Creation and checking of dataset for methamphetamine analyses, and preliminary analyses to determine data suitability

Christchurch Health and Development Study (University of Otago Christchurch) – Methamphetamine in New Zealand Research Programme

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31 May 2021

University of Otago

Project report

Contracting body name: Evidence-Based Policing Centre, New Zealand Police

Contract title: Christchurch Health and Development Study (University of Otago Christchurch) – Methamphetamine in New Zealand Research Programme

Notes: This is the report submitted to the EBPC for 31 May 2021 concerning Deliverable/Milestone 1

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The purpose of this report is to examine the extent to which the data obtained by the Christchurch Health and Development Study is adequate to examine issues associated with methamphetamine use in the cohort. Below we provide a description of the cohort, the manner in which the data have been obtained, cleaned and analysed, and a description of the relevant variables for each section of the work.

Summary

This report describes the data held by the Christchurch Health and Development Study that can be used for the purposes of investigating the causes and consequences of methamphetamine use in a cohort of approximately 1000 people born in Christchurch in mid-1977. An estimated 29% of cohort members reported trying methamphetamine on at least one occasion, while less than 7% reported using methamphetamine regularly (weekly or more often) at any time. The data show that there are several factors from childhood and adolescence that are related to a higher likelihood of using methamphetamine or having problems with methamphetamine. The data also show that there are a number of outcomes (including criminal offending and other adverse outcomes) that appear to be related to methamphetamine use and problems with methamphetamine use. The material presented in this report shows that the Christchurch Health and Development Study is well-placed to investigate methamphetamine use over the life course, and that a partnership between the Study and the New Zealand Police is likely to generate useful data and insights into methamphetamine use in New Zealand.

Contents

1. The Christchurch Health and Development Study

The Christchurch Health and Development Study (CHDS) is a birth cohort study comprising 1265 children (635 male, 630 female) born in Christchurch (New Zealand) in 1977 (1, 2). Members of the cohort were studied at birth and four months, then every year from age one to 16 years. Thereafter they were studied at age 18, 21, 25, 30, 35 and 40. Analyses reported here used exposure and outcome data from the last six waves of data collection. Participants and/or their parent provided signed consent. Currently, the CHDS has approval from the Southern Health and Disability Ethics Committee to conduct the study.

1.1 Sample Size and Sample Bias

The sample sizes for the present analyses were based on cohort members with at least one completed wave of data at ages 18, 21, 25, 30, 35, and 40 years. These sample sizes were 1025 (age 18), 1011 (age 21), 1003 (age 25), 987 (age 30), 962 (age 35), and 904 (age 40) representing 74-82% of the surviving cohort at each age. To examine the effects of sample losses on the representativeness of the sample, the obtained samples with complete data at each age, were compared with the remaining sample members on a series of socio-demographic measures collected at birth. This analysis suggested that there were statistically significant ($p<.01$) tendencies for the obtained samples to under-represent individuals from socially disadvantaged backgrounds characterized by low parental education, low socio-economic status and single parenthood. To address this issue, the data weighting methods described by Carlin et al. (3) were used 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.

1.2 Data cleaning and quality assurance

The CHDS employs a two-step process for the cleaning of data and quality assurance. First, when interviews are completed, the interviewer and a CHDS staff member go over each response in the booklet to ensure these have been entered correctly. In cases where there are errors, these are corrected, and when data are missing, the interviewer is asked to follow-up with the participant to obtain the missing data.

The second step takes place after the data are entered electronically into a SAS (4) database by trained data entry staff. A SAS data checking programme is run on each transcript to ensure that there are no out-of-range values or missing values. In cases where errors are found, data in the transcript are corrected manually.

2. Description of methamphetamine use variables

2.1 Methamphetamine use (ages 16-18, 18-21-21-25, 25-30, 30-35, and 35-40 years)

At each assessment from age 18 to age 40 cohort members were queried about their use of a range of illicit drugs. One aspect of this questioning concerned methamphetamine. The question stem was worded “Since you turned (age) have you used the following, and how often?”. The second part of the question listed a series of substances, with methamphetamine

use described as “Methamphetamine, speed, P, ice, etc.”[1] The following Table shows the response rates for this item for each assessment from age 18.

Table 1 Response rates for methamphetamine use

Assessment period	% reporting for each category					
	Never	Once or twice only	< monthly	At least monthly	At least weekly	Daily or more often
16-18 years	96.7	1.2	1.1	1	0.2	0.6
18-21 years	94.5	2.5	2.1	0.4	0.1	0.5
21-25 years	77.6	11.6	4.8	3.4	2.1	0.6
25-30 years	85.6	6.1	3.8	2.3	1.5	0.3
30-35 years	92.2	4.0	1.8	0.9	0.5	0.6
35-40 years	92.6	4.1	1.4	0.9	0.6	0.4

As can be seen in the Table, rates of methamphetamine use [2] were fairly low during any particular assessment period, with use peaking during the 21 to 25 age period. Most people who reported using methamphetamine did so only infrequently. Lifetime rates of any use of methamphetamine were approximately 29%.

Note that while “illicit drug use” was also assessed at ages 15 and 16, the format of the questionnaire does not allow us to ascertain whether meth/amphetamine was used.

2.2 Illicit drug use disorder

Also at each assessment from age 18, participants were asked a series of questions concerning problems associated with the use of illicit drugs other than cannabis (a separate section for problems associated with cannabis was also employed). While we did not query whether cohort members had problems associated with every possible drug, we did ask specifically about four classes of drugs, one of which was methamphetamine. Using this information, we were able to classify cohort members as to whether they met DSM-IV (5) criteria for illicit drug (methamphetamine) use disorder. The following table displays the percentage of those cohort members who met criteria for the disorder during each assessment period.

[1] The reference to “P” and “ice” first appeared in the age 30 (2007) assessment due to their common use as slang terms from that time.

[2] Advice from the New Zealand Police suggests that because of the age of the cohort, they would most likely have used methamphetamine rather than amphetamine sulphate.

Table 2 Percentage of the cohort meeting criteria for methamphetamine use disorder

Assessment period	% of the cohort reporting for each category		
	Used methamphetamine	Used methamphetamine regularly (at least weekly)	Met DSM criteria for methamphetamine use disorder
16-18 years	3.3	0.8	2.3
18-21 years	5.5	0.6	4.3
21-25 years	22.4	2.7	6.0
25-30 years	14.4	2.1	3.8
30-35 years	7.8	1.1	3.1
35-40 years	7.4	1.0	4.0

The Table shows that those who used early (prior to age 21) had relatively high rates of meeting criteria for methamphetamine use disorder, but these rates dropped considerably prior to age 30. Those using methamphetamine in their 30s again had a relatively high rate of methamphetamine use disorder. These data suggest that we will have sufficient power to examine the predictors of the transition from methamphetamine use to dependence (Milestone 5).

3. Predictors of methamphetamine use

We examined the database of the study to determine the variables that would be the most important and useful in examining the predictors of methamphetamine use over the lifespan (for Milestone 2).

The rationale for choosing particular variables from the database was as follows. The CHDS has a long history of examining substance use in the cohort, and in particular has been active in researching the life course factors that are associated with alcohol and illicit substance use, and alcohol and illicit substance use disorder. Variables were identified and chosen as to their likelihood of their being associated with illicit drug use and drug use disorder, on the basis of several previous CHDS publications examining alcohol use, cannabis use, and illicit drug use (6-13). In general, these variables can be described according to several categories:

1. Childhood socio-economic factors and demographic background. The variables representing “childhood socio-economic factors and demographic background” were chosen primarily from the first decade of life (many of these were measured at birth). These variables represent the socio-economic positioning of the family that the child was born into in 1977, which has been shown to be an important indicator of outcomes across the life course of the cohort (e.g. (14)). In cases where children were adopted, the data were drawn from the adoptive family rather than the birth family.
2. Family functioning. The variables chosen to represent “family functioning” pertain to several aspects of family life, including stability of parental figures, parental maladaptive behaviour, and the quality of the relationship between adolescents and parents. Previous CHDS research has shown that family functioning in middle childhood is an important predictor of

either positive or negative child outcomes (e.g. (15)), and more recent research suggests that relationships with parents can provide protection over the life course from the effects of childhood maladaptive behaviour (16), and problems with alcohol use (17).

3. Individual, personality and behavioural factors. The variables representing individual, personality and behavioural factors were chosen on the basis of that there are clear differences in outcomes over the life course for individuals depending upon their personal identity, gender, and early behaviour. Early behaviour, and in particular maladaptive behaviour, has been shown to be related to adverse psychosocial outcomes over the life course in CHDS data (14). Gender has been shown to be related to mental health outcomes, with males more likely to develop externalizing problems such as conduct disorder and substance use disorder (18), and females more likely to develop internalizing problems such as depression and anxiety (19). We have also shown that personality factors including neuroticism and novelty-seeking are also related to a number of life outcomes, particularly with respect to depression and substance use (20, 21). Finally, cognitive ability and school performance have also been shown to be associated with more positive outcomes, particularly with regard to educational pursuits (22, 23).
4. Abuse exposure. Exposure to abuse in childhood, whether directed at the child themselves (sexual or physical abuse), or exposure to parental intimate partner violence, has been shown in CHDS data to be significant predictors of later psychosocial functioning (24-28). In fact, it is important to note that exposure to sexual abuse in childhood is one of the strongest and most consistent predictors of mental ill health over the life course (29, 30).
5. Adolescent problem behaviour. Adolescence is a period marked by behavioural and emotional changes, and for many adolescents these changes result in poor psychological functioning and/or mental disorder. In the CHDS, adolescent mental health, including internalizing disorders (depression, anxiety) (31-33) and externalizing disorders (conduct disorder, oppositional/defiant disorder, attention deficit hyperactivity disorder) (34) have been shown to have consequences for psychosocial functioning over the life course. Furthermore, peer influence has also been shown to play an important role in the development and maintenance of maladaptive behaviour over the life course, but beginning primarily in adolescence (35-39).

The following childhood and adolescent variables were examined:

Family socio-economic and demographic background

Maternal age. Assessed at the time of the survey child's birth.

Family living standards (0-10 years). At each year a global assessment of the material living standards of the family was obtained by means of an interviewer rating. These were averaged over the period 0-10 years.

Maternal and paternal education (at birth). Parental education level was assessed at the time of the survey child's birth reflecting the highest level of educational achievement attained, using a three-level scale.

Family socioeconomic status (SES, at birth). Family SES was assessed at the time of the survey child's birth using the Elley-Irving (40) scale of socio-economic status for New Zealand.

Single parenthood (at birth). Family structure was assessed at the time of the survey child's birth.

Averaged family income (0–10 years). At each year, estimates of the family's gross annual income were obtained from parental report and were recoded into decile categories.

Māori ethnicity (at birth). Māori ethnicity was assessed at the time of the cohort member's birth.

Family functioning

Parental illicit drug use (0–11 years). At age 11, parents were questioned regarding their history of illicit drug use. The cohort member was classified as having a parent history of illicit drug use if one of his/her parents was reported to have a history of illicit drug use.

Parental alcohol problems (0–15 years). This was assessed at age 15 years via parental report. These reports were used to form a dichotomous measure of whether or not the young person's parents reported experiencing problems with alcohol.

Parental criminality (0–15 years). At age 15 years, parents were questioned as to whether any parent had a history of criminal offending. The cohort member was classified as having a parent history of criminality if one of his/her parents was reported to have a history of offending.

Changes of parents (to 15 years). At each assessment from birth to 15 years, information was gathered on changes in the cohort member's family situation since the previous assessment. Using this information an overall measure of family instability was constructed up to age 15.

Parental Bonding (Maternal and Paternal Care and Protection; 16 years). To measure parental bonding, the maternal care and protection scales of the Parental Bonding Instrument (PBI) (41) were administered to the cohort members at the age of 16 years. The young person was asked to rate her mother on the PBI items describing the quality of maternal 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. The reliabilities of the resulting scale scores were assessed using coefficient alpha and found to be good: maternal care $\alpha = .89$; paternal care $\alpha = .91$; maternal over protection $\alpha = .85$; paternal over protection $\alpha = .87$.

Individual, personality and behavioural factors

Gender. Recorded at birth.

Child conduct and attention problems, and anxious/withdrawn behaviour (7–9 years). When sample members were aged 7–9 years, information on child behaviour problems was obtained from parental and teacher report using a behaviour questionnaire combining items from the Rutter et al. (42) and Conners (43) parental questionnaires. ($\alpha = .97$; .93; and .92, respectively).

Neuroticism (14 years). This was assessed using a short form version of the Neuroticism scale of the Eysenck Personality Inventory (44) at age 14. ($\alpha = .80$).

Novelty-seeking (16 years). Novelty-seeking was assessed at age 16 using the novelty seeking items from the Tridimensional Personality Questionnaire (45), ($\alpha = .76$).

Childhood IQ (8-9 years). At ages 8 and 9 years cohort members were assessed using the revised version of the Wechsler Intelligence Scale for Children (WISC-R; 46) modified for New Zealand conditions. At each age total IQ scores were computed using the method described in the test manual. The reliabilities of these measures assessed by using split half methods ranged from .93 to .95. The IQ measure used in the present analyses was based on an average of the total IQ score at the two ages.

GPA (11-13 years). School performance was assessed via teachers' ratings in each of five areas of the curriculum (reading, handwriting, written expression, spelling, mathematics) using a 5-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.

Abuse exposure

Childhood sexual abuse (0-16 years). At ages 18 and 21 years sample members were questioned about their experience of sexual abuse during childhood (<16 years) (25). Questioning spanned an array of abusive experiences from episodes involving non-contact abuse (e.g. indecent exposure) to episodes involving attempted or completed intercourse. A four-level scale was devised reflecting the most extreme form of sexual abuse reported by the young person at either age.

Childhood physical abuse (0-16 years). At ages 18 and 21 years sample members were questioned about their experience of physical punishment during childhood (<16 years) (26). Questioning spanned an array of experiences with physical punishment and the frequency with which these occurred during childhood. A four-level scale was devised reflecting the most extreme form of physical punishment reported by the young person at either age.

Exposure to parental intimate partner violence (0-16 years). At the age of 18, sample members were questioned concerning their experience of violence between parental figures during their childhood (prior to age 16 years), with questions derived from Conflict Tactics Scale (CTS: 47). The items were chosen on the basis that the behaviours could have been readily observed and reported on by the participant, and also to span the potential range of violent behaviour from verbal abuse to physical assault. Separate questioning was conducted for violence initiated by the father against the mother and for violence initiated by the mother against the father, and combined into a single scale score representing overall exposure across both parents.

Adolescent problem behaviour

Information concerning disruptive childhood behaviour was obtained at two assessments taking place when the sample members were aged 15 and 16 years. At each age, sample members were interviewed on a comprehensive mental health interview that examined aspects of mental health and adjustment over the previous 12 months. A parallel interview was also conducted with the child's mother at each assessment stage.

Conduct disorder, oppositional defiant disorder, attention deficit hyperactivity disorder (14-16 years). As part of the assessments at each age information was obtained on DSM-III-R (48) symptom criteria for disruptive childhood behaviours, including conduct disorder (CD), oppositional defiant disorder (ODD), and attention deficit hyperactivity disorder (ADHD) (49). For child self-report, the assessment of ODD and ADHD was based on the relevant sections of the Diagnostic Interview Schedule for Children (DISC) (50), whereas CD was assessed using the Self-Report Early Delinquency (SRED) scale (51). For parental reports ODD and ADHD were assessed using items from the Revised Behavior Problems Checklist (RBPC) (52), and CD was assessed using a parent version of the SRED. The combined symptom data thus comprised information on DSM-III-R symptom criteria for two separate 12-month periods (ages 14-15 and 15-16 years) from two sources (parent, self-report).

Alcohol use disorders (15-16 years). At each interview at ages 15 and 16, cohort members were asked a series of questions concerning whether the individual experienced any problems relating to their drinking. This measure was based on the Diagnostic Interview Schedule for Children (DISC) (53), in order to obtain information pertaining to DSM-III-R (48) symptoms of alcohol abuse/alcohol dependence (alcohol use disorder). These data allowed classification of participants as to whether they meet DSM criteria for an alcohol use disorder; during the period following the previous assessment.

Internalizing disorders (14-16 years). Parallel to the assessment of disruptive behaviour disorders, ages 15 and 16 years cohort members and their parents were questioned about symptoms of major depression and anxiety disorders (generalized anxiety disorder; over-anxious disorder; social phobia; simple phobia) occurring in the previous 12 months using the relevant sections of the Diagnostic Interview Schedule for Children (DISC: 50). These items were used to classify participants according to DSM-III-R (48) symptom criteria for major depression and anxiety disorders. Participants were classified as having major depression or an anxiety disorder during the period 14-16 years if they met criteria for disorder on the basis of either self or parental report over the period 14-16 years.

Deviant peer affiliation (age 15). At the assessment at age 15, cohort members and their parents were asked to indicate how many of the child's friends were "deviant", defined as smoking cigarettes, drinking alcohol, using illicit drugs, or who committed crimes. The larger of the two answers (child; parent) was used as the measure.

3.1 Associations between predictors and lifetime methamphetamine use

Below are illustrated the associations between each of the childhood predictors detailed above, and lifetime methamphetamine use (ages 16-40). Spearman's *r* was used as the measure of association as lifetime methamphetamine use was a dichotomous variable, and many of the measures reported are also categorical in nature (Spearman's *r* is a non-parametric statistic, which therefore does not require an underlying assumption of a normal distribution of the two variables for which a correlation is being estimated).

For social research data such as that reported below, a correlation with an absolute value of 0 to 0.9 is considered "weak" in magnitude, 0.10 to 0.19 is considered "moderate", and 0.20 or higher is considered "strong". Significant associations are presented in the table below in bold (p-value). P-values refer to "probability values", which refers to the likelihood of error in conclusions drawn using the analysed data. Our maximum acceptable likelihood of error is set at 5% as a matter of convention. P-values larger than this are referred to as "non-significant", while p-values smaller than this are referred to as "significant" (and are shown in bold, with significance level noted at the foot of the Table).

Table 3 Associations between predictors and lifetime methamphetamine use

Measure	Any methamphetamine use	Regular (at least weekly) methamphetamine use
Measures of family socio-economic and demographic background		
Maternal age	-.03	**-.07***
Family living standards (0-10 years)	-.06	-.05
Maternal education	.00	.05
Paternal education	-.06	-.00
Family socioeconomic status	-.01	**-.09****
Single parenthood (at birth)	.02	.03
Averaged family income (0-10 years)	-.04	-.02
Māori ethnicity (at birth)	**.08***	**.08***
Measures of family functioning		
Parental illicit drug use (0-11 years)	.06	**.12*****
Parental alcohol problems (0-15 years)	.02	.06
Parental criminality (0-15 years)	.05	**.10*****
Changes of parents (to age 15 years)	**.07***	**.12*****
Maternal care (16 years)	-.04	-.03
Paternal care (16 years)	**-.09***	**-.08***
Maternal over-protection (16 years)	**.07***	.02
Paternal over-protection (16 years)	**.10****	.05
Individual, personality and behavioural factors		
Gender	**-.14*****	-.06
Child conduct problems (7-9 years)	**.09****	**.13*****
Child attention problems (7-9 years)	**.07***	**.11****
Anxious/withdrawn behaviour (7-9 years)	**-.09****	**.10****
Neuroticism (age 14)	-.06	**-.07***
Novelty-seeking (age 16)	**.22*****	**.16*****

Childhood IQ (ages 8-9)	.06	-.01
GPA (11-13 years)	-.00	.03
Abuse exposure		
Exposure to childhood sexual abuse (0-16 years)	-.02	.04
Exposure to childhood physical punishment (0-16 years)	.04	**.09****
Exposure to parental IPV (0-16 years)	.03	.04
Adolescent problem behaviour and mental health		
Conduct disorder (14-16 years)	**.19*****	**.16*****
Oppositional defiant disorder (14-16 years)	**.17*****	**.12*****
Attention deficit hyperactivity disorder (14-16 years)	**.11*****	**.07***
Alcohol use disorder (14-16 years)	**.10****	**.14*****
Major depression (14-16 years)	-.06	-.01
Anxiety disorder (14-16 years)	-.05	.02
Deviant peer affiliation (15 years)	**.16*****	**.15*****

* p < .05; ** p < .01; *** p < .001

As can be seen from the Table, childhood, family functioning and abuse exposure variables were for the most part not strongly associated with later methamphetamine use. On the other hand, behaviour problems (externalizing) in childhood and adolescence (and association with deviant peers) were moderately associated with later methamphetamine use. In terms of personality, novelty seeking was strongly associated with methamphetamine use (and moderately with regular use). The focus of prediction models will be the statistically significant (p < .05) variables noted above, although variables with a non-significant association will be used in analyses as these are often found to be associated with the exposure (methamphetamine use) when used in a set of multiple predictors.

It is also worth noting that the profile of predictors differs with respect to a person used methamphetamine at all, or used methamphetamine regularly (at least weekly) at some point. Predictors varied both in their strength of association with the methamphetamine variable, and whether they reached statistical significance. This implies that prediction models will need to be customized according to the dependent variable being modelled.

3.2 Correlates of methamphetamine use in adulthood (ages 16-40)

Several potential covariate [3] factors, measured contemporaneously with methamphetamine use, will also be employed as predictors of methamphetamine use. Previous CHDS analyses have shown that substance use in adulthood tends to "cluster" particularly in early adulthood,

[3] In this context, "covariate" refers to time-dynamic covariate factors that may influence the likelihood that an individual uses methamphetamine during any particular time period.

and specifically for illicit drugs in early and later adulthood (6, 8). In addition, mental health disorders such as depression and anxiety (54, 55), as well as life stress (56) and unemployment (57, 58) have also been shown to be associated with substance use outcomes in analyses of CHDS data. The variables chosen include:

Alcohol use disorders (16-40 years). At each interview from age 18 years, cohort members were asked a series of questions concerning whether the individual experienced any problems relating to their drinking. This measure was based on the Composite International Diagnostic Interview (CIDI) (59) at ages 18 , 21, 25, 30, 35 and 40 years, in order to obtain information pertaining to DSM-IV (age 18 and above) (60) symptoms of alcohol abuse/alcohol dependence (alcohol use disorder). These data allow classification of participants as to whether they meet DSM criteria for an alcohol use disorder; during the period following the previous assessment.

Mental health disorders (16-40 years). Cohort members completed the CIDI at ages 18, 21, 25, 30, 35, and 40 years. These data were used to classify individuals as to whether they met DSM-IV criteria for major depression and anxiety disorder over the intervals 15-18 years, 18-21 years, 21-25 years, 25-30 years, 30-35 years, and 35-40 years.

Other substance use disorders (16-40 years). Also at ages 18, 21, 25, 30, 35 and 40 years cohort members were questioned about their substance use behaviours and problems associated with substance use since the previous assessment (tobacco, cannabis), based on the CIDI (items for cigarette smoking were custom written). Using this information cohort members were classified as meeting DSM-IV criteria for nicotine dependence and cannabis dependence over the intervals 15-18 years, 18-21 years, 21-25 years, 25-30 years, 30-35 years, and 35-40 years (for nicotine dependence, the measure refers to current ND at ages 18, 21, 25, 30, 35 and 40 years).

Unemployment (18-40 years). At each assessment, starting at age 21, cohort members were asked whether they had been unemployed and looking for work for 3 or more months during any calendar year since the previous assessment (ages 18–21, 21–25, 25–30, 30–35, and 35-40 years).

Stressful life events other than unemployment (18-40 years). Life events were assessed for each 12-month period during ages 18–40 years using a 30-item inventory based on the Social Readjustment Rating Scale (61) 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 0 to 4 scale (0 = *no event*, 1 = *not upset or distressed*, 2 = *a little upset or distressed*, 3 = *moderately upset or distressed*, and 4 = *very distressed*). Using this information, a measure of exposure to stressful life events was created, 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 periods 18–21, 21–25, 25–30, 30–35, and 35-40 years.

The associations between these contemporaneous predictors and lifetime methamphetamine use are shown in the Table below.

Table 4 Associations between contemporaneous predictors and lifetime methamphetamine use

Measure	Any methamphetamine use	Regular (at least weekly) methamphetamine use
Alcohol use disorder (ages 16-40)	**.18*** **	**.09** **
Major depression (ages 16-40)	**.07***	**.07***
Anxiety disorder (ages 16-40)	.00	.00
Nicotine dependence (ages 16-40)	**.24*** **	**.13*** **
Cannabis use disorder (ages 16-40)	**.26*** **	**.15*** **
Unemployment (ages 18-40)	**.18*** **	**.08***
Life stress (ages 18-40)	**.22*** **	**.10** **

* p < .05; ** p < .01;*** p < .001

As can be seen in the Table, the contemporaneous measures are associated with lifetime methamphetamine use (with the exception of anxiety disorder), and also with regular use, although the magnitude of association was smaller. Therefore each of these will be considered in the analyses.

4. Adult criminal offending variables

For the analysis to be reported for Milestone 3, we will use a series of variables representing different classes of self-reported criminal offending, modelling the association between each of these and methamphetamine use from ages 16 to 40. Where practicable, official record data concerning arrests and convictions will be similarly classified and used alongside the classifications described below. The classification of criminal offending is as follows.

At ages 18, 21, 25, 30, 35, and 40 respondents were questioned about their criminal behaviours since the previous assessment using the Self-Report Delinquency Inventory (SRDI) (62) by additional custom-written survey items. For the purposes of the present investigation, a number of classifications of types of offending were created using a subset of these questions. This information was used to derive both categorical (yes/no) and count measures of the number of self-reported offenses, across several categories, committed in the year prior to each assessment from age 18 to age 40. The classifications of offences and the items used to create these classifications are described below. The classifications included:

Assault. Assault was assessed via responses to three items concerning physical assault and fighting, including: assaulting a person with whom the respondent lived; assaulting a person with the idea of hurting them; and being involved in a gang (group) fight.

Use of a weapon. Use of a weapon was assessed using four items concerning: use of a weapon in a violent assault; using a weapon against someone with whom the respondent lived; aggravated robbery (using a weapon to rob a person or business); or carrying a hidden weapon.

Theft/burglary/vehicle conversion. This category was assessed by several items concerning: petty theft; grand theft (cash or goods over $500); theft from an automobile; breaking and entering; handling stolen goods; shoplifting; burglary; and taking and driving away an automobile without permission.

Property damage/vandalism/arson. These forms of offending were assessed via two items concerning: destroying or damaging property that did not belong to the respondent (vandalism); and setting fire to a house, building, car or other property.

Fraud/embezzlement/misappropriation of funds. Fraud and related offences were assessed by several items pertaining to: obtaining goods via deception; stealing money from employers or others whom had entrusted the respondent with money; failure to pay bills; and benefit fraud.

The associations between these criminal offending variables and lifetime methamphetamine use are shown in the Table below.

Table 5 Associations between classes of adult criminal offending (% reporting at least one of these types of crime) and lifetime methamphetamine use

Measure	Any methamphetamine use	Regular (at least weekly) methamphetamine use
Assault	**.14*** **	**.16*** **
Use of a weapon	**.15*** **	**.15*** **
Theft/burglary/vehicle conversion	**.20*** **	**.15*** **
Property damage/vandalism/arson	**.16*** **	**.18*** **
Fraud/embezzlement/misappropriation of funds	**.18*** **	**.14*** **

*** $p < .001$

The table clearly shows a set of robust associations between methamphetamine use and the five classes of self-reported criminal offending over the period 18-40 years, thus providing sufficient rationale for these analyses.

5. Adult outcome variables (age 40)

For the analyses for Milestone 4, we will examine the associations between family and related outcomes and use of methamphetamine over the life course, in order to determine the extent to which methamphetamine use leads to poorer outcomes in middle adulthood. In order to do this, we will extract from the CHDS database a series of variables describing individual and family outcomes at age 40. These measures will include:

Dependent children. Cohort members will be classified as to whether they have had at least one dependent child prior to the age 40 interview.

Marriage/partnership. Marriage/partnership outcomes at age 40 will consist of a classification of whether the cohort member reports being in a marriage or committed partnership.

Home ownership. Those cohort members who report owning their own home (as opposed to renting their home) will be classified as home owners at age 40.

Net family income. The cohort member's net family income at age 40 will be calculated, with amounts in foreign currency being converted to New Zealand dollars using estimates of the Purchasing Power Parities (63) for 2017.

Net investments. Each cohort member's net family investments at age 40 will also be calculated, using the same conversion procedure as the income measure.

Socioeconomic status (SES). SES at age 40 will be measured using the New Zealand Socioeconomic Index of Occupational Status (64).

Family living standards. Family living standards at age 40 will be measured using the Economic Living Standard Index (65).

The associations between these outcome variables at age 40, and lifetime history of methamphetamine use are shown in the Table below.

Table 6 Associations between individual and family outcome measures at age 40 and lifetime methamphetamine use

Measure	Any methamphetamine use	Regular (at least weekly) methamphetamine use
Dependent children	**-.08***	**-.08***
Marriage/partnership	**-.08***	.06
Home ownership	**-.11****	**-.14*****
Net family income	.06	**-.11*****
Net investments	.00	**-.08***
Socioeconomic status	-.05	**-.08***
Family living standards	-.04	**-.10***
Social support	.03	**.12*****
Life satisfaction	-.02	**-.08***
Self-esteem	-.00	.01

* p < .05; ** p < .01; *** p < .001

The table shows that a history of methamphetamine use over the life course was associated with a lower likelihood of being a parent and having a marriage/partnership at age 40, as well as a lower likelihood of home ownership, and a lower income, suggesting that these measures will be appropriate for the analyses examining the causal role of methamphetamine use in adverse life outcomes at midlife.

The table also shows that regular mathamphetamine use was associated with most of the life outcome variables measured at age 40, further suggesting that the proposed analyses should consider the associations between regular methamphetamine use and outcomes. Notably, there was a significant association between social support and regular methamphetamine use, with higher levels of social support being associated with regular use. This seemingly anomalous result will be investigated further.

6. Discussion

The data presented in this report show that, among the CHDS cohort, approximately 29% of participants reported using methamphetamine at least once, while fewer than 7% reported using methamphetamine regularly (at least weekly) or met the DSM criteria for methamphetamine use disorder at some point. While these represent relatively low rates of regular use and disorder, it remains possible to model the predictors and outcomes associated with regular use due to the size of the cohort (approximately 1000 participants over the period from age 16 years to age 40 years). Also, the data suggest that there are sufficient numbers of cohort members reporting methamphetamine use disorder that we will be able to fit models predicting the transition from methamphetamine use to methamphetamine use disorder (for the fifth report from CHDS to EBPC).

The data also show that there are robust associations between a series of predictors (from both childhood/adolescence and adulthood) and methamphetamine use/regular methamphetamine use. One of the key issues in tackling methamphetamine use from a population perspective is understanding the factors that are associated with an increased likelihood of using methamphetamine or transitioning to regular use of methamphetamine. A critical step in this process will be to develop multivariate models that are able to show which predictors are the strongest among those identified in the present report. Those analyses will be the focus of the second report for the EBPC from CHDS.

It is also important to note that there were robust associations between methamphetamine use/regular methamphetamine use and a series of criminal offending outcomes. While it has often been concluded that methamphetamine use is associated with criminal offending in a general way, the present data suggest that methamphetamine use may be associated with specific categories of crime, including violence, theft, property damage, and financial crimes. A further analysis (which will be the focus of report three for the EBPC) will examine the extent to which methamphetamine can be determined to play a causal role in each kind of crime.

Finally, the data show somewhat sparse associations between methamphetamine use and life course outcomes at age 40. However, there were more robust associations between regular methamphetamine use and outcomes, suggesting that it will be possible to model the associations between regular methamphetamine use and life outcomes at age 40, and through controlling confounding variables over the life course, to determine the extent to which regular methamphetamine use plays a causal role in adverse outcomes at age 40 (the subject of the fourth report for the EBPC).

On the basis of the data presented, it is anticipated that the data held by the CHDS will enable the Methamphetamine in New Zealand Programme of Research to use an evidence-based approach when discussing methamphetamine harm in New Zealand.

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