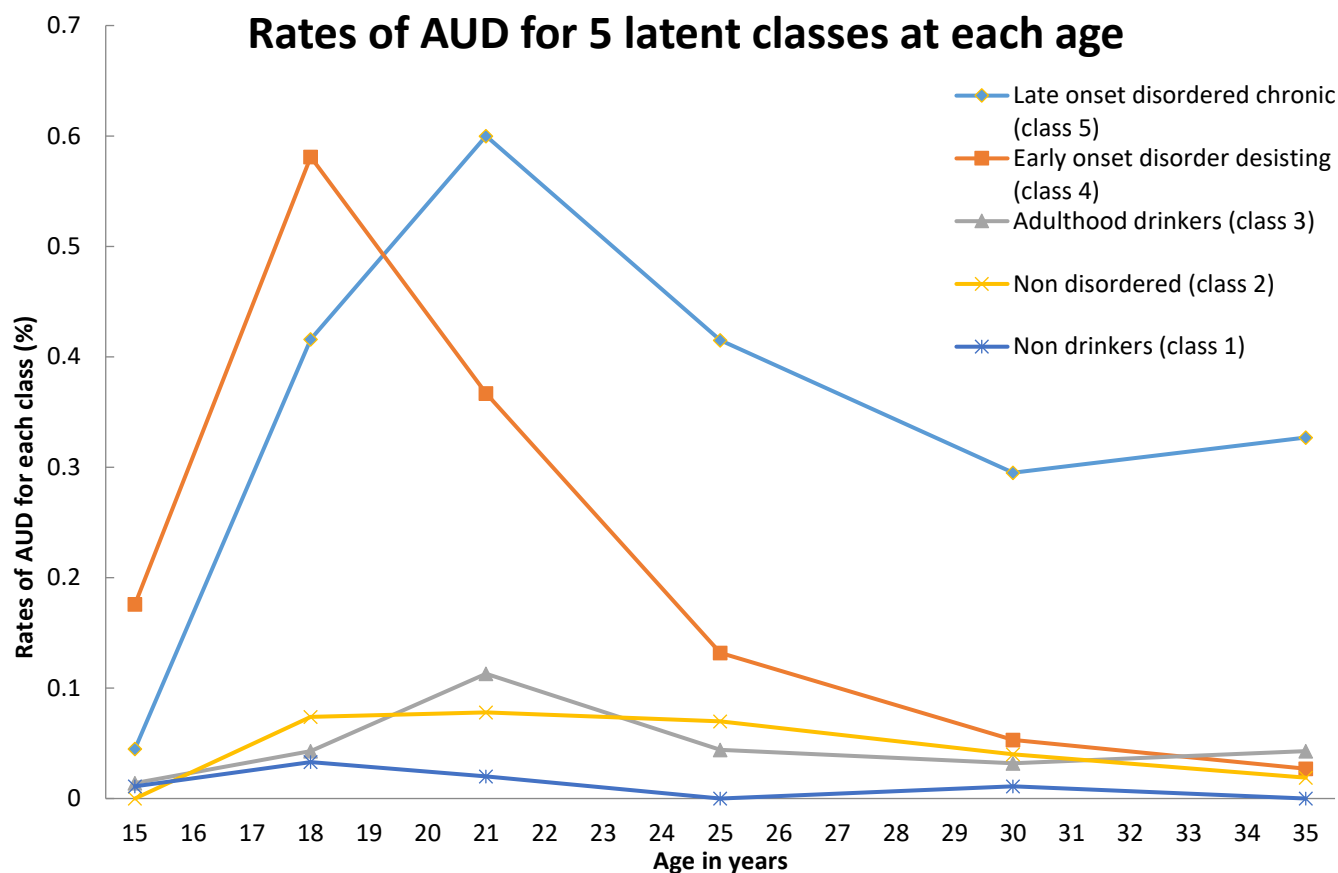
Figure 2 shows the rates of engaging in frequent drinking ("at least weekly" to "daily drinking") from age 15 to 35 based upon latent class membership using the five trajectory model. The major feature noticeable in figure 2 is the additional latent class (class 3) which becomes discriminated in the five class model but not the four class model. This group exhibited high rates of frequent alcohol use from early adolescence all the way into age 35. The two figures (figure 1 and 2) combined show good discriminability between classes. Table A12 within the thesis appendix presents the rates of frequent drinking ("at least weekly" to "daily drinking") for five latent classes in an alternative table form for ease of readability.

Figure 2.

Rates of frequent drinking ("at least weekly" to "daily drinking") from ages 15-35 for a 5 class trajectory model.

Rates of frequent drinking for 5 latent classes at each age
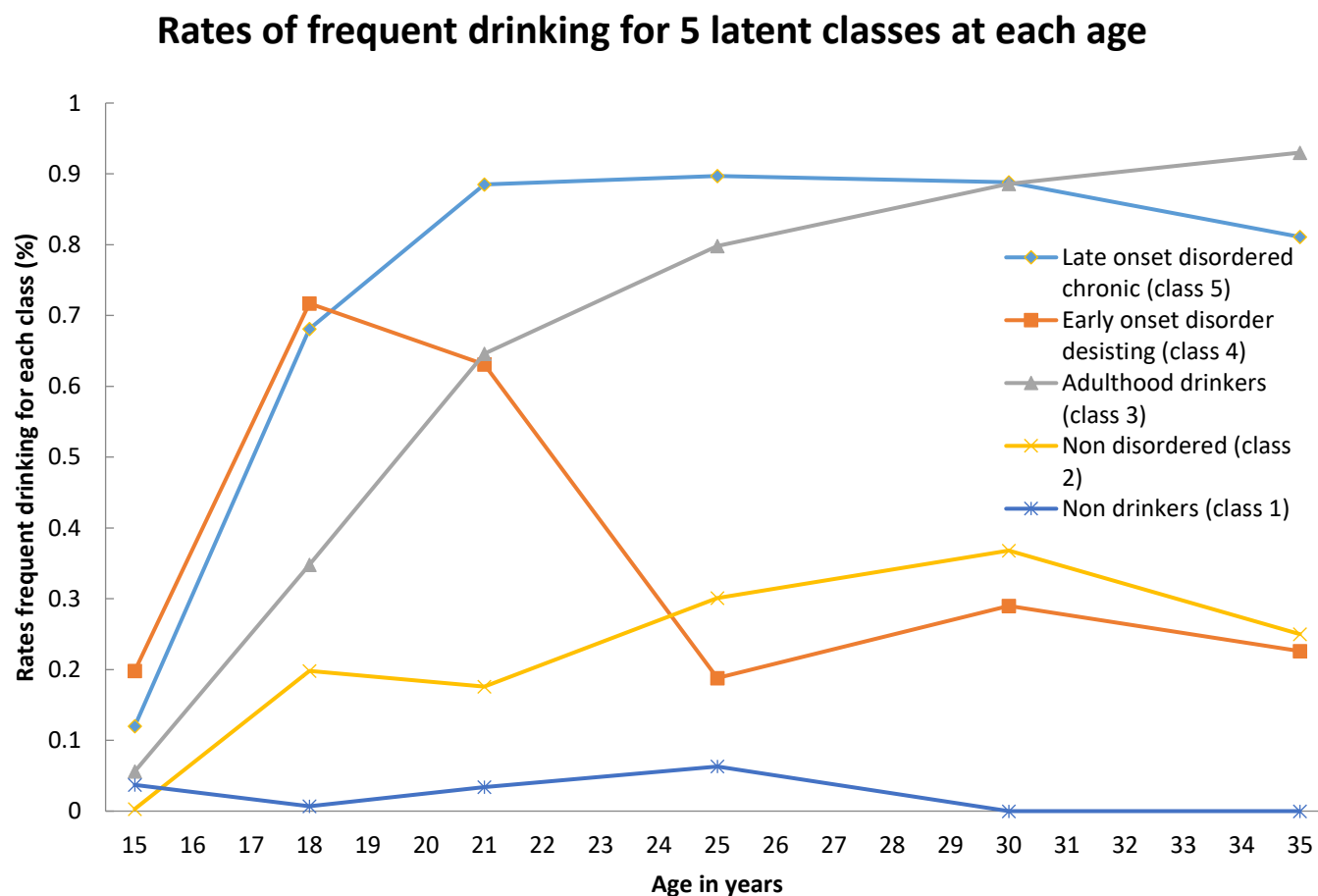
3.3 Predictive factors

Associations between alcohol use trajectory and childhood covariates.

A bivariate analysis of associations was performed to examine childhood covariates which predicted latent class membership for the different alcohol use trajectories. The analysis compared latent class assignment as a function of childhood covariates with non-drinkers (class 1) as the reference category. The total dataset of covariates included is presented in the appendix as table A13. From this, 23 predictors were significantly associated with latent trajectory

assignment at p<.05; gender (male), conduct problems, attention problems, parental alcohol problems, novelty seeking, average family income, average family living standards, changes of parental figures, extraversion, GPA, total IQ, maternal care, maternal overprotection, parental attachment, parental attitude towards child's alcohol consumption, paternal care, exposure to parental intimate partner violence, childhood physical abuse, paternal overprotection, SES, self-esteem, childhood sexual abuse, and ethnicity (Māori).

A multinomial logistic regression was conducted with the factors that were statistically significant (p <.05) at the bivariate level entered as blocks to predict latent class assignment with non-drinkers (class 1) as the reference category. The blocks were revised and ran again with the significant variables together until a final revised set of covariates remained. Results are presented in table 11. The following nine variables remained significantly associated for the comparison of at least two latent trajectories after adjusting covariates at p<.05; average family living standards, paternal care scale, parental attitudes toward child's alcohol consumption, gender (male), ethnicity (Māori), extraversion, self-esteem, attention problems and novelty seeking. Individuals in the latent trajectory classes characterized by higher rates of AUD and frequent alcohol use (classes 3-5) typically had greater levels of covariate factors than those in the non-drinker (class 1) and non-disordered classes (class 2).

Table 8.

Multinomial logistic regression of childhood covariates predicting latent class membership of alcohol use trajectories as compared with class 1 (non-drinkers).

Measure	Non-disordered (Class 2) Mean Score OR (95% CI) B (SE) p	Adulthood drinkers (Class 3) Mean Score OR (95% CI) B (SE) p	Early onset disordered desisting (Class 4) Mean Score OR (95% CI) B (SE) p	Late onset disordered chronic (Class 5) Mean Score OR (95% CI) B (SE) p	Overall effect of predictor in model p
Average family living standards ages 0-10	29.082 .979 (.911, 1.051) -.022 (.037) *.554*	**27.117** **.894 (.829, .964)** **-.112 (.039)** ***.004***	30.195 .971 (.887, 1.063) -.030 (.046) *.522*	**27.788** **.874 (.808, .945)** **-.135 (.040)** ***.001***	<.001
Paternal care scale age 16	28.330 .993 (.954, 1.034) -.007 (.021) *.737*	29.358 .988 (.945, 1.033) -.012 (.023) *.597*	**23.174** **.941 (.887, 1.063)** **-.061 (.024)** ***.010***	27.381 .975 (.932, 1.019) -.026 (.023) *.258*	.016
Parental attitudes toward child's alcohol consumption age 15	**2.658** **1.401 (1.031, 1.905)** **.337 (.157)** ***.031***	**2.900** **1.944 (1.391, 2.718)** **.0665 (.171)** ***<.001***	**2.824** **1.650 (1.124, 2.420)** **.500 (.196)** ***.010***	**2.945** **1.983 (1.396, 2.818)** **.685 (.179)** ***<.001***	<.001
Exposure to childhood sexual abuse to age 16	.346 .837 (.610, 1.148) -.178 (.162) *.538*	**.181** **.606 (.409, .898)** **-.501 (.201)** ***.013***	.591 .847 (.580, 1.237) -.166 (.193) *.390*	.230 .781 (.536, 1.140) -.247 (.193) *.200*	.105
Gender (Male)	1.61 .826 (.448, 1.520) -.192 (.311) *.538*	**1.45** **.373 (.194, .717)** **-.986 (.333)** ***.003***	**1.56** **.451 (.209, .972)** **-.796 (.392)** ***.042***	**1.30** **.170 (.085, .341)** **-1.773 (.355)** ***<.001***	<.001
Ethnicity (Māori)	.160 1.477 (.636, 3.430) .390 (.430) *.364*	.089 .940 (.370, 2.384) -.062 (.475) *.896*	**.330** **3.197 (1.242, 8.227)** **1.162 (.482)** ***.016***	.178 1.900 (.760, 4.750) .642 (.467) *.169*	.007
Extraversion age 14	22.572 1.039 (.980, 1.101) .038 (.030) *.198*	**23.860** **1.135 (1.062, 1.212)** **.126 (.034)** ***<.001***	**24.476** **1.170 (1.080, 1.268)** **.157 (.041)** ***<.001***	**23.799** **1.121 (1.046, 1.201)** **.114 (.035)** ***.001***	<.001
Attention problems (age 7-9)	19.65 .969 (.913, 1.029) -.031 (.030) *.305*	**19.04** **.919 (.859, .983)** **-.085 (.034)** ***.014***	21.38 .963 (.930, 1.046) -.038 (.037) *.309*	20.86 .982 (.920, 1.049) -.018 (.034) *.599*	.043

Novelty seeking (age 16)	17.520	17.727	20.457	20.041	<.001
	1.108 (1.044, 1.176)	**1.124 (1.055, 1.197)**	**1.249 (1.157, 1.348)**	**1.243 (1.162, 1.330)**	
	.102 (.030)	**.116 (.032)**	**.222 (.039)**	**.218 (.034)**	
	.001	*<.001*	*<.001*	*<.001*	

Reference category is non-drinkers (class 1)
Bold factors were statistically significant (p<.05)

3.4 Outcomes at age 35

Associations between alcohol use trajectories and outcomes in adulthood (30-35).

Table 12 shows the bivariate associations between various dichotomous and continuous measures of adult outcomes and alcohol use trajectory assignment. The measures included substance use, mental health, socio-economic, and social outcomes. There were 16 adult outcome variables significantly (p<.05) associated with alcohol use trajectory assignment for at least two latent classes; cannabis dependence, nicotine dependence, major depression, psychoses symptoms, life stress, unemployment over three or more months, home ownership, unemployment, welfare dependence, socio-economic status score (NZSEI), investments value, weekly income, number of dependent children, arrest rates, conviction rates, and perpetration of intimate partner violence. From the table, the classes which engaged in the most disordered drinking; adolescent onset disordered desisting (class 4) and late onset disordered chronic (class 5), were more likely to meet criteria for ND, had higher scores of life stress, and were more likely to be arrested compared to the non-drinkers class. The adulthood drinkers (class 3) typically had higher rates of functional outcomes (lower rates of depression, lower rates of psychosis symptoms, lower rates of unemployment of 3+ months, higher scores of SES, higher rates of home ownership, higher amounts of investment value, higher amounts of income, lower rates of unemployment, and lower rates welfare dependence) compared to the non-drinkers class (class 1).

Table 9.

Bivariate associations of dichotomous and continuous adult outcome variables (ages 30-35) for 5 latent class model.

Measure	Non-drinkers (class 1) (N = 88) Mean	Non-disordered (class 2) (N = 330) Mean t/z (95% CI) Coefficient (SE) p	Adulthood drinkers (class 3) (N = 248) Mean t/z (95% CI) Coefficient (SE) p	Early onset disordered desisting (class 4) (N = 103) Mean t/z (95% CI) Coefficient (SE) p	Late onset disordered chronic (class 5) (N = 193) Mean t/z (95% CI) Coefficient (SE) p	Overall effect p
Substance use disorder						
Cannabis dependence	.011	.039 1.22 (-.776, 3.320) 1.272 (1.044) .223	.012 .05 (-2.213, 2.340) .063 (1.161) .957	**.097 2.11 (.160, 4.312) 2.235 (1.059) .035**	.021 .54 (-1.596, 2.816) .610 (1.126) .588	.003
Nicotine dependence	.125	.130 .13 (-.661, .756) .047 (.361) .895	.085 -1.10 (-1.208, .339) -.435 (.395) .271	**.350 3.46 (.574, 2.075) 1.325 (.383) .001**	**.233 2.07 (.041, 1.470) .755 (.365) .038**	<.001
Mental health						
Major depression	.205	.230 .51 (-.426, .729) .152 (.295) .607	**.105 -2.34 (-1.445, -.128) -.786 (.336) .019**	.301 1.51 (-.152, 1.183) .515 (.341) .130	.145 -1.24 (-1.070, .239) -.416 (.334) .213	<.001
Any anxiety disorder	.171	.139 -.73 (-.875, .399) -.238 (.325) .464	.121 -1.17 (-1.075, .273) -.401 (.343) .244	.262 1.52 (-.161, 1.256) .548 (.361) .130	.145 -.55 (-.876, .494) -.191 (.349) .584	.027
Life stress measure	5.886	**6.915 2.05 (.046, 2.012) 1.029 (.501) .040**	6.786 1.74 (-.1165, 1.916) .900 (.518) .083	**7.485 2.64 (.410, 2.788) 1.599 (.606) .008**	**8.067 4.06 (1.127, 3.235) 2.181 (.537) <.001**	<.001
Psychoses symptoms	.159	.070 .-1.53 (-1.693, .208) -.742 (.485) .126	**.020 -2.60 (-2.916, -.408) -1.662 (.640) .009**	.175 .19 (-.929, 1.133) .102 (.526) .846	.073 -.90 (-1.450, .542) -.458 (.511) .369	.016
Suicidal ideation ages	.023	.046 .94 (-.778, 2.211) .717 (.763) .347	.020 -.14 (-1.781, 1.536) -.122 (.846) .885	.087 1.78 (-.145, 2.975) 1.415 (.796) .075	.036 .59 (-1.111, 2.073) .717 (.763) .347	.068

Socioeconomic

Unemployment of at least 3 months	.182	**.088** **-2.47 (-1.498, -.173)** **-.836 (.338)** **.013**	**.044** **-3.78 (-2.378, -.754)** **-1.567 (.414)** **<.001**	.165 -.31 (-.868, .634) -.117 (.383) .760	**.083** **-2.37 (-1.645, -.154)** **-.899 (.380)** **.018**	<.001
Life satisfaction score	39.659	39.495 -.029 (-1.27, .944) -.164 (.564) .772	40.456 1.36 (-.349, 1.942) .796 (.584) .173	38.524 -1.66 (-2.475, .205) -1.135 (.683) .097	39.495 -.039 (-1.421, .953) -.234 (.605) .699	.008
NZSEI score (an SES measure)	45.657	48.529 2.872 (-1.694, 7.437) 1.23 (2.326) .217	**52.967** **7.311 (2.638, 11.983)** **3.07 (2.381)** **.002**	41.233 -4.424 (-9.925, 1.078) 2.803 (.115) .115	46.755 1.098 (-3.735, 5.932) .045 (2.463) .656	<.001
Owns own home	.386	.491 1.74 (-.054, .907) .426 (.245) .082	**.597** **3.36 (.356, 1.353)** **.854 (.254)** **.001**	.388 .03 (-.576, .592) .008 (.298) .978	.456 1.09 (-.228, .800) .286 (.262) .276	<.001
Investments value	49866.385	75733.614 25867.230 (-8696.809, 60431.269) 1.47 (17612.43) .142	**128920.744** **79054.359 (43372.619, 114736.009)** **4.35 (18181.96)** **<.001**	72790.564 22924.179 (-19154.516, 65002.874) 1.07 (.285) .285	**90015.559** **40149.175 (3133.335, 77165.015)** **2.13 (18861.77)** **.034**	<.001
Net weekly income	568.345	772.919 204.574 (-7.780, 416.929) 1.89 (108.208) .059	**1224.068** **655.723 (436.197, 875.249)** **5.86 (111.862)** **<.001**	735.607 167.262 (-90.597, 425.121) 1.27 (131.396) .203	**1077.113** **508.768 (281.113, 736.404)** **4.39 (115.995)** **<.001**	<.001
Unemployment	2.807	**.997** **-2.40 (-1.516, -.155)** **-.835 (.347)** **.016**	**.381** **-3.69 (-2.429, -.745)** **-1.587 (.429)** **<.001**	2.757 -.28 (-.881, .659) -.111 (.393) .778	**.536** **-2.91 (-2.048, -.340)** **-1.224 (.420)** **.004**	<.001
Welfare dependence	.250	.1606 -1.93 (-1.120, .010) -.555 (.288) .054	**.069** **-4.29 (-2.200, -.821)** **-1.511 (.352)** **<.001**	.262 .19 (-.589, .716) .064 (.333) .848	**.130** **-2.47 (-1.446, -.167)** **-.806 (.326)** **.013**	<.001

Social/family outcomes

Living with partner/length of relationship	6.511	6.546 .034 (-1.226, 1.294) .05 (.642) .958	6.472 -.040 (-1.342, 1.263) -.06 (.664) .952	6.592 .081 (-1.443, 1.605) .10 (.777) .917	**4.974** **-1.537 (-2.888, -.187)** **-2.23 (.688)** **.026**	.012

Number of dependent children	1.489	1.285 -.19 (-.542, .448) -.047 (.253) .853	1.069 -1.16 (-.809, .208) -.301 (.259) .246	1.379 .02 (-.596, .605) .005 (.306) .987	**1.005** **-1.96 (1.048, -.001)** **-.524 (.267)** **.050**	.057
Arrested	.125	.055 .94 (-.778, 2.11) .717 (.763) .347	.040 .75 (-.947, 2.13) .592 (.785) .451	**.359** **2.09 (.102, 3.17)** **1.637 (.783)** **.037**	**.269** **2.13 (.127, 3.080)** **1.604 (.753)** **.033**	.005
Convicted	.046	.052 1.29 (.693, 3.392) 1.349 (1.042) .195	.040 1.23 (-.774, 3.366) 1.296 (1.056) .220	**.165** **2.11 (.160, 4.312)** **2.236 (1.059)** **.035**	.098 1.84 (-.127, 3.962) 1.918 (1.043) .066	.032
Intimate partner violence perpetration age 35	1.296	1.536 .57 (-.570, 1.037) .233 (.410) .569	.641 -.30 (-.990, .728) -.131 (.438) .765	.728 .97 (-.467, 1.373) .453 (.469) .334	1.689 1.83 (-.056, 1.576) .760 (.416) .068	.035

Reference category is non-drinkers
Bold factors were statistically significant (p<.05)

Adjusted associations between outcomes and latent trajectory assignment, net of covariate factors.

A series of multinomial logistic regressions were conducted with adult outcome variables fitted to the data to predict latent class assignment with non-drinkers (class 1) as the reference before and after adjustment for childhood covariates to examine the extent adult outcomes could be explained by confounding variables and the size of the association. The statistical significance of each outcome was tested and the strength of the association between the latent class membership and adult outcome was calculated as an odds-ratio (OR) for dichotomous outcomes and a mean difference (Cohen's *d*) for continuous outcomes. After the adult outcome variables were adjusted for childhood co-variates, only eight variables remained significant (p<.05) for the comparison of at least two latent classes. The variables which remained significant were unemployment of three or more months, home ownership, unemployment,

welfare dependence, investments value, weekly income, life stress, and cohabiting with a partner. Those in the adulthood drinkers class (class 3) typically had higher scores of socio-economic outcomes than the non-drinkers class (class 1) which was evidenced by lower rates of unemployment of 3+ months, higher rates of home ownership, lower rates of unemployment, lower rates of welfare dependence, higher amounts of investment value, and a higher amount of weekly income. Late onset disordered chronic drinkers (class 5) typically had higher rates of life stress and lower rates of cohabiting with a partner however, they also experienced lower rates of unemployment and lower rates of welfare dependence. Adjustment for covariates typically decreased the strength of the effect sizes. This is examined further in the Discussion.

Table 10 demonstrated that after adjusting for covariates compared to those in the non-drinkers class (class 1), those in the late onset disordered chronic class (class 5) had:

1. Significantly higher rates of life stress (AOR 1.65)

2. Significantly lower rates of cohabitating with a partner (AOR -1.90)

3. Significantly lower rates of unemployment (AOR .292), and lower rates welfare dependence (AOR .413)

Compared to those in the non-drinkers class (class 1), those in the adulthood drinker's class (class 3) had:

4. Significantly higher scores of socio-economic wellbeing including lower rates of unemployment of 3+ months (AOR .272), higher rates of home ownership (AOR 1.956), lower rates of unemployment (AOR .253), lower rates of welfare dependence (AOR .376), higher amount of investment value ($50,366), and a higher amount of weekly income ($372 pw).

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Table 10.

Effect size estimates of dichotomous and continuous adult outcome measures (ages 30-35) and latent class membership compared against the non-drinkers class (class 1).

Measure	Non-disordered (Class 2) vs Non-drinkers (Class 1)		Adulthood drinkers (Class 3) vs Non-drinkers (Class 1)		Early onset disordered desisting (Class 4) vs Non-drinkers (Class 1)		Late onset disordered chronic (Class 5) vs Non-drinkers (Class 1)	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Substance use disorder								
Cannabis dependence	3.568	2.333	1.065	1.270	**9.355**	2.724	1.841	.819
OR (95% CI)	(.460, 27.652)	(.281, 19.346)	(.106, 10.377)	(.120, 13.390)	**(1.173, 74.605)**	(.285, 26.040)	(.203, 16.717)	(.076, 8.824)
P <.05	.223	.433	.957	.842	**.035**	.384	.588	.869
Nicotine dependence	1.049	1.163	.648	.746	**3.761**	2.332	**2.128**	2.163
OR (95% CI)	(.516, 2.130)	(.495, 2.734)	(.299, 1.404)	(.280, 1.989)	**(1.776, 7.966)**	(.886, 6.139)	**(1.042, 4.348)**	(.861. 5.439)
P <.05	.895	.729	.271	.559	**.001**	.086	**.038**	.101
Mental health								
Major depression	1.164	1.060	**.455**	.521	1.674	1.212	.660	.768
OR (95% CI)	(.653, 2.074)	(.545, 2.061)	**(.236, .880)**	(.239, 1.134)	(.859, 3.264)	(.532, 2.761)	(.343, 1.270)	(.350, 1.686)
P <.05	.607	.864	**.019**	.101	.130	.647	.213	.511
Any anxiety disorder	.788		.670		1.729		.828	
OR (95% CI)	(.417, 1.490)		(.341, 1.314)		(.852, 3.510)		(.416, 1.638)	
P <.05	.464		.244		.130		.584	
Psychoses symptoms	.476	.894	**.190**	.543	1.108	1.367	.632	.876
OR (95% CI)	(.184, 1.232)	(.234, 3.419)	**(.054, .665)**	(.110, 2.686)	(.395, 3.108)	(.309, 6.043)	(.232, 1.720)	(.200, 3.838)
P <.05	.126	.869	**.009**	.454	.846	.680	.369	.861

Suicidal ideation	2.048	1.448	.885	1.021	4.117	1.492	1.618	1.324
OR (95% CI)	(.459, 9.127)	(.280, 7.500)	(.169, 4.645)	(.157, 6.632)	(.865, 19.589)	(.232, 9.607)	(.329, 7.952)	(.214, 8.197)
P <.05	*.347*	*.659*	*.885*	*.983*	*.075*	*.673*	*.553*	*.763*
Life stress measure	**2.05**	.694	1.74	.606	**2.64**	.584	**4.06**	**1.651**
Mean difference	**(.046, 2.012)**	(-.449, 1.838)	(-.1165, 1.916)	(-.614, 1.826)	**(.410, 2.788)**	(-.846, 2.015)	**(1.127, 3.235)**	**(.367, 2.935)**
(95% CI)								
P <.05	***.040***	*.234*	*.083*	*.330*	***.008***	*.423*	***<.001***	***.012***

<u>Socioeconomic</u>

Unemployment of at least 3 months	**.434**	.600	**.209**	**.272**	.890	.738	**.407**	.454
OR (95% CI)	**(.224, .841)**	(.272, 1.324)	**(.093, .470)**	**(.100, .739)**	(.420, 1.885)	(.278, 1.955)	**(.193, .857)**	(.176, 1.173)
P <.05	***.013***	*.206*	***<.001***	***.011***	*.760*	*.541*	***.018***	*.103*
Owns own home	1.532	1.378	**2.351**	**1.956**	1.008	.023	1.331	1.247
OR (95% CI)	(.947, 2.476)	(.784, 2.423)	**(1.428, 3.870)**	**(1.070, 3.576)**	(.562, 1.808)	(.501, 2.088)	(.796, 2.226)	(.662, 2.351)
P <.05	*.082*	*.266*	***.001***	***.029***	*.978*	*.950*	*.276*	*.495*
Unemployment	**.434**	.477	**.204**	**.253**	.895	.660	**.294**	**.292**
OR (95% CI)	**(.219, .857)**	(.212, 1.075)	**(.088, .475)**	**(.092, .690)**	(.414, 1.933)	(.240, 1.816)	**(.129, .671)**	**(.106, .806)**
P <.05	***.016***	*.074*	***<.001***	***.007***	*.778*	*.422*	***.004***	***.018***
Welfare dependence	.574	.764	**.221**	**.376**	1.066	.756	**.446**	**.413**
OR (95% CI)	(.326, 1.010)	(.374, 1.563)	**(.111, .440)**	**(.159, .888)**	(.555, 2.046)	(.313, 1.823)	**(.235, .846)**	**(.174, .979)**
P <.05	*.054*	*.462*	***<.001***	***.026***	*.848*	*.533*	***.013***	***.045***
Life satisfaction score	-.029	-.616	1.36	.107	-1.66	-1.167	-.039	-.280
Mean difference	(-1.27, .944)	(-1.85, .626)	(-.349, 1.942)	(-1.219, 1.432)	(-2.475, .205)	(-2.721, .388)	(-1.421, .953)	(-1.676, 1.115)
(95% CI)								
P <.05	*.772*	*.330*	*.173*	*.874*	*.097*	*.141*	*.699*	*.693*
NZSEI score (an SES measure)	2.872	1.663	**7.311**	4.067	-4.424	-.975	1.098	.929
Mean difference	(-1.694, 7.437)	(-3.176, 6.504)	**(2.638, 11.983)**	(-1.043, 9.177)	(-9.925, 1.078)	(-7.027, 5.079)	(-3.735, 5.932)	(-4.434, 6.292)
(95% CI)	*.217*	*.50*	***.002***	*.119*	*.115*	*.752*	*.656*	*.752*
P <.05								

Investments value	25867.230	13855.91	**79054.359**	**50365.55**	72790.564	12804.34	**40149.175**	27071.43
Mean difference (95% CI)	(-8696.809, 60431.269)	(-26095.61, 53807.44)	**(43372.619, 114736.009)**	**(7775.571, 92955.53)**	22924.179 (-19154.516, 65002.874)	(37166.22, 62774.9)	**(3133.335, 77165.015)**	(17791.94, 71934.81)
P <.05	*.142*	*.496*	***<.001***	***.021***	*.285*	*.615*	***.034***	*.237*
Net weekly income	204.574	65.895	**655.723**	**371.878**	167.262	65.107	**508.768**	255.036
Mean difference (95% CI)	(-7.780, 416.929)	(-181.434, 313.225)	**(436.197, 875.249)**	**(107.948, 635.809)**	(-90.597, 425.121)	(-244.777, 374.991)	**(281.113, 736.404)**	(-22.640, 532.712)
P <.05	*.059*	*.601*	***<.001***	***.006***	*.203*	*.680*	***<.001***	*.072*
Social/family outcomes								
Dependent child	.954	.763	.740	.591	1.005	.717	**.592**	.525
OR (95% CI)	(.581, 1.566)	(.422, 1.378)	(.445, 1.231)	(.316, 1.107)	(.551, 1.832)	(.343, 1.496)	**(.351, .999)**	(.272, 1.011)
P <.05	*.853*	*.370*	*.246*	*.100*	*.987*	*.375*	***.050***	*.054*
Arrested	2.048	1.639	1.807	1.224	**5.141**	1.090	**4.971**	1.739
OR (95% CI)	(.459, 9.127)	(.342, 7.828)	(.388, 8.411)	(.232, 6.462)	**(1.108, 23.864)**	(.189, 6.296)	**(1.136, 21.759)**	(.346, 8.750)
P <.05	*.347*	*.535*	*.451*	*.812*	***.037***	*.923*	***.033***	*.502*
Convicted	3.854	3.407	3.655	2.007	**9.355**	1.324	6.804	2.505
OR (95% CI)	(.500, 29.720)	(.418, 27.748)	(.461, 28.976)	(.219, 18.373)	**(1.173, 74.605)**	(.129, 13.538)	(.880, 52.586)	(.286, 21.915)
P <.05	*.195*	*.252*	*.220*	*.537*	***.035***	*.813*	*.066*	*.407*
Intimate partner violence perpetration	1.263		.877		1.573		2.138	
OR (95% CI)	(.566, 2.819)		(.372, 2.070)		(.627, 3.946)		(.946, 4.834)	
P <.05	*.569*		*.765*		*.334*		*.068*	
Cohabiting with a partner	.034	-.533	-.040	-.758	.081	-.474	**-1.537**	**-1.900**
Mean difference (95% CI)	(-1.226, 1.294)	(-1.962, .896)	(-1.342, 1.263)	(-2.284, .767)	(-1.443, 1.605)	(-2.263, 1.315)	**(-2.888, -.187)**	**(-3.505, -.294)**
P <.05	*.958*	*.464*	*.952*	*.329*	*.917*	*.603*	***.026***	***.020***

Reference category is non-drinkers
Bold factors were statistically significant (p<.05)

4. DISCUSSION

4.1 Current study

The current study used data from a longitudinal birth cohort to investigate predictive factors and adult outcomes associated with alcohol use trajectories over the life course within a New Zealand cohort. The study fit latent trajectory models which enabled researchers to compare abuse exposure, family functioning, individual, socio-economic, and childhood behavior characteristics of different trajectory groups from ages 15-35. It was hypothesized the childhood and adolescent factors of socio-economic status, parental drug use, and childhood adversity would predict the trajectories of alcohol use over the life course. It was also hypothesized that alcohol use trajectories will be associated with offending variables (arrest, conviction, intimate partner violence) and socio-economic variables (socio-economic index, unemployment, welfare dependence) both before and after adjustment for covariate factors.

The study identified that over the life-course, almost the entire cohort used alcohol to some extent. When investigating the data, a pattern emerged where rates of frequent alcohol use for groups which consumed alcohol typically increased during adolescence and persisted to age 35. The AUD data followed a pattern where rates of AUD generally increased rapidly during adolescence, peaked around age 21, then tapered off into adulthood. The latent trajectory classes early onset disordered desisting (class 4) and late onset disordered chronic (class 5) which were described by disordered drinking patterns, typically had greater levels of covariate factors and higher scores on adverse adult outcomes compared to the non-drinker class (class 1). The adulthood drinking latent class (class 3) had higher scores of socio-economic outcomes relative to the non-drinker class (class 1).

The hypothesis that the factors of socio-economic status, parental drug use, and childhood adversity would predict alcohol use trajectories over the life course was partially supported. The measure of socio-economic status at birth was not a significant predictive factor. However, average family living standards (a different indicator of socio-economic status) was significant. Parental alcohol use was not significant yet, parental attitudes towards alcohol use was significant in predicting alcohol use trajectory membership. Childhood adversity in the form of exposure to childhood sexual abuse to age 16 was another significant factor within the model.

The second hypothesis that the offending variables (arrest, conviction, intimate partner violence) and socio-economic outcomes variables (socio-economic status, unemployment, welfare dependence) will be predicted by alcohol use trajectory assignment was partially supported. The offending outcome variables of arrest and conviction were significant before adjustment for covariates, however after adjustment they were no longer significant. Intimate partner violence was not a significant outcome variable. The socio-economic outcome variables of unemployment and welfare dependence were significantly predicted by trajectory assignment both before and after adjustment for covariates. Socio-economic index was only significantly predicted by alcohol use trajectory membership prior to adjustment for covariates.

4.2 Age and gender trends

Age related findings indicating that the majority of the cohort began drinking between age 15 and 18 with the greater part of the cohort either infrequent or frequently drinking from age 18 onwards, were generally consistent with existing literature. The finding that AUD increased rapidly during adolescence, peaked around age 21, and then tapered off into adulthood was also supported in the literature.

The New Zealand Health Survey found the majority of adults in New Zealand consumed alcohol and that the proportion of New Zealanders using alcohol increased rapidly from age 15 to 19, peaked between 18 to 24 years old, and then remained high into adulthood (MOH, 2015) which was observed within our findings. The report also noted frequent alcohol use persisted into adulthood and that a greater percentage of youth and young adults reported heavy drinking and binge drinking, reducing rapidly with age which is reflected in the current study through comparable age related rates of AUD.

The rates of alcohol consumption in the current study were higher than the results reported by the Ministry of Health (MOH) in the New Zealand Alcohol and Drug Use Survey (2009). The MOH reported 86.1% of New Zealand adults aged 18-24 had consumed alcohol in the past 12 months compared to 93.1% at age 18 and 95.9% at age 25 in the current study. Adult drinking rates were also higher in the current study with 94.2% at age 30 and 92.6% at age 35 having consumed alcohol the past 12 months compared to 85.7% of adults aged 25-34 in the MOH survey.

Additionally, Wells (2006) identified 7.1% of New Zealand adults aged 16-24 met criteria for an AUD over the past 12 months in the New Zealand Mental Health Survey compared to 19.4% at age 18 and 13.6% at age 25 in the current study. Wells noted that the prevalence of AUD may have been underestimated due to the version of interview used therefore, the results in the current study are more likely to reflect the true rates. It is also probable the higher rates found in the results of the current study reflected more accurate responses from participants due to a greater degree of trust when discussing potentially taboo subjects such as alcohol use and associated problems with interviewers as a result of their extended involvement and participation with the Christchurch Health and Development Study.

Researchers such as Schulenberg & Maggs (2002) have attempted to explain age related changes in alcohol use behaviors as a function of contextual and developmental changes such as moving to college during adolescence and other developmental transitions. It has also been proposed that age related trends are driven by conformity motives, key life events such as parenthood, social motives, and other reasons such as enjoyment (Bachman et al., 1997; Borschmann et al., 2019; Chassin et al., 2002; Kuntsche et al., 2005). Additionally, neurobiological research proposes age related trends of alcohol use are related to periods of increased vulnerability to the neurobiologically motivating properties of alcohol in adolescence due to an imbalance between early emerging "bottom-up" motivational systems and later emerging "top-down" cognitive systems (Casey & Jones, 2010; Gladwin et al., 2011). This suggests reasons for age related trends in alcohol use are multi-faceted and driven by a range of factors. This applies to the current study as the estimation of latent trajectory classes, which characterized several notable age related relationships, was fitted from an extensive set of factors which is explored further in section 4.4.

Consistent with our findings, many previous studies have identified a gender difference where males are more likely to have an AUD and use alcohol frequently than females (Hanna & Grant, 1997; MOH, 2015; Nolen-Hoeksema, 2004; Kahn et al., 2011). The mechanisms which underlie the gender difference in AUD and alcohol use behaviors are debated however, it appears social norms (Nolen-Hoeksema, 2004), heritability (King et al., 2005), physiological responses (Nolen-Hoeksema & Hilt, 2006) and greater levels of impulsivity and sensation seeking among men (Petry et al., 2002) may contribute to their development.

4.3 Age and ethnicity trends

The current study identified Māori rates of AUD exceeded that of non-Māori rates during adolescence which was consistent with findings from the Dunedin Multidisciplinary Health & Development Study (DMHDS) who found Māori rates of SUD exceeded that of non-Māori rates at ages 14-15 and at age 18 (Fergusson et al., 2003). Findings indicated Māori rates of AUD also exceeded that of non-Māori rates in early adulthood. This finding was consistent with previous research on the DMHDS cohort which identified Māori rates of SUD also exceed that of non-Māori rates in young adulthood (Fergusson et al., 2003). Previous research by Baxter et al. (2006) and Oakely-Brown et al. (2006) identified lifetime rates of SUD for Māori exceeded that of non-Māori rates. However, when investigating specific age periods, the current study found that from age 30-35 Māori rates of AUD diminished to that of non-Māori rates and remained comparable. This finding was novel and replicated an international finding from Muthen & Muthen (2000) who found that in a US national sample, ethnicity differentials of heavy drinking seen in the 20's diminish when individuals reach their 30's. Explanations for this finding were not investigated in the current study and remain an area for further research.

The health disparities experienced by Māori must be considered in a New Zealand context through a social-structural model proposed by Reid et al. (2014). This model demonstrates how historical trauma, inflicted during the colonization process, has left Māori structurally disadvantaged which is transmitted across generations and can manifest as a vulnerability to mental health disorders for Māori in New Zealand. The mechanisms of colonization including large scale displacement, economic and psychological marginalization, and loss of resources inflicted trauma which is transmitted through means such as structural

poverty and is manifested as a vulnerability to mental health outcomes. Shapero and Steinberg

(2013) reported that low household income during childhood was associated directly with

elevated rates of emotional and behavioral problems in adolescence. Māori are more likely to be

born into environments with elevated rates of socio-economic disadvantage, parental alcohol

abuse, and lower average living standards (Gillies, 2015). Gillies reported that after controlling

for socio-economic disadvantage, associations between Māori ethnicity and internalizing

disorder rates reduced to statistic insignificance. Therefore, it is important to consider contextual

contributing factors when examining Māori mental health trends.

4.4 Predictive factors

The current study identified the factors of average family living standards, paternal care

scale, parental attitudes toward child's alcohol consumption, gender (male), ethnicity, (Māori),

extraversion, self-esteem, attention problems and novelty seeking as being significantly

associated with predicting alcohol use trajectory membership. A key finding was individuals in

the latent classes characterized by high rates of AUD; early onset disordered desisting (class 4)

and late onset disordered chronic (class 5), had greater level of predictive factors than the non-

drinking (class 1) and non-disordered (class 2) classes. These findings on childhood and

adolescent factors were consistent with existing literature which found adverse alcohol use

trajectories are predicted from a range of socio-demographic, familial, individual, and other

factors earlier in life (Boden et al., 2019a; Chassin et al., 2002; Hawkins et al., 1992; Lee et al.,

2010; Poikolainen, 2000).

A systematic review demonstrated that childhood adversities have a cumulative effect

where exposure to a greater number of adversities results in a greater risk of psychopathology

including AUD (Jacobs et al., 2012; Kessler et al., 2012). A study by Hayatbakhsh et al. (2009) found that exposure to multiple risk factors in early life course cumulatively increased the likelihood of developing CUD by early adulthood. Risk cumulation theory states risk factors accumulate towards an increasing likelihood of using and abusing drugs and can be used to explain the role multiple risk factors have on later substance use (Hops et al., 2000). This theory is consistent with our findings as those in the disordered latent classes (class 4 & 5) typically had greater exposure to childhood predictive factors than those in the non-drinker (class 1) and non-disordered classes (class 2). This finding highlights the importance to collectively consider predictive factors and the impact commonly occurring factors have on increasing the likelihood of AUD rather than addressing factors individually.

4.5 Adult outcomes

The current study found the adult outcomes variables of unemployment of 3+ months, home ownership, unemployment, welfare dependence, investments value, weekly income, life stress, and living with a partner as significant outcomes associated with at least two latent trajectory classes. This was consistent with findings from Boden et al. (2019b) who investigated outcomes associated with latent trajectories of cannabis use over the life course and indicated that alcohol and cannabis misuse have common adverse outcomes. Similar international research has also identified associations between alcohol use and adverse mental health, socio-economic, and social/family outcomes later in life (Viner & Taylor, 2007). An area for future research was identified where adult outcomes of alcohol use trajectories have not been examined utilizing longitudinal data for later periods in the life-course such as late adulthood.

The current study also found that those in the late onset disordered chronic class (class 5) typically were associated with higher levels of adverse adult outcomes later in life, evidenced by

higher rates of life stress and lower rates of cohabiting with a partner (consistent with Patton et al., 2007). Patton et al. (2007) examined alcohol use trajectories from adolescence through to young adulthood in a large Australian cohort study and also reported that the high risk alcohol use classes were regularly associated with higher rates of adverse adult outcomes including lower rates of being in a relationship, higher rates of cigarette smoking, and higher rates of other illicit drug use compared to the low risk class. It is plausible that high risk alcohol consumption is directly linked to higher levels of life stress and cohabiting with a partner however, the current study did not control for every covariate so it is possible alternative explanations which can explain this pathway exist. The present study also did not find a relationship between high risk alcohol consumption and other common related mental health and social outcomes which suggests the outcomes found in the current study are only indirectly associated with alcohol use trajectories, rather than being directly caused by them.

The finding that those in the adulthood drinker's class (class 3) typically had higher levels of socio-economic outcomes than the non-drinkers class (class 1) was consistent with findings from Viner and Taylor (2007) who reported frequent drinking was not associated with adverse outcomes but was associated with higher adult social class. The researchers attributed this to habitual frequent alcohol consumption being a separate behavioral pattern to binge drinking where there were less risks to later socio-economic, social, and educational adversity.

Associations between adult outcomes and alcohol use typically weakened after adjusting for childhood co-variates. This effect may have been due to sources of variation unaccounted for in the model which would weaken the association of outcomes. Further research should

determine which factors were responsible for reducing the strength of associations in the current model and measure their effect.

4.6 Implications

The study found that a range of factors including average family living standards, paternal care scale, parental attitudes toward child's alcohol consumption, gender (male), ethnicity (Māori), extraversion, self-esteem, attention problems and novelty seeking predicted alcohol use trajectory membership. These findings could be used to assist with delivering early interventions and education to areas of the population who are most at risk to reduce subsequent later harms from developing by tailoring public health policies regarding alcohol use.

The findings from the current study also demonstrated that the non-drinking, non-disordered, and adulthood drinking classes experienced lower rates of harmful outcomes in adulthood compared to the disordered alcohol users in the heavier use classes. This suggests harmful effects of alcohol emerge through high risk alcohol consumption and that policy and prevention approaches could reduce harm through addressing current cultural attitudes towards heavy alcohol use, advocating for reducing harm throughout the life-course, and promoting drinking in moderation as an alternative to heavy alcohol use for those who do wish to consume alcohol (Butt et al., 2011).

4.7 Strengths and limitations

A strength of the research was the sample size which remained substantial to age 35. This was beneficial for reducing the margin of error within results, giving the study greater power to detect differences, ensuring the results are relevant beyond the sample, and further informing our understanding of adult drinking behaviors. Another strength was the prospective

assessment of cohort members throughout the life course. This was useful for measuring the impacts of drinking behaviors from as young as 15 on long term outcomes in adulthood.

A limitation of the current study was the entropy of the selected model was not extremely high. This meant the model was not as accurate as desirable and introduced additional variation which may have reduced the strength of outcome associations. Another limitation identified was that it is possible that there were sources of variation that were not assessed. Therefore, it is unlikely all the variance was accounted for when calculating the adjusted outcome associations. A final limitation was the self-reporting of drinking behaviors may have introduced a source of information bias. However, research has demonstrated self-reporting is a reliable and valid method for measuring alcohol consumption (Del Boca & Darkes, 2003).

4.8 Conclusions

In conclusion, the current study utilized longitudinal data to demonstrate that various childhood and adolescent factors were able to predict later membership of various alcohol use trajectories. A key finding was trajectory membership to latent classes characterized by AUD was predicted from higher rates of early life factors than those in the non-drinking and non-disordered classes.

The research also determined pathological alcohol use was associated with subsequent adverse outcomes in adulthood. The results established that problematic alcohol consumption behaviors put individuals at risk of harm to later health and social wellbeing.

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APPENDIX

Table A11 and A12 present the rates of AUD and rates of frequent drinking ("at least weekly" to "daily drinking") in table format for the five latent class model.

Table A11.

Rates of AUD at each age for the 5 latent class model.

Percentage	Age 15	Age 18	Age 21	Age 25	Age 30	Age 35
Non-drinkers	.011	.033	.02	0	.011	0
Non-disordered	0	.074	.078	.07	.004	.019
Adulthood drinkers	.014	.043	.113	.044	.032	.043
Early onset disordered desisting	.176	.581	.367	.132	.053	.027
Late onset disordered chronic	.045	.416	.6	.415	.295	.327

Table A12.

Rates of frequent drinking ("at least weekly" to "daily drinking") at each age for the 5 latent class model.

Percentage	Age 15	Age 18	Age 21	Age 25	Age 30	Age 35
Non-drinkers	.037	.007	.034	.063	0	0
Non-disordered	.003	.198	.176	.301	.368	.25
Adulthood drinkers	.056	.348	.646	.798	.886	.93
Early onset disordered desisting	.198	.717	.631	.188	.29	.226
Late onset disordered chronic	.12	.681	.885	.897	.888	.811

Table A13 presents the bivariate associations of childhood behavior, family, socio-economic, and individual factors to examine if factors distinguished between latent class memberships using a chi square test of independence. Significant factors were then imputed to a multinomial logistic regression.

Table A13.

All childhood covariates predicting latent class membership of alcohol use (with non-drinkers as the reference class).

Measure	Non-drinkers (class 1) Mean Score	Non-disordered (class 2) Mean Score OR (95% CI) B (SE) p	Adulthood drinkers (class 3) Mean Score OR (95% CI) B (SE) p	Adolescent onset disordered desisting (class 4) Mean Score OR (95% CI) B (SE) p	Late onset disordered chronic (class 5) Mean Score OR (95% CI) B (SE) p	Overall effect p
Gender (Male)	1.63	1.61 .891 (.562, 1.412) -.116 (.235) .623	**1.45 .475 (.295, .764) -.745 (.243) .002**	1.56 .729 (.420, 1.265) -.317 (.281) .260	**1.30 .249 (.151, .413) -1.389 (.257) <.001**	<.001
Conduct problems (age 7-9)	50.19	49.25 .983 (.954, 1.012) -.017 (.015) .253	**48.50 .966 (.936, .998) -.034 (.016) .036**	**52.88 1.034 (1.002, 1.068) .034 (.016) .037**	50.86 1.010 (.980, 1.041) .010 (.015) .505	<.001
Attention problems (age 7-9)	20.87	**19.65 .952 (.912, .995) -.049 (.022) .028**	**19.04 .922 (.880, .967) -.081 (.024) .001**	21.38 1.017 (.968, 1.069) .017 (.025) .506	20.86 1.000 (.956, 1.046) .000 (.023) .987	<.001
Parental alcohol problems (age 11)	.111	.120 1.104 (.533, 2.289) .099 (.372) .790	.065 .530 (.231, 1.215) -.635 (.423) .134	**.247 2.788 (1.274, 6.099) 1.025 (.399) .010**	.125 1.162 (.535, 2.524) .150 (.396) .705	<.001
Novelty seeking (age 16)	16.095	**17.520 1.064 (1.016, 1.115) .062 (.024) .009**	**17.727 1.074 (1.023, 1.128) .072 (.025) .004**	**20.457 1.220 (1.149, 1.295) .199 (.031) <.001**	**20.041 1.196 (1.134, 1.260) .179 (.027) <.001**	<.001
Average family income ages 0-10 (ranked)	45.340	49.904 1.011 (1.00, 1.022) .011 (.006) .054	**55.041 1.023 (1.011, 1.035) .023 (.006) <.001**	45.805 1.01 (.988, 1.014) .001 (.007) .869	**53.972 1.021 (1.009, 1.033) .020 (.006) .001**	<.001
Average family living standards ages 0-10	30.051	**29.082 .945 (.895, .998) -.057 (.028) .041**	**27.117 .855 (.807, .905) -.157 (.029) <.001**	30.195 1.008 (.945, 1.076) .008 (.033) .802	**27.788 .882 (.832, .935) -.126 (.030) <.001**	<.001
Changes of parental figures to age 15	1.622	1.127 .922 (.846, 1.004) -.082 (.043) .06	**.706 .808 (.725, .901) -.213 (.055) <.001**	2.296 1.062 (.976, 1.157) .060 (.043) .164	1.136 .923 (.840, 1.015) -.08 (.048) .098	<.001

Extraversion age 14	21.512	22.572 1.049 (.997, 1.104) .048 (.026) .063	**23.860** **1.120 (1.061, 1.182)** **.113 (.028)** **<.001**	**24.476** **1.160 (1.086, 1.239)** **.149 (.034)** **<.001**	**23.799** **1.116 (1.056, 1.180)** **.110 (.028)** **<.001**	<.001
Neuroticism age 14	14.976	14.464 .969 (.915, 1.027) -.031 (.030) .293	**13.413** **.894 (.839, .954)** **-.112 (.033)** **.001**	14.848 .993 (.926, 1.063) -.007 (.035) .833	14.123 .947 (.889, 1.009) -.054 (.032) .091	.001
Paternal education level	1.722	1.670 .914 (.675, 1.237) -.09 (.154) .560	1.817 1.170 (.859, 1.595) .157 (.158) .320	**1.468** **.613 (.414, .906)** **-.490 (.199)** **.014**	1.750 1.048 (.759, 1.447) .047 (.165) .776	.001
GPA ages 11-13	2.812	**2.494** **.645 (.497, .837)** **-.439 (.133)** **.001**	**2.393** **.555 (.422, .731)** **-.589 (.140)** **<.001**	2.631 .783 (.572, 1.072) -.244 (.160) .127	**2.592** **.742 (.561, .981)** **-.298 (.142)** **.036**	<.001
IQ score ages 8-9	98.226	**102.203** **1.018 (1.003, 1.034)** **.018 (.008)** **.017**	**107.037** **1.044 (1.027, 1.061)** **.043 (.008)** **<.001**	101.373 1.014 (.996, 1.033) .014 (.009) .126	**103.867** **1.027 (1.010, 1.044)** **.026 (.008)** **.002**	<.001
Maternal age at cohort member's birth	25.684	25.597 .996 (.951, 1.044) -.004 (.024) .872	26.665 1.042 (.993, 1.094) .041 (.025) .093	24.991 .969 (.914, 1.026) -.032 (.029) .281	25.798 1.005 (.856, 1.057) .005 (.026) .844	.014
Maternal care scale score age 16	29.575	30.328 1.020 (.981, 1.060) .020 (.020) .320	**31.350** **1.054 (1.010, 1.099)** **.052 (.021)** **.015**	27.941 .966 (.925, 1.009) -.034 (.022) .119	29.633 1.001 (.962, 1.043) .001 (.021) .946	<.001
Maternal education level	1.592	1.708 1.222 (.907, 1.645) .2 (.152) .187	**1.788** **1.389 (1.022, 1.887)** **.328 (.156)** **.036**	1.522 .875 (.604, 1.269) -.133 (.189) .482	1.723 1.252 (.911, 1.720) .225 (.162) .165	.018
Maternal overprotection scale score age 16	7.225	7.617 1.010 (.971, 1.052) .010 (.020) .614	6.454 .978 (.937, 1.020) -.022 (.022) .303	**10.059** **1.065 (1.018, 1.115)** **.063 (.023)** **.006**	7.898 1.017 (.975, 1.061) .017 (.022) .422	<.001
Parental attachment age 14	72.464	73.746 1.016 (.990, 1.043) .016 (.013) .233	**75.413** **1.042 (1.013, 1.072)** **.041 (.015)** **.004**	**69.457** **.971, (.943, 1.00)** **-.029 (.015)** **.047**	72.554 1.001 (.974, 1.029) .001 (.014) .941	<.001
Parental illicit drug use	.271	.264 .965 (.579, 1.606) -.036 (.260)	.180 .591 (.340, 1.028) -.528 (.283)	.290 1.098 (.594, 2.029) .094 (.313)	.268 .987 (.572, 1.704) -.013 (.279)	.067

		.890	.063	.795	.963	
Parental attitudes toward child's alcohol consumption age 15	2.444	2.658 1.306 (.996, 1.712) .267 (.138) .053	**2.900 1.806 (1.355, 2.408) .591 (.147) <.001**	**2.824 1.626 (1.171, 2.258) .486 (.168) .004**	**2.945 1.923 (1.428, 2.589) -.654 (.152) <.001**	<.001
Paternal care scale age 16	28.181	28.330 1.003 (.968, 1.039) .003 (.018) .873	29.358 1.025 (.987, 1.064) .025 (.019) .195	**23.174 .931 (.896, .968) -.071 (.020) <.001**	27.381 .986 (.950, 1.023) -.014 (.019) .446	<.001
Exposure to parental intimate partner violence to age 16	8.844	9.269 1.117 (.977, 1.276) .110 (.068) .106	8.923 1.027 (.891, 1.185) .027 (.073) .713	**10.532 1.285 (1.120, 1.475) .251 (.070) <.001**	9.053 1.066 (.924, 1.229) .063 (.073) .384	<.001
Parental history of depression/anxiety	.356	.276 .690 (.421, 1.129) -.371 (.251) .140	.285 .723 (.432, 1.209) -.324 (.262) .216	.380 1.109 (.621, 1.983) .104 (.296) .727	.292 .748 (.441, 1.267) -.291 (.269) .280	.223
Parental history of offending	.144	.132 .900 (.463, 1.753) -.105 (.340) .758	.083 .534 (.253, 1.124) -.628 (.380) .098	.213 1.603 (.760, 3.382) .472 (.381) .216	.149 1.033 (.511, 2.089) .033 (.359) .928	.019
Exposure to physical abuse in childhood	2.792	2.775 .956 (.663, 1.381) -.045 (.187) .812	**2.940 1.637 (1.083, 2.474) .493 (.211) .019**	**2.548 .60 (.399, .901) -.511 (.207) .014**	2.836 1.134 (.758, 1.696) .125 (.206) .542	<.001
Paternal overprotection scale age 16	6.306	6.654 1.009 (.968, 1.053) .009 (.021) .667	5.216 .967 (.925, 1.012) -.033 (.023) .148	**9.225 1.066 (1.017, 1.117) .064 (.024) .008**	6.741 1.012 (.968, 1.057) .011 (.023) .614	<.001
SES at birth (Elley-Irving)	3.612	3.711 1.051 (.898, 1.230) .049 (.080) .538	3.316 .863 (.733, 1.017) -.147 (.083) .863	**4.017 1.231 (1.014, 1.494) .208 (.099) .036**	3.460 .927 (.783, 1.098) -.076 (.086) .380	<.001
Coopersmith self-esteem age 15	38.321	**41.259 1.049 (1.011, 1.089) .048 (.019) .011**	**42.801 1.105 (1.060, 1.152) .100 (.021) <.001**	37.954 .973 (.934, 1.014) -.027 (.021) .192	**41.322 1.051 (1.010, 1.094) .050 (.020) .015**	<.001
Exposure to childhood sexual abuse to age 16	.448	.346 .887 (.699, 1.124) -.120 (.121) .321	**.181 .660 (.498, .874) -.415 (.143) .004**	.591 1.144 (.877, 1.491) .134 (.135) .321	**.230 .736 (.556, .973) -.307 (.143) .031**	<.001

Anxious/withdrawn behavior ages 7-9	27.093	**26.159** **.937 (.884, .993)** **-.065 (.030)** **.028**	**25.525** **.889 (.834, .946)** **-.118 (.032)** **<.001**	**26.046** **.929 (.863, 1.00)** **-.074 (.037)** **.049**	**25.676** **.901 (.844, .961)** **-.105 (.033)** **.002**	.003
Ethnicity (Māori)	.153	.160 1.053 (.569, 1.951) .052 (.314) .869	.089 .542 (.271, 1.082) -.612 (.353) .083	**.330** **2.731 (1.393, 5.354)** **1.005 (.344)** **.003**	.178 1.202 (.626, 2.307) 1.84 (.333) .581	<.001

Reference category is non-drinkers
Bold factors were statistically significant (p<.05)