Missed Opportunities: Childhood Learning Disabilities as Early Indicators of Risk among Homeless Adults with Mental Illness in Vancouver, British Columbia

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TITLE. Missed Opportunities: Childhood Learning Disabilities as Early Indicators of Risk among Homeless Adults with Mental Illness in Vancouver, British Columbia.

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ABSTRACT

Objectives. It is well documented that early learning problems and poor academic achievement adversely impact child development and a wide range of adult outcomes; however, these indicators have received scant attention among homeless adults. This study examines self-reported learning disabilities in childhood as predictors of duration of homelessness, mental and substance use disorders, physical health, and service utilization in a sample of homeless adults with current mental illness.

Design: This study was conducted using the baseline sample from a randomized controlled trial.

Setting: Participants were sampled from the community in Vancouver, British Columbia.

Participants: The total sample included 497 adult participants who met criteria for absolute homelessness or precarious housing and a current mental disorder based on a structured diagnostic interview. Learning disabilities in childhood were assessed by asking adult participants whether they thought they had a learning disability in childhood and if anyone had told them they had a learning disability. Only participants who responded positively to both questions (n=133) were included in the analyses.

Outcome measures. Primary outcomes include current mental disorders, substance use disorders, physical health, service utilization and duration of homelessness.

Results. In multivariable regression models, self-reported learning disability during childhood independently predicted self-reported educational attainment and lifetime duration of homelessness as well as a range of mental health, physical health, and substance use problems, but did not predict reported health or justice service utilization.

Conclusions. Childhood learning problems are overrepresented among homeless adults

with complex comorbidities and long histories of homelessness. Our findings are consistent with a growing body of literature indicating that adverse childhood events are potent risk factors for a number of adult health and psychiatric problems, including substance abuse. Results are discussed in the context of cumulative adversity and problem behaviour theory.

Trials registration number: This trial has been registered with the International Standard Randomised Control Trial Number Register and assigned ISRCTN42520374.

ARTICLE SUMMARY

Article focus

- The relationship between self-reported learning disability in childhood as a predictor of adult homelessness and associated health and service use outcomes among a cohort of adult who are homeless and have a mental disorder.
- Primary outcomes include current mental disorders, substance use disorders, physical health, service utilization and duration of homelessness.
- How homelessness and the myriad of associated negative health and social outcomes might be prevented.

Key messages

- Childhood learning disabilities are overrepresented among homeless adults with complex comorbidities and predict a range of poor health outcomes in adulthood including mood and anxiety disorders, suicidal ideation, early and severe substance use, and physical health problems.
- Early risk factors are often longstanding and drive a trajectory of cumulative risk, potentially leading to severe psychopathology and social exclusion.

Strengths and limitations of this study

- Strengths include a large sample size, a diverse recruitment strategy, and structured diagnostic interviews for mental disorders.
- Limitations include retrospective, self-report of childhood learning disabilities.
- Lack of access to early trauma and family dysfunction variables as well as measures of general cognitive impairment at baseline.

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INTRODUCTION

Efforts to prevent homelessness require an understanding of the underlying causes and early indicators of risk. Research into the causes of homelessness suggests complex interactions between structural and individual factors, both of which are often present long before the onset of first homelessness.[1-2] The childhoods of homeless adults are disproportionately characterized by persistent poverty, residential mobility, school problems, and other stressful and/or traumatic experiences[3-5] particularly among homeless individuals with severe mental illness.[2]

While a growing body of research has examined the relationship between adverse childhood events and subsequent homelessness,[3, 4] few studies have examined the role of childhood learning disabilities. There is growing evidence that academic problems in school foreshadow later educational and employment difficulties and may affect multiple domains of functioning.[6]

In Canada, educational policies fall under provincial jurisdiction, therefore, definitions of learning disabilities (LD) vary widely and include learning problems, difficulties, disorders, as well as "children at risk."[7] LD are assumed to be neurological in origin and affect the acquisition, organization, retention, understanding or use of verbal and/or nonverbal information.[8] According to Statistics Canada, 4.9% of children aged 6 to 15 have a LD, varying from 1.6% for children aged 6 to 7.2% among 10-year-olds.[9]

While the consequences of LD on childhood academic and social development are well documented,[10, 11] the impact in adulthood is challenging to assess. However,

research suggests that LD often persist into adulthood and affect diverse aspects of functioning including employment, social relationships, quality of life, and mental and physical health.[12]

In school settings, LD typically manifest as poor academic achievement, which is associated with a greater number of school absences, suspensions, and grade retention as well as externalizing and internalizing behaviour problems.[7-10] Almost one-third of US adolescents with LD in the National Longitudinal Transition Study did not complete high school and were less likely to enroll in subsequent vocational or academic programs compared to their non-LD peers.[10]

Research examining substance abuse among youth with LD remains inconclusive.[13] Beitchman et al.[11] assessed 264 Canadian children for LD at ages 12 and 19, and for psychiatric and substance use disorders at age 19. Children who met criteria for LD at ages 12 and 19 were more likely to develop a psychiatric or substance use disorder compared to non-LD children at both time points. LD at 19 years of age increased the risk for substance use disorder three-fold after controlling for behavioural problems and family structure. Difficulties with executive functioning, academic failure, low self-esteem, and poor social skills are viewed as the strongest predictors of substance use disorder.[14]

Compared to non-LD peers, youth with LD frequently report feelings of loneliness, stress, depression, and suicide, among other psychiatric symptoms.[15, 16] For example, in the National Longitudinal Study of Adolescent Health, the LD sample was twice as likely to report a suicide attempt in the past year.[16] Longitudinal research on risk-taking indicates that, compared to non-LD peers, adolescents with LD engage more

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frequently in various risk behaviours.[17] Therefore, the presence of LD in childhood appears to confer a general risk for adverse outcomes throughout adolescence and into adulthood.

In identifying early indicators for homelessness, we are posing a larger question about how we might prevent homelessness and the myriad of associated negative health and social outcomes. There has been a resurgence of interest in early intervention as a means of preventing or attenuating a wide range of developmental outcomes in adulthood.[18] In this study, we focus on the relationship between early LD as a predictor of adult homelessness and associated health and service use outcomes. Unlike family instability and dysfunction, which fall under the jurisdiction of child welfare agencies, LD can be identified and addressed within the school system and may serve as an early marker of social and developmental risk.

METHODS

The Vancouver At Home Project is a randomized controlled trial (RCT) involving homeless adults with mental illness in Vancouver, British Columbia. Study design and sample size were determined by the At Home/Chez Soi National Research Team which monitored activities at five different study sites.[19] Details related to the RCT protocol such as CONSORT have been reported elsewhere[19]. The current study focuses on baseline data from one study site (Vancouver) prior to randomization and does not incorporate any findings related to RCT elements.

Eligibility criteria included legal adult status (19 years and older), current mental disorder on the MINI Neuropsychiatric Interview (MINI),[20] and being absolutely homeless or precariously housed. Absolute homelessness was defined as living on the

streets or in an emergency shelter for at least the past seven nights with little likelihood of obtaining secure accommodation in the upcoming month. Precariously housed was defined as living in a rooming house, hotel or other transitional housing; in addition, individuals must have experienced at least two episodes of absolute homelessness in the past year, or one episode lasting for at least four weeks in the past year.

Participants were recruited through referral from over 40 agencies available to homeless adults in Vancouver; the majority were recruited from homeless shelters, drop-in centres, homeless outreach teams, hospitals, community mental health teams, and criminal justice programs. We specifically targeted organizations that serve women, youth, aboriginal peoples, and gay/lesbian/transgender individuals in order to obtain as diverse and representative a sample as possible. Referral was initiated by service providers and a preliminary screening for eligibility was conducted via telephone with the referral agent. All participants met face-to-face with a trained research interviewer who explained procedures, obtained informed consent, and confirmed study eligibility. A cash honorarium of $5 was provided for the screening process. Institutional ethics board approval was obtained through Simon Fraser University and the University of British Columbia.

Approximately 85 individuals were turned away on the phone because they clearly did not meet eligibility criteria. In addition, approximately 100 individuals were invited to meet with an interviewer for further eligibility screening and/or to begin the baseline questionnaire but did not show up for an appointment. Whenever possible, appointments were rescheduled and interviewers tried to locate individuals in the community. Finally, 92 recruits completed the formal eligibility screening process but

were deemed ineligible. When these individuals were compared with participants who were enrolled in the study, no significant differences were found in terms of current age or gender.

If the individual met all study criteria, they were enrolled as a participant and the baseline interview commenced, consisting of a series of interviewer-administered questionnaires including socio-demographic characteristics, psychiatric symptoms, substance use, physical health, service use, and quality of life. Participants received a further cash honorarium of $30 upon completion of the baseline interview. The following analyses are based upon data from the baseline questionnaires of 497 participants recruited from October 2009 to June 2011.

Variables of interest

LD were assessed using the following questions, focusing on childhood: (1) "Do you think you had a learning problem or learning disability?" and (2) "Did anyone ever tell you that you have a learning problem or learning disability?" Only participants who responded positively to both questions were included in the analysis.

With regard to mental disorders, Severe Cluster includes at least one of current Psychosis, Mood Disorder with Psychotic Features, and Hypomanic or Manic Episode, as identified through the MINI or documented physician diagnosis. Less Severe Cluster includes at least one of current Major Depressive Episode, Panic Disorder, and Post-traumatic Stress Disorder. Suicidality, Alcohol Dependence, and Substance Dependence were also identified using the MINI. Frequency and type of substance use over the past month were recorded using the Maudsley Addiction Profile (MAP).[21] Physical illness

was assessed by self-report using a checklist of 30 chronic health conditions (lasting longer than six months). Blood-borne infectious disease consisted of positive self-report diagnosis of HIV, Hepatitis B or Hepatitis C. Head injury status was based on the question "Did you ever receive a head injury that left you unconscious?" Shoplifting and selling drugs were assessed during the past month using the MAP.

Self-reported involvement with health services was collected for the past six months including visiting and talking to a health or service provider, Emergency Room visits, and being transported by ambulance. Criminal justice services included contact with the police that resulted in detention, arrest and court appearances. The Multnomah Community Ability Scale (MCAS)[22] quantifies community functioning based on 17 items and was scored by the interviewer upon completion of the baseline interview.

Statistical analyses

Comparisons of categorical data between participants who did or did not report a learning problem or disability were conducted using Pearson's chi-square or Fisher's exact test. Comparisons of numeric variables (e.g., age at enrolment) between groups were conducted using the Student t test and Wilcoxon's rank-sum test. Univariate and multivariable logistic regression analyses were used to model the independent associations between childhood LD and a series of a priori outcome variables. Outcomes variables that were significant at the $p \leq 0.10$ level were considered for univariate and multivariable logistic regression analyses. Each variable was modeled in both univariate and multivariate settings using childhood LD as an independent risk factor and the same set of controlling variables (age at enrolment, age of first homelessness, gender, ethnicity, marital status, and language spoken in the childhood home). Both unadjusted and

adjusted odds ratios and 95% confidence intervals (CI) are reported and all p-values are two-sided. SPSS-19 was used to conduct these analyses. Missing values ranged from zero to 4% and were excluded from the analyses.

RESULTS

In total, 497 participants completed the baseline questionnaire, and 133 (27%) responded positively to both indicators of childhood LD. The majority of the total sample was male (73%) and Caucasian (56%); the mean age at enrollment was 40.8 (SD=11.0) years; and the mean age when first homeless was 30.3 (SD=13.3) years. The median duration of lifetime homelessness was 36 months (IQR: 12-84 months). All bivariate comparisons by childhood LD are summarized in Tables 1 to 3. Tables 1 and 2 present demographic characteristics and current mental disorder status of participants by childhood LD status (yes vs. no).

[Insert Tables 1 and 2 about here]

Table 3 presents self-reported substance use (past month) and service use (past six months) characteristics by childhood LD status. Participants who reported having a childhood LD were significantly more likely to report a number of negative health outcomes related to physical health (i.e., blood-born infectious diseases, migraine, and seizures), mental health (i.e., major depressive episode, panic disorder, high suicidality) and substance use (i.e., alcohol dependence, early initiation of drug use, daily drug use, and injection drug use).

[Insert Table 3 about here]

Unadjusted (UOR) and adjusted odds ratios (AOR) and 95% CI for variables included in the univariate and multivariable analyses are presented in Table 4. Results

from the multivariable logistic regression analyses indicate that reporting a childhood LD independently predicted not entering high school (AOR: 2.21), lifetime duration of homelessness greater than three years (AOR: 1.90), current major depressive episode (AOR: 1.64), panic disorder (AOR: 1.86), alcohol dependence (AOR: 1.69), high suicidality (AOR: 1.93), less severe cluster of mental disorders (AOR: 1.95), two or more mental disorders (AOR: 2.06), infectious disease (AOR: 1.75), migraine (AOR: 2.50), seizures (AOR: 2.23), head injury (AOR: 2.23), poor or fair overall health (AOR: 1.90), injection drug use (AOR: 2.01), daily drug and alcohol use (AOR: 1.70), daily drug use (not including alcohol) (AOR: 1.77), daily hard drug use (not including alcohol or marijuana) (AOR: 1.79), early initiation of drug use (<14 years) (AOR: 1.60), shoplifting in the past six months (AOR: 2.31), and talking to a health or social service provider in the past six months (AOR: 2.00).

[Insert Table 4 about here]

DISCUSSION

Our multivariable models identified several factors that were associated with self-reported childhood LD in a cohort of adults who are homeless and have a mental disorder: longer lifetime duration of homelessness; less severe mental disorders as well as multiple mental disorders and high suicidal ideation; early and severe substance use, including injection drug use and daily use of both drugs and alcohol; and physical health problems including infectious disease, head injury, multiple illnesses, and rating ones' overall health as fair or poor. Despite the complex health needs of this sub-group, the only service use variable that was predicted by childhood learning problems or disabilities was very generic: talking to a health or social service provider in the past six

months. A range of criminal justice variables as well as emergency room, ambulance utilization, and various other health services were not significant in our analyses. Collectively, our results indicate that childhood LD are overrepresented among homeless adults with complex comorbidities and predict a range of poor health outcomes in adulthood.

These findings support previous research demonstrating a link between poor academic achievement and the psychological adversity faced by some adults.[6, 23] Studies of homeless and highly mobile children have identified that both groups show slower learning and academic progress than their residentially stable peers.[23] However, the risk of homelessness among people with LD has received scant attention in the research literature.[24, 25] Among our sample of homeless adults, 41% did not graduate from high school and 43% reported being in a special class in school, suggesting that learning and academic achievement was challenging throughout their school years and likely persists in adulthood.

Our index of LD does not discriminate between focal and more general cognitive difficulties. Several studies have found increased rates of general cognitive impairment among homeless adults compared to housed comparison groups.[26, 27] In our sample of homeless adults with current mental disorders, 66% reported experiencing a head injury that left them unconscious. However, these injuries may have occurred in adulthood and it is well documented that homeless adults are more likely to experience a variety of accidents compared to housed counterparts.[27] It is also possible that childhood LD among our sample were related to psychological distress in the home.[24] Regardless of

the origin of learning problems among homeless adults, it appears that they persist over time and are associated with significant functional impairment.

Childhood LD independently predicted a range of substance use problems in our adult sample, including early initiation of drug use (before age 14). Abuse of alcohol and other drugs places an individual at greater risk of homelessness, but is not a direct causal factor.[28] Along with other studies, our findings suggest that daily drug use is a common mediator for a range of early risk factors.[29] Previous research using our sample of homeless adults with mental disorders found that daily drug use significantly predicts duration of homelessness[30] as well as severity of mental health symptoms.[31]

Cross-sectional, retrospective data cannot disentangle the unique predictors of homelessness and mental illness, but it is likely that negative childhood experiences have both direct and indirect (mediated by substance use) effects on participants' history of homelessness. Documentation of these underlying common factors points to a broad range of vulnerabilities for homelessness and mental illness. These common factors increase the complexity of personal problems as well as the duration of homelessness.[30] Therefore, substance dependence, especially when concurrent with mental illness among homeless populations, is not only a clinical problem but also a critical indicator for a range of other social and psychological problems that may need to be addressed before homelessness can be resolved.

Problems such as homelessness that have long developmental trajectories, are perhaps best understood from models of cumulative adversity and amplification of risk.[32] Based on life course development and social learning theory, the risk amplification model addresses mechanisms through which experiences on the street

amplify negative developmental effects originating in the family. According to this model, harmful behaviours and negative self-concept are perpetuated by the progressive accumulation of their own consequences. Thus, homelessness can be understood as the result of a developmental trajectory defined by successive environmental disruptions, each of which places individuals at greater risk for homelessness and associated risk factors.

Individuals generally become homeless after experiencing a crisis due to limited income, social support, and personal coping skills.[5, 28] However, it is unclear what leads some people to become homeless while others do not. Problem Behaviour Theory[33, 34] suggests that various risk factors may comprise a cluster of risky behaviours that mediate the link from childhood adversity to illicit drug use in adulthood, rather than distinct independent pathways. Another potential pathway linking childhood adversity to adult homelessness is the likelihood that such adversity elevates individuals' risk for psychiatric disorders such as depression and substance abuse, which are risk factors for homelessness, by reducing one's ability to earn adequate income and maintain stable housing.

Implications

The growing body of research that suggests a trajectory of risk preceding the first episode of homelessness begs the question "Can outcomes such as homelessness be prevented?" Many researchers and policy makers have called for comprehensive preventive interventions for high-risk children in public and community settings.[35, 36] Supporting children's cognitive development and schooling is particularly important and early childhood education programs should be available for children at greatest risk. High risk

includes established indicators such as early learning problems, abuse and/or neglect, behavioural and emotional problems, and early substance use. From a public health perspective, early interventions in childhood might change or moderate the cycle of homelessness across generations because early risk factors are often longstanding and drive a trajectory of cumulative risk, potentially leading to severe psychopathology and social exclusion.

Limitations

Despite the strengths of our study design (i.e., large sample size, diverse recruitment strategy, structured diagnostic interviews), several limitations must be considered. First, all variables were based on participant self-report. Given that participants were selected based on current mental disorder, accuracy of recall may have been compromised. Furthermore, participants were interviewed before being randomized to a housing intervention, therefore, some may have modified their responses in an attempt to influence the outcome of randomization. In addition, at baseline, we did not have access to early trauma or family dysfunction variables. Given the association between early trauma, foster care placements and adult homelessness,[2] it will be important to further examine the impact of these variables on later health and social outcomes. Similarly, we did not have access to measures of general cognitive impairment at baseline. Examination of current cognitive impairment, particularly as it relates to early learning problems, may shed light on current health and social functioning.

Future directions

Early indicators of risk clearly cannot explain all cases of homelessness. Many people without early risk factors become homeless and many who experience risk do not become

homeless. Further research is needed to examine what differentially places people at risk for risk.[37] We need better theory and better data to understand how social factors regulate behaviours or distribute individuals into risk groups and how those social factors 'push' individual trajectories toward or away from adverse outcomes. However, our results linking early learning problems to homelessness, mental illness and substance use are consistent with a growing body of research indicating that adverse childhood events are potent risk factors for a number of psychiatric and substance use disorders.[6]

Real prevention with regard to homelessness and other social problems will require systemic social and policy changes that address the environments within which children adapt so that they can mature into well-functioning adults. Nonetheless, our findings, along with others', outline a risk profile that can guide future research into mechanisms and pathways through which childhood risks are translated into adult sequelae. Interventions that can effectively address childhood risk factors such as learning problems and disabilities may ultimately prevent critical social problems including homelessness and the enormous social and individual costs related to these problems.

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DECLARATION OF INTERESTS

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Table 1: Comparisons of socio-demographic characteristics between participants who reported childhood learning problems or disabilities (LD-Yes; n=133) and those who did not (LD-No; n=364). [1]

Variable	Total Sample N (%)	LD-No N (%)	LD-Yes N (%)	p value
Male gender	359 (73)	259 (72)	100 (76)	0.375
Age at enrolment				0.001**
19-25 years	36 (7)	25 (7)	11 (8)	
25-44 years	281 (57)	190 (52)	91 (68)	
Over 44 years	180 (36)	149 (41)	31 (23)	
Ethnicity				0.469
Aboriginal	77 (15)	52 (14)	25 (19)	
Caucasian	280 (56)	208 (57)	72 (54)	
Other	140 (28)	104 (29)	36 (27)	
Educational attainment (≤Grade 8)	76 (15)	44 (12)	32 (25)	<0.001**
Single marital status	343 (70)	250 (69)	93 (70)	0.797
Language spoken at home during childhood (English)	392 (79)	282 (77)	110 (83)	0.206
Psychiatric hospitalization (past 5 years) longer than 6 months	57 (12)	43 (12)	14 (11)	0.686
Psychiatric hospitalization (past 5 years) 2 or more times	253 (53)	189 (54)	64 (50)	0.542
Employment history (at least 1 year of continuous work)	323 (65)	243 (67)	80 (60)	0.138
Jail (past 6 months)	68 (14)	46 (13)	22 (17)	0.262
Duration of homelessness				
Total lifetime (>3 years)	234 (48)	155 (43)	79 (61)	<0.001**
Longest single period (>1 year)	245 (50)	174 (48)	71 (55)	0.143
Age of first homelessness (<25 years)	214 (44)	143 (39)	71 (56)	0.001**
Overall health (poor or fair)	235 (47)	161 (44)	74 (56)	0.026*
MCAS total score (<56) #	244 (49)	177 (49)	67 (50)	0.730

[1] Each multivariable model was controlled for age (continuous measure), age of first homelessness age (continuous measure), gender, ethnicity (Aboriginals, Caucasian, Other), marital status (Single vs. Other) and language spoken in childhood home (English vs. Other).
Dichotomized based on median value.
**p≤0.001
*p≤0.05

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Table 2: Comparisons of mental disorders and physical illness between participants who reported childhood learning problems or disability (LD-Yes; n=133) and those who did not (LD-No; n=364). [1]

Variable	Total sample N (%)	LD-No N (%)	LD-Yes N (%)	p value
Mental Disorders (past month)				
Major Depressive Episode	199 (40)	134 (37)	65 (49)	0.015*
Manic or Hypomanic Episode	97 (20)	64 (18)	33 (25)	0.072+
Post-traumatic Stress Disorder	129 (26)	88 (24)	41 (31)	0.122
Panic Disorder	104 (21)	64 (18)	40 (30)	0.002*
Mood Disorder with Psychotic Features	84 (17)	57 (16)	27 (20)	0.208
Psychotic Disorder	263 (53)	200 (55)	63 (47)	0.134
Alcohol dependence	121 (24)	79 (22)	42 (32)	0.023*
Substance dependence	288 (58)	205 (56)	83 (62)	0.224
Two or more mental disorders	240 (48)	158 (43)	82 (62)	<0.001**
High suicidality	87 (18)	54 (15)	33 (25)	0.010+
Less severe cluster	264 (53)	176 (48)	88 (66)	<0.001**
Severe cluster	363 (73)	267 (73)	96 (72)	0.794
Physical Health				
Migraine	157 (32)	94 (26)	63 (48)	<0.001**
Epilepsy or seizures	67 (14)	40 (11)	27 (21)	0.006*
Blood-borne infectious diseases	157 (32)	103 (29)	54 (41)	0.008*
Head injury	270 (56)	179 (51)	91 (71)	<0.001**
Two or more physical conditions	402 (81)	287 (78.8)	115 (86)	0.056+

[1] Each multivariable model was controlled for age (continuous), age of first homelessness age (continuous), gender, ethnicity (Aboriginals, Caucasian, Other), marital status (Single vs. Other) and language spoken in childhood home (English vs. Other).

**p≤0.001

*p≤0.05

+ p≤0.10

Learning problems and disabilities

Table 3: Comparisons of substance use and service utilization between participants who reported childhood learning problems or disability (LD-Yes; n=133) and those who did not (LD-No; n=364). [1]

Variable	Total sample N (%)	LD-No N (%)	LD-Yes N (%)	p value
Substance Use (past month)				
IV drug use	88 (18)	53 (15)	35 (27)	0.003*
Daily substance use (including alcohol)	143 (29)	91 (25)	52 (39)	0.002*
Daily drug use (no alcohol)	126 (25)	78 (21)	48 (36)	0.001*
Daily hard drug use (no alcohol, no marijuana)	74 (15)	45 (12)	29 (22)	0.009*
Daily alcohol use	26 (5)	17 (5)	9 (7)	0.367
Polysubstance use (no alcohol)	188 (38)	128 (35)	60 (45)	0.050+
Age first drunk (<14 years)	212 (45)	142 (42)	70 (56)	0.007*
Age of first drug use (<14 years)	178 (40)	114 (35)	64 (52)	0.001*
Sold drugs	50 (10)	32 (9)	18 (14)	0.140
Shop-lifting	62 (13)	34 (10)	28 (21)	0.001*
Service Use (past 6 months)				
Psychiatrist	134 (27)	109 (30)	25 (19)	0.013*
Addiction counselor	18 (4)	10 (3)	8 (6)	0.084+
Seen by a health/social service provider	384 (78)	276 (76)	108 (82)	0.204
Talked with a health/social service provider	112 (23)	69 (19)	43 (32)	0.002*
ER visit (yes/no)	281 (58)	204 (57)	77 (60)	0.594
Multiple ER visits (three or more)	107 (22)	71 (20)	36 (28)	0.058+
Ambulance (yes/no)	195 (40)	147 (41)	48 (36)	0.381
Police detention (yes/no)	80 (19)	61 (19)	19 (17)	0.610
Arrested (yes/no)	172 (36)	124 (35)	48 (38)	0.603
Multiple arrests (two or more)	75 (16)	48 (14)	27 (21)	0.044+
Court appearance	172 (35)	127 (36)	45 (35)	0.932
Justice program	48 (11)	30 (9)	18 (16)	0.076+

[1] Each multivariable model was controlled for age (continuous), age of first homelessness age (continuous), gender, ethnicity (Aboriginals, Caucasian, Other), marital status (Single vs. Other) and language spoken in childhood home (English vs. Other).
**p≤0.001
*p≤0.05
+ p≤0.10

Learning problems and disabilities

Table 4: Logistic regression analyses for socio-demographics, mental disorders, substance use and service utilization related outcomes based on early learning problems or disability (n=497).

Outcome Variable	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[1]
Age of first homelessness (<25 years)[2]	1.96 (1.30, 2.95)**	1.52 (0.95, 2.44)
Lifetime duration of homelessness (>3 years)[#]	2.11 (1.40, 3.18)**	1.90 (1.19, 3.06)*
Education level (Grade 8 or less)	2.38 (1.43, 3.95)	2.20 (1.28, 3.81)
Type of Mental Disorder		
Major Depressive Episode	1.64 (1.10, 2.45)*	1.64 (1.07, 2.52)*
Manic or Hypomanic Episode	1.55 (0.96, 2.49)	1.51 (0.91, 2.51)
Panic Disorder	2.02 (1.28, 3.19)*	1.86 (1.15, 3.02)*
Alcohol dependence	1.67 (1.07, 2.59)*	1.69 (1.06, 2.69)*
Two or more mental disorders	2.10 (1.40, 3.15)**	2.06 (1.33, 3.19)**
High suicidality	1.89 (1.16, 3.09)*	1.93 (1.15, 3.24)*
Less severe cluster of mental disorders	2.10 (1.38, 3.16)**	1.95 (1.25, 3.04)*
Physical Health		
Blood-borne infectious diseases	1.76 (1.16, 2.66)*	1.75 (1.11, 2.74)*
Migraine	2.57 (1.70, 3.90)**	2.50 (1.62, 3.88)**
Seizures	2.11 (1.23, 3.61)*	2.23 (1.25, 4.00)*
Multiple physical illness	1.71 (0.98, 2.99)	2.16 (1.16, 4.02)*
Overall health (fair/poor)	1.57 (1.06, 2.35)*	1.90 (1.24, 2.92)*
History of head injury	2.33 (1.51, 3.59)*	2.23 (1.42, 3.50)*
Substance Use		
IV drug use	2.07 (1.28, 3.36)*	2.01 (1.19, 3.39)*
Daily drug use (no alcohol)	2.07 (1.34, 3.19)**	1.77 (1.12, 2.80)*
Daily drug use (no alcohol, no marijuana)	1.98 (1.18, 3.31)*	1.79 (1.03, 3.11)*
Daily substance use (including alcohol)	1.93 (1.26, 2.94)*	1.70 (1.09, 2.65)*
Poly-substance use (no alcohol)	1.50 (1.00, 2.24)	1.27 (0.82, 1.97)
Age first drunk (<14 years)	1.75 (1.16, 2.65)*	1.37 (0.88, 2.14)
Age of first drug use (<14 years	1.98 (1.30, 3.02)**	1.60 (1.02, 2.50)*
	2.53 (1.46, 4.36)**	2.31 (1.30, 4.11)*
Service Use		
Talked with a health/social service provider	1.99 (1.30, 3.11)*	2.00 (1.25, 3.21)*
Multiple ER visits (three or more)[#]	1.12 (0.74, 1.68)	1.04 (0.67, 1.60)
Multiple arrests (two or more)[#]	1.70 (1.01, 2.87)*	1.65 (0.95, 2.86)
Justice program	1.76 (0.94, 3.92)	1.34 (0.59, 3.08)

[1] Each multivariable model was controlled for age (continuous), age of first homelessness age (continuous), gender, ethnicity (Aboriginal, Caucasian, Other), marital status (Single, Other) and language spoken in the childhood home (English, Other).

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[2] This multivariable model was controlled for age (continuous), gender, ethnicity (Aboriginal, Caucasian, Other), marital status (Single, Other), and language spoken in the childhood home (English, Other).
[#] Dichotomized based on median value.
**p≤0.001
*p≤0.05

CONSORT 2010 checklist of information to include when reporting a randomised trial*

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract			
	1a	Identification as a randomised trial in the title **(our findings focus on baseline data prior to the RCT elements. The RCT protocol and CONSORT details have been reported in a previous BMJ publication)**	N/A
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	2-3
Introduction			
Background and objectives	2a	Scientific background and explanation of rationale	5-6
	2b	Specific objectives or hypotheses	7
Methods			
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	NA (see 1a)
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	NA (see 1a)
Participants	4a	Eligibility criteria for participants	7-8
	4b	Settings and locations where the data were collected	7-8
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	NA (see 1a)
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	9-10
	6b	Any changes to trial outcomes after the trial commenced, with reasons	NA
Sample size	7a	How sample size was determined	7
	7b	When applicable, explanation of any interim analyses and stopping guidelines	NA
Randomisation:			
Sequence generation	8a	Method used to generate the random allocation sequence	NA (see 1a)
	8b	Type of randomisation; details of any restriction (such as blocking and block size)	NA (see 1a)
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	NA (see 1a)
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	NA (see 1a)

Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how	NA
	11b	If relevant, description of the similarity of interventions	NA
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	10-11
	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	NA
Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	NA (see 1a)
	13b	For each group, losses and exclusions after randomisation, together with reasons	NA (see 1a)
Recruitment	14a	Dates defining the periods of recruitment (and follow-up)	9
	14b	Why the trial ended or was stopped	NA
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	Table 1 (p.23)
Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	NA
Outcomes and estimation	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	Tables 2-4 (pp.24-26)
	17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory	
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	NA
Discussion			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	16
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	NA
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	12-15
Other information			
Registration	23	Registration number and name of trial registry	3
Protocol	24	Where the full trial protocol can be accessed, if available	7
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	18

*We strongly recommend reading this statement in conjunction with the CONSORT 2010 Explanation and Elaboration for important clarifications on all the items. If relevant, we also recommend reading CONSORT extensions for cluster randomised trials, non-inferiority and equivalence trials, non-pharmacological treatments, herbal interventions, and pragmatic trials. Additional extensions are forthcoming: for those and for up to date references relevant to this checklist, see www.consort-statement.org.

Missed Opportunities: Childhood Learning Disabilities as Early Indicators of Risk among Homeless Adults with Mental Illness in Vancouver, British Columbia

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Learning problems and disabilities

MANUSCRIPT COVER PAGE

TITLE. Missed Opportunities: Childhood Learning Disabilities as Early Indicators of Risk among Homeless Adults with Mental Illness in Vancouver, British Columbia.

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ABSTRACT

Objectives. It is well documented that early learning problems and poor academic achievement adversely impact child development and a wide range of adult outcomes; however, these indicators have received scant attention among homeless adults. This study examines self-reported learning disabilities in childhood as predictors of duration of homelessness, mental and substance use disorders, physical health, and service utilization in a sample of homeless adults with current mental illness.

Design: This study was conducted using the baseline sample from a randomized controlled trial.

Setting: Participants were sampled from the community in Vancouver, British Columbia.

Participants: The total sample included 497 adult participants who met criteria for absolute homelessness or precarious housing and a current mental disorder based on a structured diagnostic interview. Learning disabilities in childhood were assessed by asking adult participants whether they thought they had a learning disability in childhood and if anyone had told them they had a learning disability. Only participants who responded positively to both questions (n=133) were included in the analyses.

Outcome measures. Primary outcomes include current mental disorders, substance use disorders, physical health, service utilization and duration of homelessness.

Results. In multivariable regression models, self-reported learning disability during childhood independently predicted self-reported educational attainment and lifetime duration of homelessness as well as a range of mental health, physical health, and substance use problems, but did not predict reported health or justice service utilization.

Conclusions. Childhood learning problems are overrepresented among homeless adults

with complex comorbidities and long histories of homelessness. Our findings are consistent with a growing body of literature indicating that adverse childhood events are potent risk factors for a number of adult health and psychiatric problems, including substance abuse. Results are discussed in the context of cumulative adversity and problem behaviour theory.

Trials registration number: This trial has been registered with the International Standard Randomised Control Trial Number Register and assigned ISRCTN42520374.

Learning problems and disabilities

ARTICLE SUMMARY

Article focus

- The relationship between self-reported learning disability in childhood as a predictor of adult homelessness and associated health and service use outcomes among a cohort of adult who are homeless and have a mental disorder.
- Primary outcomes include current mental disorders, substance use disorders, physical health, service utilization and duration of homelessness.
- How homelessness and the myriad of associated negative health and social outcomes might be prevented.

Key messages

- Childhood learning disabilities are overrepresented among homeless adults with complex comorbidities and predict a range of poor health outcomes in adulthood including mood and anxiety disorders, suicidal ideation, early and severe substance use, and physical health problems.
- Early risk factors are often longstanding and drive a trajectory of cumulative risk, potentially leading to severe psychopathology and social exclusion.

Strengths and limitations of this study

- Strengths include a large sample size, a diverse recruitment strategy, and structured diagnostic interviews for mental disorders.
- Limitations include retrospective self-report of childhood learning disabilities.
- Lack of access to early trauma and family dysfunction variables as well as measures of general cognitive impairment at baseline.

Learning problems and disabilities

INTRODUCTION

Efforts to prevent homelessness require an understanding of the underlying causes and early indicators of risk. Research into the causes of homelessness suggests complex interactions between structural and individual factors, both of which are often present long before the onset of first homelessness.[1-2] The childhoods of homeless adults are disproportionately characterized by persistent poverty, residential mobility, school problems, and other stressful and/or traumatic experiences[3-5] particularly among homeless individuals with severe mental illness.[2]

While a growing body of research has examined the relationship between adverse childhood events and subsequent homelessness,[3, 4] few studies have examined the role of childhood learning disabilities. There is growing evidence that academic problems in school foreshadow later educational and employment difficulties and may affect multiple domains of functioning.[6]

In Canada, educational policies fall under provincial jurisdiction, therefore, definitions of learning disabilities (LD) vary widely and include learning problems, difficulties, disorders, as well as "children at risk."[7] LD are assumed to be neurological in origin and affect the acquisition, organization, retention, understanding or use of verbal and/or nonverbal information.[8] According to Statistics Canada, 4.9% of children aged 6 to 15 have a LD, varying from 1.6% for children aged 6 to 7.2% among 10-year-olds.[9]

While the consequences of LD on childhood academic and social development are well documented,[10, 11] the impact in adulthood is challenging to assess. However,

research suggests that LD often persist into adulthood and affect diverse aspects of functioning including employment, social relationships, quality of life, and mental and physical health.[12]

In school settings, LD typically manifest as poor academic achievement, which is associated with a greater number of school absences, suspensions, and grade retention as well as externalizing and internalizing behaviour problems.[7-10] Almost one-third of US adolescents with LD in the National Longitudinal Transition Study did not complete high school and were less likely to enroll in subsequent vocational or academic programs compared to their non-LD peers.[10]

Research examining substance abuse among youth with LD remains inconclusive.[13] Beitchman et al.[11] assessed 264 Canadian children for LD at ages 12 and 19, and for psychiatric and substance use disorders at age 19. Children who met criteria for LD at ages 12 and 19 were more likely to develop a psychiatric or substance use disorder compared to non-LD children at both time points. LD at 19 years of age increased the risk for substance use disorder three-fold after controlling for behavioural problems and family structure. Difficulties with executive functioning, academic failure, low self-esteem, and poor social skills are viewed as the strongest predictors of substance use disorder.[14]

Compared to non-LD peers, youth with LD frequently report feelings of loneliness, stress, depression, and suicide, among other psychiatric symptoms.[15, 16] For example, in the National Longitudinal Study of Adolescent Health, the LD sample was twice as likely to report a suicide attempt in the past year.[16] Longitudinal research on risk-taking indicates that, compared to non-LD peers, adolescents with LD engage more

frequently in various risk behaviours.[17] Therefore, the presence of LD in childhood appears to confer a general risk for adverse outcomes throughout adolescence and into adulthood.

In identifying early indicators for homelessness, we are posing a larger question about how we might prevent homelessness and the myriad of associated negative health and social outcomes. There has been a resurgence of interest in early intervention as a means of preventing or attenuating a wide range of developmental outcomes in adulthood.[18] In this study, we focus on the relationship between early LD as a predictor of adult homelessness and associated health and service use outcomes. Unlike family instability and dysfunction, which fall under the jurisdiction of child welfare agencies, LD can be identified and addressed within the school system and may serve as an early marker of social and developmental risk.

METHODS

The Vancouver At Home Project is a randomized controlled trial (RCT) involving homeless adults with mental illness in Vancouver, British Columbia. Study design and sample size were determined by the At Home/Chez Soi National Research Team which monitored activities at five different study sites.[19] Details related to the RCT protocol such as CONSORT have been reported elsewhere[19]. The current study focuses on baseline data from one study site (Vancouver) prior to randomization and does not incorporate any findings related to RCT elements.

Eligibility criteria included legal adult status (19 years and older), current mental disorder on the MINI Neuropsychiatric Interview (MINI),[20] and being absolutely homeless or precariously housed. Absolute homelessness was defined as living on the

streets or in an emergency shelter for at least the past seven nights with little likelihood of obtaining secure accommodation in the upcoming month. Precariously housed was defined as living in a rooming house, hotel or other transitional housing; in addition, individuals must have experienced at least two episodes of absolute homelessness in the past year, or one episode lasting for at least four weeks in the past year.

Participants were recruited through referral from over 40 agencies available to homeless adults in Vancouver; the majority were recruited from homeless shelters, drop-in centres, homeless outreach teams, hospitals, community mental health teams, and criminal justice programs. We specifically targeted organizations that serve women, youth, aboriginal peoples, and gay/lesbian/transgender individuals in order to obtain as diverse and representative a sample as possible. Referral was initiated by service providers and a preliminary screening for eligibility was conducted via telephone with the referral agent. All participants met face-to-face with a trained research interviewer who explained procedures, obtained informed consent, and confirmed study eligibility. A cash honorarium of $5 was provided for the screening process. Institutional ethics board approval was obtained through Simon Fraser University and the University of British Columbia.

Approximately 85 individuals were turned away on the phone because they clearly did not meet eligibility criteria. In addition, approximately 100 individuals were invited to meet with an interviewer for further eligibility screening and/or to begin the baseline questionnaire but did not show up for an appointment. Whenever possible, appointments were rescheduled and interviewers tried to locate individuals in the community. Finally, 92 recruits completed the formal eligibility screening process but

were deemed ineligible. When these individuals were compared with participants who were enrolled in the study, no significant differences were found in terms of current age or gender.

If the individual met all study criteria, they were enrolled as a participant and the baseline interview commenced, consisting of a series of interviewer-administered questionnaires including socio-demographic characteristics, psychiatric symptoms, substance use, physical health, service use, and quality of life. Participants received a further cash honorarium of $30 upon completion of the baseline interview. The following analyses are based upon data from the baseline questionnaires of 497 participants recruited from October 2009 to June 2011.

Variables of interest

LD were assessed using the following questions, focusing on childhood: (1) "Do you think you had a learning problem or learning disability?" and (2) "Did anyone ever tell you that you have a learning problem or learning disability?" Given the retrospective nature of these questions, only participants who responded positively to both questions were included in the analysis.

With regard to mental disorders, Severe Cluster includes at least one of current Psychosis, Mood Disorder with Psychotic Features, and Hypomanic or Manic Episode, as identified through the MINI or documented physician diagnosis. Less Severe Cluster includes at least one of current Major Depressive Episode, Panic Disorder, and Post-traumatic Stress Disorder. Suicidality, Alcohol Dependence, and Substance Dependence were also identified using the MINI. Frequency and type of substance use over the past

month were recorded using the Maudsley Addiction Profile (MAP).[21] Physical illness was assessed by self-report using a checklist of 30 chronic health conditions (lasting longer than six months). Blood-borne infectious disease consisted of positive self-report diagnosis of HIV, Hepatitis B or Hepatitis C. Head injury status was based on the question "Did you ever receive a head injury that left you unconscious?" Shoplifting and selling drugs were assessed during the past month using the MAP.

Self-reported involvement with health services was collected for the past six months including visiting and talking to a health or service provider, Emergency Room visits, and being transported by ambulance. Criminal justice services included contact with the police that resulted in detention, arrest and court appearances. The Multnomah Community Ability Scale (MCAS)[22] quantifies community functioning based on 17 items and was scored by the interviewer upon completion of the baseline interview.

Statistical analyses

Comparisons of categorical data between participants who did or did not report a learning problem or disability were conducted using Pearson's chi-square or Fisher's exact test. Comparisons of numeric variables (e.g., age at enrolment) between groups were conducted using the Student t test and Wilcoxon's rank-sum test. Univariate and multivariable logistic regression analyses were used to model the independent associations between childhood LD and a series of a priori outcome variables. Outcomes variables that were significant at the $p \leq 0.10$ level were considered for univariate and multivariable logistic regression analyses. Each variable was modeled in both univariate and multivariate settings using childhood LD as an independent risk factor and the same set of controlling variables (age at enrolment, age of first homelessness, gender, ethnicity,

marital status, and language spoken in the childhood home). Both unadjusted and adjusted odds ratios and 95% confidence intervals (CI) are reported and all p-values are two-sided. SPSS-19 was used to conduct these analyses. Missing values ranged from zero to 4% and were excluded from the analyses.

RESULTS

In total, 497 participants completed the baseline questionnaire; 178 participants (36%) thought they had a learning problem or disability in childhood, 182 (37%) reported being told they had a learning problem or disability, and 133 (27%) responded positively to both indicators of childhood LD. The majority of the total sample was male (73%) and Caucasian (56%); the mean age at enrollment was 40.8 (SD=11.0) years; and the mean age when first homeless was 30.3 (SD=13.3) years. The median duration of lifetime homelessness was 36 months (IQR: 12-84 months). All bivariate comparisons by childhood LD are summarized in Tables 1 to 3. Tables 1 and 2 present demographic characteristics and current mental disorder status of participants by childhood LD status (yes vs. no).

[Insert Tables 1 and 2 about here]

Table 3 presents self-reported substance use (past month) and service use (past six months) characteristics by childhood LD status. Participants who reported having a childhood LD were significantly more likely to report a number of negative health outcomes related to physical health (i.e., blood-born infectious diseases, migraine, and seizures), mental health (i.e., major depressive episode, panic disorder, high suicidality) and substance use (i.e., alcohol dependence, early initiation of drug use, daily drug use, and injection drug use).

Learning problems and disabilities

[Insert Table 3 about here]

Unadjusted (UOR) and adjusted odds ratios (AOR) and 95% CI for variables included in the univariate and multivariable analyses are presented in Table 4. Results from the multivariable logistic regression analyses indicate that reporting a childhood LD independently predicted not entering high school (AOR: 2.21), lifetime duration of homelessness greater than three years (AOR: 1.90), current major depressive episode (AOR: 1.64), panic disorder (AOR: 1.86), alcohol dependence (AOR: 1.69), high suicidality (AOR: 1.93), less severe cluster of mental disorders (AOR: 1.95), two or more mental disorders (AOR: 2.06), infectious disease (AOR: 1.75), migraine (AOR: 2.50), seizures (AOR: 2.23), head injury (AOR: 2.23), poor or fair overall health (AOR: 1.90), injection drug use (AOR: 2.01), daily drug and alcohol use (AOR: 1.70), daily drug use (not including alcohol) (AOR: 1.77), daily hard drug use (not including alcohol or marijuana) (AOR: 1.79), early initiation of drug use (<14 years) (AOR: 1.60), shoplifting in the past six months (AOR: 2.31), and talking to a health or social service provider in the past six months (AOR: 2.00).

[Insert Table 4 about here]

DISCUSSION

Our multivariable models identified several factors that were associated with self-reported childhood LD in a cohort of adults who are homeless and have a mental disorder: longer lifetime duration of homelessness; less severe mental disorders as well as multiple mental disorders and high suicidal ideation; early and severe substance use, including injection drug use and daily use of both drugs and alcohol; and physical health problems including infectious disease, head injury, multiple illnesses, and rating ones'

overall health as fair or poor. Despite the complex health needs of this sub-group, the only service use variable that was predicted by childhood learning problems or disabilities was very generic: talking to a health or social service provider in the past six months. A range of criminal justice variables as well as emergency room, ambulance utilization, and various other health services were not significant in our analyses. Collectively, our results indicate that childhood LD are overrepresented among homeless adults with complex comorbidities and predict a range of poor health outcomes in adulthood.

These findings support previous research demonstrating a link between poor academic achievement and the psychological adversity faced by some adults.[6, 23] Studies of homeless and highly mobile children have identified that both groups show slower learning and academic progress than their residentially stable peers.[23] However, the risk of homelessness among people with LD has received scant attention in the research literature.[24, 25] Among our sample of homeless adults, 41% did not graduate from high school and 43% reported being in a special class in school, suggesting that learning and academic achievement was challenging throughout their school years and likely persists in adulthood in the form of poor literacy skills and difficulties finding and maintaining employment.

Our index of LD does not discriminate between focal and more general cognitive difficulties, nor did we assess the presence of LD in adulthood. Several studies have found increased rates of general cognitive impairment among homeless adults compared to housed comparison groups.[26, 27] In our sample of homeless adults with current mental disorders, 66% reported experiencing a head injury that left them unconscious.

However, these injuries may have occurred in adulthood and it is well documented that homeless adults are more likely to experience a variety of accidents compared to housed counterparts.[27] It is also possible that childhood LD among our sample were related to psychological distress in the home.[24] Regardless of the origin of learning problems among homeless adults, it appears that they persist over time and are associated with significant functional impairment.

Childhood LD independently predicted a range of substance use problems in our adult sample, including early initiation of drug use (before age 14). Abuse of alcohol and other drugs places an individual at greater risk of homelessness, but is not a direct causal factor.[28] Along with other studies, our findings suggest that daily drug use is a common mediator for a range of early risk factors.[29] Previous research using our sample of homeless adults with mental disorders found that daily drug use significantly predicts duration of homelessness[30] as well as severity of mental health symptoms.[31]

Cross-sectional, retrospective data cannot disentangle the unique predictors of homelessness and mental illness, but it is likely that negative childhood experiences have both direct and indirect (mediated by substance use) effects on participants' history of homelessness. Documentation of these underlying common factors points to a broad range of vulnerabilities for homelessness and mental illness. These common factors increase the complexity of personal problems as well as the duration of homelessness.[30] Therefore, substance dependence, especially when concurrent with mental illness among homeless populations, is not only a clinical problem but also a critical indicator for a range of other social and psychological problems that may need to be addressed before homelessness can be resolved.

Learning problems and disabilities

Problems such as homelessness that have long developmental trajectories, are perhaps best understood from models of cumulative adversity and amplification of risk.[32,33] Based on life course development and social learning theory, the risk amplification model addresses mechanisms through which experiences on the street amplify negative developmental effects originating in the family. According to this model, harmful behaviours and negative self-concept are perpetuated by the progressive accumulation of their own consequences. Thus, homelessness can be understood as the result of a developmental trajectory defined by successive environmental disruptions, each of which places individuals at greater risk for homelessness and associated risk factors. Individuals generally become homeless after experiencing a crisis due to limited income, social support, and personal coping skills.[5, 28] However, it is unclear what leads some people to become homeless while others do not. The risk amplification model may apply primarily to subgroups who are most vulnerable to a variety of structural contributors to homelessness such as poverty and the lack of affordable housing. Problem Behaviour Theory[34, 35] suggests that various risk factors may comprise a cluster of risky behaviours that mediate the link from childhood adversity to illicit drug use in adulthood, rather than distinct independent pathways. Another potential pathway linking childhood adversity to adult homelessness is the likelihood that such adversity elevates individuals' risk for psychiatric disorders such as depression and substance abuse, which are risk factors for homelessness, by reducing one's ability to earn adequate income and maintain stable housing.

Implications

Learning problems and disabilities

The growing body of research that suggests a trajectory of risk preceding the first episode of homelessness begs the question "Can outcomes such as homelessness be prevented?" In addition to addressing structural barriers such as income inequality and affordable housing, many researchers and policy makers have called for comprehensive preventive interventions for high-risk children in public and community settings.[36, 37] Supporting children's cognitive development and schooling is particularly important and early childhood education programs should be available for children at greatest risk. High risk includes established indicators such as early learning problems, abuse and/or neglect, behavioural and emotional problems, and early substance use. From a public health perspective, early interventions in childhood might change or moderate the cycle of homelessness across generations because early risk factors are often longstanding and drive a trajectory of cumulative risk, potentially leading to severe psychopathology and social exclusion. Despite the need for early intervention, our study also highlights the need for identifying and addressing current learning problems among homeless adults. Learning problems may contribute to challenges with print and financial literacy, obtaining and maintaining housing and employment, and a wide range of daily living skills.

Limitations

Despite the strengths of our study design (i.e., large sample size, diverse recruitment strategy, structured diagnostic interviews), several limitations must be considered. First, all variables were based on participant self-report. Given that participants were selected based on current mental disorder, accuracy of recall may have been compromised. Furthermore, participants were interviewed before being randomized to a housing

intervention, therefore, some may have modified their responses in an attempt to influence the outcome of randomization. In addition, at baseline, we did not have access to early trauma or family dysfunction variables. Given the association between early trauma, foster care placements and adult homelessness,[2] it will be important to further examine the impact of these variables on later health and social outcomes. Similarly, we did not have access to measures of current LD or general cognitive impairment at baseline. Examination of current cognitive impairment, particularly as it relates to early learning problems, may shed light on current health and social functioning.

Future directions

Early indicators of risk clearly cannot explain all cases of homelessness. Many people without early risk factors become homeless and many who experience risk do not become homeless. Further research is needed to examine what differentially places people at risk for risk.[38] We need better theory and better data to understand how social factors regulate behaviours or distribute individuals into risk groups and how those social factors 'push' individual trajectories toward or away from adverse outcomes. However, our results linking early learning problems to homelessness, mental illness and substance use are consistent with a growing body of research indicating that adverse childhood events are potent risk factors for a number of psychiatric and substance use disorders.[6]

Real prevention with regard to homelessness and other social problems will require systemic social and policy changes that address the environments within which children adapt so that they can mature into well-functioning adults. Nonetheless, our findings, along with others', outline a risk profile that can guide future research into mechanisms and pathways through which childhood risks are translated into adult

sequelae. Interventions that can effectively address childhood risk factors such as learning problems and disabilities may ultimately prevent critical social problems including homelessness and the enormous social and individual costs related to these problems.

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DECLARATION OF INTERESTS

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Learning problems and disabilities

Table 1: Comparisons of socio-demographic characteristics between participants who reported childhood learning problems or disabilities (LD-Yes; n=133) and those who did not (LD-No; n=364). [1]

Variable	Total Sample N (%)	LD-No N (%)	LD-Yes N (%)	p value
Male gender	359 (73)	259 (72)	100 (76)	0.375
Age at enrolment				0.001**
19-25 years	36 (7)	25 (7)	11 (8)	
25-44 years	281 (57)	190 (52)	91 (68)	
Over 44 years	180 (36)	149 (41)	31 (23)	
Ethnicity				0.469
Aboriginal	77 (15)	52 (14)	25 (19)	
Caucasian	280 (56)	208 (57)	72 (54)	
Other	140 (28)	104 (29)	36 (27)	
Educational attainment (≤Grade 8)	76 (15)	44 (12)	32 (25)	<0.001**
Single marital status	343 (70)	250 (69)	93 (70)	0.797
Language spoken at home during childhood (English)	392 (79)	282 (77)	110 (83)	0.206
Psychiatric hospitalization (past 5 years) longer than 6 months	57 (12)	43 (12)	14 (11)	0.686
Psychiatric hospitalization (past 5 years) 2 or more times	253 (53)	189 (54)	64 (50)	0.542
Employment history (at least 1 year of continuous work)	323 (65)	243 (67)	80 (60)	0.138
Jail (past 6 months)	68 (14)	46 (13)	22 (17)	0.262
Duration of homelessness				
Total lifetime (>3 years)	234 (48)	155 (43)	79 (61)	<0.001**
Longest single period (>1 year)	245 (50)	174 (48)	71 (55)	0.143
Age of first homelessness (<25 years)	214 (44)	143 (39)	71 (56)	0.001**
Overall health (poor or fair)	235 (47)	161 (44)	74 (56)	0.026*
MCAS total score (<56) #	244 (49)	177 (49)	67 (50)	0.730

[1] Each multivariable model was controlled for age (continuous measure), age of first homelessness age (continuous measure), gender, ethnicity (Aboriginals, Caucasian, Other), marital status (Single vs. Other) and language spoken in childhood home (English vs. Other).
Dichotomized based on median value.
**p≤0.001
*p≤0.05

Learning problems and disabilities

Table 2: Comparisons of mental disorders and physical illness between participants who reported childhood learning problems or disability (LD-Yes; n=133) and those who did not (LD-No; n=364).[1]

Variable	Total sample N (%)	LD-No N (%)	LD-Yes N (%)	p value
Mental Disorders (past month)				
Major Depressive Episode	199 (40)	134 (37)	65 (49)	0.015*
Manic or Hypomanic Episode	97 (20)	64 (18)	33 (25)	0.072+
Post-traumatic Stress Disorder	129 (26)	88 (24)	41 (31)	0.122
Panic Disorder	104 (21)	64 (18)	40 (30)	0.002*
Mood Disorder with Psychotic Features	84 (17)	57 (16)	27 (20)	0.208
Psychotic Disorder	263 (53)	200 (55)	63 (47)	0.134
Alcohol dependence	121 (24)	79 (22)	42 (32)	0.023*
Substance dependence	288 (58)	205 (56)	83 (62)	0.224
Two or more mental disorders	240 (48)	158 (43)	82 (62)	<0.001**
High suicidality	87 (18)	54 (15)	33 (25)	0.010+
Less severe cluster	264 (53)	176 (48)	88 (66)	<0.001**
Severe cluster	363 (73)	267 (73)	96 (72)	0.794
Physical Health				
Migraine	157 (32)	94 (26)	63 (48)	<0.001**
Epilepsy or seizures	67 (14)	40 (11)	27 (21)	0.006*
Blood-borne infectious diseases	157 (32)	103 (29)	54 (41)	0.008*
Head injury	270 (56)	179 (51)	91 (71)	<0.001**
Two or more physical conditions	402 (81)	287 (78.8)	115 (86)	0.056+

[1] Each multivariable model was controlled for age (continuous), age of first homelessness age (continuous), gender, ethnicity (Aboriginals, Caucasian, Other), marital status (Single vs. Other) and language spoken in childhood home (English vs. Other).

**p≤0.001

*p≤0.05

+ p≤0.10

Learning problems and disabilities

Table 3: Comparisons of substance use and service utilization between participants who reported childhood learning problems or disability (LD-Yes; n=133) and those who did not (LD-No; n=364). [1]

Variable	Total sample N (%)	LD-No N (%)	LD-Yes N (%)	p value
Substance Use (past month)				
IV drug use	88 (18)	53 (15)	35 (27)	0.003*
Daily substance use (including alcohol)	143 (29)	91 (25)	52 (39)	0.002*
Daily drug use (no alcohol)	126 (25)	78 (21)	48 (36)	0.001*
Daily hard drug use (no alcohol, no marijuana)	74 (15)	45 (12)	29 (22)	0.009*
Daily alcohol use	26 (5)	17 (5)	9 (7)	0.367
Polysubstance use (no alcohol)	188 (38)	128 (35)	60 (45)	0.050+
Age first drunk (<14 years)	212 (45)	142 (42)	70 (56)	0.007*
Age of first drug use (<14 years)	178 (40)	114 (35)	64 (52)	0.001*
Sold drugs	50 (10)	32 (9)	18 (14)	0.140
Shop-lifting	62 (13)	34 (10)	28 (21)	0.001*
Service Use (past 6 months)				
Psychiatrist	134 (27)	109 (30)	25 (19)	0.013*
Addiction counselor	18 (4)	10 (3)	8 (6)	0.084+
Seen by a health/social service provider	384 (78)	276 (76)	108 (82)	0.204
Talked with a health/social service provider	112 (23)	69 (19)	43 (32)	0.002*
ER visit (yes/no)	281 (58)	204 (57)	77 (60)	0.594
Multiple ER visits (three or more)	107 (22)	71 (20)	36 (28)	0.058+
Ambulance (yes/no)	195 (40)	147 (41)	48 (36)	0.381
Police detention (yes/no)	80 (19)	61 (19)	19 (17)	0.610
Arrested (yes/no)	172 (36)	124 (35)	48 (38)	0.603
Multiple arrests (two or more)	75 (16)	48 (14)	27 (21)	0.044+
Court appearance	172 (35)	127 (36)	45 (35)	0.932
Justice program	48 (11)	30 (9)	18 (16)	0.076+

[1] Each multivariable model was controlled for age (continuous), age of first homelessness age (continuous), gender, ethnicity (Aboriginals, Caucasian, Other), marital status (Single vs. Other) and language spoken in childhood home (English vs. Other).
**p≤0.001
*p≤0.05
+ p≤0.10

Learning problems and disabilities

Table 4: Logistic regression analyses for socio-demographics, mental disorders, substance use and service utilization related outcomes based on early learning problems or disability (n=497).

Outcome Variable	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[1]
Age of first homelessness (<25 years)[2]	1.96 (1.30, 2.95)**	1.52 (0.95, 2.44)
Lifetime duration of homelessness (>3 years)[#]	2.11 (1.40, 3.18)**	1.90 (1.19, 3.06)*
Education level (Grade 8 or less)	2.38 (1.43, 3.95)	2.20 (1.28, 3.81)
Type of Mental Disorder		
Major Depressive Episode	1.64 (1.10, 2.45)*	1.64 (1.07, 2.52)*
Manic or Hypomanic Episode	1.55 (0.96, 2.49)	1.51 (0.91, 2.51)
Panic Disorder	2.02 (1.28, 3.19)*	1.86 (1.15, 3.02)*
Alcohol dependence	1.67 (1.07, 2.59)*	1.69 (1.06, 2.69)*
Two or more mental disorders	2.10 (1.40, 3.15)**	2.06 (1.33, 3.19)**
High suicidality	1.89 (1.16, 3.09)*	1.93 (1.15, 3.24)*
Less severe cluster of mental disorders	2.10 (1.38, 3.16)**	1.95 (1.25, 3.04)*
Physical Health		
Blood-borne infectious diseases	1.76 (1.16, 2.66)*	1.75 (1.11, 2.74)*
Migraine	2.57 (1.70, 3.90)**	2.50 (1.62, 3.88)**
Seizures	2.11 (1.23, 3.61)*	2.23 (1.25, 4.00)*
Multiple physical illness	1.71 (0.98, 2.99)	2.16 (1.16, 4.02)*
Overall health (fair/poor)	1.57 (1.06, 2.35)*	1.90 (1.24, 2.92)*
History of head injury	2.33 (1.51, 3.59)*	2.23 (1.42, 3.50)*
Substance Use		
IV drug use	2.07 (1.28, 3.36)*	2.01 (1.19, 3.39)*
Daily drug use (no alcohol)	2.07 (1.34, 3.19)**	1.77 (1.12, 2.80)*
Daily drug use (no alcohol, no marijuana)	1.98 (1.18, 3.31)*	1.79 (1.03, 3.11)*
Daily substance use (including alcohol)	1.93 (1.26, 2.94)*	1.70 (1.09, 2.65)*
Poly-substance use (no alcohol)	1.50 (1.00, 2.24)	1.27 (0.82, 1.97)
Age first drunk (<14 years)	1.75 (1.16, 2.65)*	1.37 (0.88, 2.14)
Age of first drug use (<14 years	1.98 (1.30, 3.02)**	1.60 (1.02, 2.50)*
	2.53 (1.46, 4.36)**	2.31 (1.30, 4.11)*
Service Use		
Talked with a health/social service provider	1.99 (1.30, 3.11)*	2.00 (1.25, 3.21)*
Multiple ER visits (three or more)[#]	1.12 (0.74, 1.68)	1.04 (0.67, 1.60)
Multiple arrests (two or more)[#]	1.70 (1.01, 2.87)*	1.65 (0.95, 2.86)
Justice program	1.76 (0.94, 3.92)	1.34 (0.59, 3.08)

[1] Each multivariable model was controlled for age (continuous), age of first homelessness age (continuous), gender, ethnicity (Aboriginal, Caucasian, Other), marital status (Single, Other) and language spoken in the childhood home (English, Other).

Learning problems and disabilities

[2] This multivariable model was controlled for age (continuous), gender, ethnicity (Aboriginal, Caucasian, Other), marital status (Single, Other), and language spoken in the childhood home (English, Other).
[#] Dichotomized based on median value.
**p≤0.001
*p≤0.05

CONSORT 2010 checklist of information to include when reporting a randomised trial*

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract			
	1a	Identification as a randomised trial in the title **(our findings focus on baseline data prior to the RCT elements. The RCT protocol and CONSORT details have been reported in a previous BMJ publication)**	N/A
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	2-3
Introduction			
Background and objectives	2a	Scientific background and explanation of rationale	5-6
	2b	Specific objectives or hypotheses	7
Methods			
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	NA (see 1a)
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	NA (see 1a)
Participants	4a	Eligibility criteria for participants	7-8
	4b	Settings and locations where the data were collected	7-8
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	NA (see 1a)
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	9-10
	6b	Any changes to trial outcomes after the trial commenced, with reasons	NA
Sample size	7a	How sample size was determined	7
	7b	When applicable, explanation of any interim analyses and stopping guidelines	NA
Randomisation:			
Sequence generation	8a	Method used to generate the random allocation sequence	NA (see 1a)
	8b	Type of randomisation; details of any restriction (such as blocking and block size)	NA (see 1a)
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	NA (see 1a)
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	NA (see 1a)

Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how	NA
	11b	If relevant, description of the similarity of interventions	NA
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	10-11
	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	NA
Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	NA (see 1a)
	13b	For each group, losses and exclusions after randomisation, together with reasons	NA (see 1a)
Recruitment	14a	Dates defining the periods of recruitment (and follow-up)	9
	14b	Why the trial ended or was stopped	NA
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	Table 1 (p.23)
Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	NA
Outcomes and estimation	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	Tables 2-4 (pp.24-26)
	17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory	
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	NA
Discussion			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	16
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	NA
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	12-15
Other information			
Registration	23	Registration number and name of trial registry	3
Protocol	24	Where the full trial protocol can be accessed, if available	7
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	18

*We strongly recommend reading this statement in conjunction with the CONSORT 2010 Explanation and Elaboration for important clarifications on all the items. If relevant, we also recommend reading CONSORT extensions for cluster randomised trials, non-inferiority and equivalence trials, non-pharmacological treatments, herbal interventions, and pragmatic trials. Additional extensions are forthcoming: for those and for up to date references relevant to this checklist, see www.consort-statement.org.

Learning problems and disabilities

MANUSCRIPT COVER PAGE

TITLE. Missed Opportunities: Childhood Learning Disabilities as Early Indicators of Risk among Homeless Adults with Mental Illness in Vancouver, British Columbia.

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ABSTRACT

Objectives. It is well documented that early learning problems and poor academic achievement adversely impact child development and a wide range of adult outcomes; however, these indicators have received scant attention among homeless adults. This study examines self-reported learning disabilities in childhood as predictors of duration of homelessness, mental and substance use disorders, physical health, and service utilization in a sample of homeless adults with current mental illness.

Design: This study was conducted using the baseline sample from a randomized controlled trial.

Setting: Participants were sampled from the community in Vancouver, British Columbia.

Participants: The total sample included 497 adult participants who met criteria for absolute homelessness or precarious housing and a current mental disorder based on a structured diagnostic interview. Learning disabilities in childhood were assessed by asking adult participants whether they thought they had a learning disability in childhood and if anyone had told them they had a learning disability. Only participants who responded positively to both questions (n=133) were included in the analyses.

Outcome measures. Primary outcomes include current mental disorders, substance use disorders, physical health, service utilization and duration of homelessness.

Results. In multivariable regression models, self-reported learning disability during childhood independently predicted self-reported educational attainment and lifetime duration of homelessness as well as a range of mental health, physical health, and substance use problems, but did not predict reported health or justice service utilization.

Conclusions. Childhood learning problems are overrepresented among homeless adults

with complex comorbidities and long histories of homelessness. Our findings are consistent with a growing body of literature indicating that adverse childhood events are potent risk factors for a number of adult health and psychiatric problems, including substance abuse. Results are discussed in the context of cumulative adversity and problem behaviour theory.

Trials registration number: This trial has been registered with the International Standard Randomised Control Trial Number Register and assigned ISRCTN42520374.

ARTICLE SUMMARY

Article focus

- The relationship between self-reported learning disability in childhood as a predictor of adult homelessness and associated health and service use outcomes among a cohort of adult who are homeless and have a mental disorder.
- Primary outcomes include current mental disorders, substance use disorders, physical health, service utilization and duration of homelessness.
- How homelessness and the myriad of associated negative health and social outcomes might be prevented.

Key messages

- Childhood learning disabilities are overrepresented among homeless adults with complex comorbidities and predict a range of poor health outcomes in adulthood including mood and anxiety disorders, suicidal ideation, early and severe substance use, and physical health problems.
- Early risk factors are often longstanding and drive a trajectory of cumulative risk, potentially leading to severe psychopathology and social exclusion.

Strengths and limitations of this study

- Strengths include a large sample size, a diverse recruitment strategy, and structured diagnostic interviews for mental disorders.
- Limitations include retrospective, self-report of childhood learning disabilities.
- Lack of access to early trauma and family dysfunction variables as well as measures of general cognitive impairment at baseline.

INTRODUCTION

Efforts to prevent homelessness require an understanding of the underlying causes and early indicators of risk. Research into the causes of homelessness suggests complex interactions between structural and individual factors, both of which are often present long before the onset of first homelessness.[1-2] The childhoods of homeless adults are disproportionately characterized by persistent poverty, residential mobility, school problems, and other stressful and/or traumatic experiences[3-5] particularly among homeless individuals with severe mental illness.[2]

While a growing body of research has examined the relationship between adverse childhood events and subsequent homelessness,[3, 4] few studies have examined the role of childhood learning disabilities. There is growing evidence that academic problems in school foreshadow later educational and employment difficulties and may affect multiple domains of functioning.[6]

In Canada, educational policies fall under provincial jurisdiction, therefore, definitions of learning disabilities (LD) vary widely and include learning problems, difficulties, disorders, as well as "children at risk."[7] LD are assumed to be neurological in origin and affect the acquisition, organization, retention, understanding or use of verbal and/or nonverbal information.[8] According to Statistics Canada, 4.9% of children aged 6 to 15 have a LD, varying from 1.6% for children aged 6 to 7.2% among 10-year-olds.[9]

While the consequences of LD on childhood academic and social development are well documented,[10, 11] the impact in adulthood is challenging to assess. However,

research suggests that LD often persist into adulthood and affect diverse aspects of functioning including employment, social relationships, quality of life, and mental and physical health.[12]

In school settings, LD typically manifest as poor academic achievement, which is associated with a greater number of school absences, suspensions, and grade retention as well as externalizing and internalizing behaviour problems.[7-10] Almost one-third of US adolescents with LD in the National Longitudinal Transition Study did not complete high school and were less likely to enroll in subsequent vocational or academic programs compared to their non-LD peers.[10]

Research examining substance abuse among youth with LD remains inconclusive.[13] Beitchman et al.[11] assessed 264 Canadian children for LD at ages 12 and 19, and for psychiatric and substance use disorders at age 19. Children who met criteria for LD at ages 12 and 19 were more likely to develop a psychiatric or substance use disorder compared to non-LD children at both time points. LD at 19 years of age increased the risk for substance use disorder three-fold after controlling for behavioural problems and family structure. Difficulties with executive functioning, academic failure, low self-esteem, and poor social skills are viewed as the strongest predictors of substance use disorder.[14]

Compared to non-LD peers, youth with LD frequently report feelings of loneliness, stress, depression, and suicide, among other psychiatric symptoms.[15, 16] For example, in the National Longitudinal Study of Adolescent Health, the LD sample was twice as likely to report a suicide attempt in the past year.[16] Longitudinal research on risk-taking indicates that, compared to non-LD peers, adolescents with LD engage more

frequently in various risk behaviours.[17] Therefore, the presence of LD in childhood appears to confer a general risk for adverse outcomes throughout adolescence and into adulthood.

In identifying early indicators for homelessness, we are posing a larger question about how we might prevent homelessness and the myriad of associated negative health and social outcomes. There has been a resurgence of interest in early intervention as a means of preventing or attenuating a wide range of developmental outcomes in adulthood.[18] In this study, we focus on the relationship between early LD as a predictor of adult homelessness and associated health and service use outcomes. Unlike family instability and dysfunction, which fall under the jurisdiction of child welfare agencies, LD can be identified and addressed within the school system and may serve as an early marker of social and developmental risk.

METHODS

The Vancouver At Home Project is a randomized controlled trial (RCT) involving homeless adults with mental illness in Vancouver, British Columbia. Study design and sample size were determined by the At Home/Chez Soi National Research Team which monitored activities at five different study sites.[19] Details related to the RCT protocol such as CONSORT have been reported elsewhere[19]. The current study focuses on baseline data from one study site (Vancouver) prior to randomization and does not incorporate any findings related to RCT elements.

Eligibility criteria included legal adult status (19 years and older), current mental disorder on the MINI Neuropsychiatric Interview (MINI),[20] and being absolutely homeless or precariously housed. Absolute homelessness was defined as living on the

streets or in an emergency shelter for at least the past seven nights with little likelihood of obtaining secure accommodation in the upcoming month. Precariously housed was defined as living in a rooming house, hotel or other transitional housing; in addition, individuals must have experienced at least two episodes of absolute homelessness in the past year, or one episode lasting for at least four weeks in the past year.

Participants were recruited through referral from over 40 agencies available to homeless adults in Vancouver; the majority were recruited from homeless shelters, drop-in centres, homeless outreach teams, hospitals, community mental health teams, and criminal justice programs. We specifically targeted organizations that serve women, youth, aboriginal peoples, and gay/lesbian/transgender individuals in order to obtain as diverse and representative a sample as possible. Referral was initiated by service providers and a preliminary screening for eligibility was conducted via telephone with the referral agent. All participants met face-to-face with a trained research interviewer who explained procedures, obtained informed consent, and confirmed study eligibility. A cash honorarium of $5 was provided for the screening process. Institutional ethics board approval was obtained through Simon Fraser University and the University of British Columbia.

Approximately 85 individuals were turned away on the phone because they clearly did not meet eligibility criteria. In addition, approximately 100 individuals were invited to meet with an interviewer for further eligibility screening and/or to begin the baseline questionnaire but did not show up for an appointment. Whenever possible, appointments were rescheduled and interviewers tried to locate individuals in the community. Finally, 92 recruits completed the formal eligibility screening process but

were deemed ineligible. When these individuals were compared with participants who were enrolled in the study, no significant differences were found in terms of current age or gender.

If the individual met all study criteria, they were enrolled as a participant and the baseline interview commenced, consisting of a series of interviewer-administered questionnaires including socio-demographic characteristics, psychiatric symptoms, substance use, physical health, service use, and quality of life. Participants received a further cash honorarium of $30 upon completion of the baseline interview. The following analyses are based upon data from the baseline questionnaires of 497 participants recruited from October 2009 to June 2011.

Variables of interest

LD were assessed using the following questions, focusing on childhood: (1) "Do you think you had a learning problem or learning disability?" and (2) "Did anyone ever tell you that you have a learning problem or learning disability?" ~~Only~~ Given the retrospective nature of these questions, only participants who responded positively to both questions were included in the analysis.

With regard to mental disorders, Severe Cluster includes at least one of current Psychosis, Mood Disorder with Psychotic Features, and Hypomanic or Manic Episode, as identified through the MINI or documented physician diagnosis. Less Severe Cluster includes at least one of current Major Depressive Episode, Panic Disorder, and Post-traumatic Stress Disorder. Suicidality, Alcohol Dependence, and Substance Dependence were also identified using the MINI. Frequency and type of substance use over the past

month were recorded using the Maudsley Addiction Profile (MAP).[21] Physical illness was assessed by self-report using a checklist of 30 chronic health conditions (lasting longer than six months). Blood-borne infectious disease consisted of positive self-report diagnosis of HIV, Hepatitis B or Hepatitis C. Head injury status was based on the question "Did you ever receive a head injury that left you unconscious?" Shoplifting and selling drugs were assessed during the past month using the MAP.

Self-reported involvement with health services was collected for the past six months including visiting and talking to a health or service provider, Emergency Room visits, and being transported by ambulance. Criminal justice services included contact with the police that resulted in detention, arrest and court appearances. The Multnomah Community Ability Scale (MCAS)[22] quantifies community functioning based on 17 items and was scored by the interviewer upon completion of the baseline interview.

Statistical analyses

Comparisons of categorical data between participants who did or did not report a learning problem or disability were conducted using Pearson's chi-square or Fisher's exact test. Comparisons of numeric variables (e.g., age at enrolment) between groups were conducted using the Student t test and Wilcoxon's rank-sum test. Univariate and multivariable logistic regression analyses were used to model the independent associations between childhood LD and a series of a priori outcome variables. Outcomes variables that were significant at the $p \leq 0.10$ level were considered for univariate and multivariable logistic regression analyses. Each variable was modeled in both univariate and multivariate settings using childhood LD as an independent risk factor and the same set of controlling variables (age at enrolment, age of first homelessness, gender, ethnicity,

marital status, and language spoken in the childhood home). Both unadjusted and adjusted odds ratios and 95% confidence intervals (CI) are reported and all p-values are two-sided. SPSS-19 was used to conduct these analyses. Missing values ranged from zero to 4% and were excluded from the analyses.

RESULTS

In total, 497 participants completed the baseline questionnaire~~,~~; 178 participants (36%) thought they had a learning problem or disability in childhood, 182 (37%) reported being told they had a learning problem or disability, and 133 (27%) responded positively to both indicators of childhood LD. The majority of the total sample was male (73%) and Caucasian (56%); the mean age at enrollment was 40.8 (SD=11.0) years; and the mean age when first homeless was 30.3 (SD=13.3) years. The median duration of lifetime homelessness was 36 months (IQR: 12-84 months). All bivariate comparisons by childhood LD are summarized in Tables 1 to 3. Tables 1 and 2 present demographic characteristics and current mental disorder status of participants by childhood LD status (yes vs. no).

[Insert Tables 1 and 2 about here]

Table 3 presents self-reported substance use (past month) and service use (past six months) characteristics by childhood LD status. Participants who reported having a childhood LD were significantly more likely to report a number of negative health outcomes related to physical health (i.e., blood-born infectious diseases, migraine, and seizures), mental health (i.e., major depressive episode, panic disorder, high suicidality) and substance use (i.e., alcohol dependence, early initiation of drug use, daily drug use, and injection drug use).

Learning problems and disabilities

[Insert Table 3 about here]

Unadjusted (UOR) and adjusted odds ratios (AOR) and 95% CI for variables included in the univariate and multivariable analyses are presented in Table 4. Results from the multivariable logistic regression analyses indicate that reporting a childhood LD independently predicted not entering high school (AOR: 2.21), lifetime duration of homelessness greater than three years (AOR: 1.90), current major depressive episode (AOR: 1.64), panic disorder (AOR: 1.86), alcohol dependence (AOR: 1.69), high suicidality (AOR: 1.93), less severe cluster of mental disorders (AOR: 1.95), two or more mental disorders (AOR: 2.06), infectious disease (AOR: 1.75), migraine (AOR: 2.50), seizures (AOR: 2.23), head injury (AOR: 2.23), poor or fair overall health (AOR: 1.90), injection drug use (AOR: 2.01), daily drug and alcohol use (AOR: 1.70), daily drug use (not including alcohol) (AOR: 1.77), daily hard drug use (not including alcohol or marijuana) (AOR: 1.79), early initiation of drug use (<14 years) (AOR: 1.60), shoplifting in the past six months (AOR: 2.31), and talking to a health or social service provider in the past six months (AOR: 2.00).

[Insert Table 4 about here]

DISCUSSION

Our multivariable models identified several factors that were associated with self-reported childhood LD in a cohort of adults who are homeless and have a mental disorder: longer lifetime duration of homelessness; less severe mental disorders as well as multiple mental disorders and high suicidal ideation; early and severe substance use, including injection drug use and daily use of both drugs and alcohol; and physical health problems including infectious disease, head injury, multiple illnesses, and rating ones'

overall health as fair or poor. Despite the complex health needs of this sub-group, the only service use variable that was predicted by childhood learning problems or disabilities was very generic: talking to a health or social service provider in the past six months. A range of criminal justice variables as well as emergency room, ambulance utilization, and various other health services were not significant in our analyses. Collectively, our results indicate that childhood LD are overrepresented among homeless adults with complex comorbidities and predict a range of poor health outcomes in adulthood.

These findings support previous research demonstrating a link between poor academic achievement and the psychological adversity faced by some adults.[6, 23] Studies of homeless and highly mobile children have identified that both groups show slower learning and academic progress than their residentially stable peers.[23] However, the risk of homelessness among people with LD has received scant attention in the research literature.[24, 25] Among our sample of homeless adults, 41% did not graduate from high school and 43% reported being in a special class in school, suggesting that learning and academic achievement was challenging throughout their school years and likely persists in adulthood in the form of poor literacy skills and difficulties finding and maintaining employment.

Our index of LD does not discriminate between focal and more general cognitive difficulties, nor did we assess the presence of LD in adulthood. Several studies have found increased rates of general cognitive impairment among homeless adults compared to housed comparison groups.[26, 27] In our sample of homeless adults with current mental disorders, 66% reported experiencing a head injury that left them unconscious.

However, these injuries may have occurred in adulthood and it is well documented that homeless adults are more likely to experience a variety of accidents compared to housed counterparts.[27] It is also possible that childhood LD among our sample were related to psychological distress in the home.[24] Regardless of the origin of learning problems among homeless adults, it appears that they persist over time and are associated with significant functional impairment.

Childhood LD independently predicted a range of substance use problems in our adult sample, including early initiation of drug use (before age 14). Abuse of alcohol and other drugs places an individual at greater risk of homelessness, but is not a direct causal factor.[28] Along with other studies, our findings suggest that daily drug use is a common mediator for a range of early risk factors.[29] Previous research using our sample of homeless adults with mental disorders found that daily drug use significantly predicts duration of homelessness[30] as well as severity of mental health symptoms.[31]

Cross-sectional, retrospective data cannot disentangle the unique predictors of homelessness and mental illness, but it is likely that negative childhood experiences have both direct and indirect (mediated by substance use) effects on participants' history of homelessness. Documentation of these underlying common factors points to a broad range of vulnerabilities for homelessness and mental illness. These common factors increase the complexity of personal problems as well as the duration of homelessness.[30] Therefore, substance dependence, especially when concurrent with mental illness among homeless populations, is not only a clinical problem but also a critical indicator for a range of other social and psychological problems that may need to be addressed before homelessness can be resolved.

Learning problems and disabilities

Problems such as homelessness that have long developmental trajectories, are perhaps best understood from models of cumulative adversity and amplification of risk.[32,33] Based on life course development and social learning theory, the risk amplification model addresses mechanisms through which experiences on the street amplify negative developmental effects originating in the family. According to this model, harmful behaviours and negative self-concept are perpetuated by the progressive accumulation of their own consequences. Thus, homelessness can be understood as the result of a developmental trajectory defined by successive environmental disruptions, each of which places individuals at greater risk for homelessness and associated risk factors.

Individuals generally become homeless after experiencing a crisis due to limited income, social support, and personal coping skills.[5, 28] However, it is unclear what leads some people to become homeless while others do not. The risk amplification model may apply primarily to subgroups who are most vulnerable to a variety of structural contributors to homelessness such as poverty and the lack of affordable housing. Problem Behaviour Theory[~~33~~34, ~~34~~35] suggests that various risk factors may comprise a cluster of risky behaviours that mediate the link from childhood adversity to illicit drug use in adulthood, rather than distinct independent pathways. Another potential pathway linking childhood adversity to adult homelessness is the likelihood that such adversity elevates individuals' risk for psychiatric disorders such as depression and substance abuse, which are risk factors for homelessness, by reducing one's ability to earn adequate income and maintain stable housing.

Implications

Learning problems and disabilities

The growing body of research that suggests a trajectory of risk preceding the first episode of homelessness begs the question "Can outcomes such as homelessness be prevented?" In addition to addressing structural barriers such as income inequality and affordable housing, ~~M~~many researchers and policy makers have called for comprehensive preventive interventions for high-risk children in public and community settings.[~~35~~36, ~~36~~37] Supporting children's cognitive development and schooling is particularly important and early childhood education programs should be available for children at greatest risk. High risk includes established indicators such as early learning problems, abuse and/or neglect, behavioural and emotional problems, and early substance use. From a public health perspective, early interventions in childhood might change or moderate the cycle of homelessness across generations because early risk factors are often longstanding and drive a trajectory of cumulative risk, potentially leading to severe psychopathology and social exclusion. Despite the need for early intervention, our study also highlights the need for identifying and addressing current learning problems among homeless adults. Learning problems may contribute to challenges with print and financial literacy, obtaining and maintaining housing and employment, and a wide range of daily living skills.

Limitations

Despite the strengths of our study design (i.e., large sample size, diverse recruitment strategy, structured diagnostic interviews), several limitations must be considered. First, all variables were based on participant self-report. Given that participants were selected based on current mental disorder, accuracy of recall may have been compromised. Furthermore, participants were interviewed before being randomized to a housing

intervention, therefore, some may have modified their responses in an attempt to influence the outcome of randomization. In addition, at baseline, we did not have access to early trauma or family dysfunction variables. Given the association between early trauma, foster care placements and adult homelessness,[2] it will be important to further examine the impact of these variables on later health and social outcomes. Similarly, we did not have access to measures of current LD or general cognitive impairment at baseline. Examination of current cognitive impairment, particularly as it relates to early learning problems, may shed light on current health and social functioning.

Future directions

Early indicators of risk clearly cannot explain all cases of homelessness. Many people without early risk factors become homeless and many who experience risk do not become homeless. Further research is needed to examine what differentially places people at risk for risk.[~~37~~38] We need better theory and better data to understand how social factors regulate behaviours or distribute individuals into risk groups and how those social factors 'push' individual trajectories toward or away from adverse outcomes. However, our results linking early learning problems to homelessness, mental illness and substance use are consistent with a growing body of research indicating that adverse childhood events are potent risk factors for a number of psychiatric and substance use disorders.[6]

Real prevention with regard to homelessness and other social problems will require systemic social and policy changes that address the environments within which children adapt so that they can mature into well-functioning adults. Nonetheless, our findings, along with others', outline a risk profile that can guide future research into mechanisms and pathways through which childhood risks are translated into adult

sequelae. Interventions that can effectively address childhood risk factors such as learning problems and disabilities may ultimately prevent critical social problems including homelessness and the enormous social and individual costs related to these problems.

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DECLARATION OF INTERESTS

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Learning problems and disabilities

Table 1: Comparisons of socio-demographic characteristics between participants who reported childhood learning problems or disabilities (LD-Yes; n=133) and those who did not (LD-No; n=364). [1]

Variable	Total Sample N (%)	LD-No N (%)	LD-Yes N (%)	p value
Male gender	359 (73)	259 (72)	100 (76)	0.375
Age at enrolment				0.001**
19-25 years	36 (7)	25 (7)	11 (8)	
25-44 years	281 (57)	190 (52)	91 (68)	
Over 44 years	180 (36)	149 (41)	31 (23)	
Ethnicity				0.469
Aboriginal	77 (15)	52 (14)	25 (19)	
Caucasian	280 (56)	208 (57)	72 (54)	
Other	140 (28)	104 (29)	36 (27)	
Educational attainment (≤Grade 8)	76 (15)	44 (12)	32 (25)	<0.001**
Single marital status	343 (70)	250 (69)	93 (70)	0.797
Language spoken at home during childhood (English)	392 (79)	282 (77)	110 (83)	0.206
Psychiatric hospitalization (past 5 years) longer than 6 months	57 (12)	43 (12)	14 (11)	0.686
Psychiatric hospitalization (past 5 years) 2 or more times	253 (53)	189 (54)	64 (50)	0.542
Employment history (at least 1 year of continuous work)	323 (65)	243 (67)	80 (60)	0.138
Jail (past 6 months)	68 (14)	46 (13)	22 (17)	0.262
Duration of homelessness				
Total lifetime (>3 years)	234 (48)	155 (43)	79 (61)	<0.001**
Longest single period (>1 year)	245 (50)	174 (48)	71 (55)	0.143
Age of first homelessness (<25 years)	214 (44)	143 (39)	71 (56)	0.001**
Overall health (poor or fair)	235 (47)	161 (44)	74 (56)	0.026*
MCAS total score (<56) #	244 (49)	177 (49)	67 (50)	0.730

[1] Each multivariable model was controlled for age (continuous measure), age of first homelessness age (continuous measure), gender, ethnicity (Aboriginals, Caucasian, Other), marital status (Single vs. Other) and language spoken in childhood home (English vs. Other).
Dichotomized based on median value.
**p≤0.001
*p≤0.05

Learning problems and disabilities

Table 2: Comparisons of mental disorders and physical illness between participants who reported childhood learning problems or disability (LD-Yes; n=133) and those who did not (LD-No; n=364). [1]

Variable	Total sample N (%)	LD-No N (%)	LD-Yes N (%)	p value
Mental Disorders (past month)				
Major Depressive Episode	199 (40)	134 (37)	65 (49)	0.015*
Manic or Hypomanic Episode	97 (20)	64 (18)	33 (25)	0.072+
Post-traumatic Stress Disorder	129 (26)	88 (24)	41 (31)	0.122
Panic Disorder	104 (21)	64 (18)	40 (30)	0.002*
Mood Disorder with Psychotic Features	84 (17)	57 (16)	27 (20)	0.208
Psychotic Disorder	263 (53)	200 (55)	63 (47)	0.134
Alcohol dependence	121 (24)	79 (22)	42 (32)	0.023*
Substance dependence	288 (58)	205 (56)	83 (62)	0.224
Two or more mental disorders	240 (48)	158 (43)	82 (62)	<0.001**
High suicidality	87 (18)	54 (15)	33 (25)	0.010+
Less severe cluster	264 (53)	176 (48)	88 (66)	<0.001**
Severe cluster	363 (73)	267 (73)	96 (72)	0.794
Physical Health				
Migraine	157 (32)	94 (26)	63 (48)	<0.001**
Epilepsy or seizures	67 (14)	40 (11)	27 (21)	0.006*
Blood-borne infectious diseases	157 (32)	103 (29)	54 (41)	0.008*
Head injury	270 (56)	179 (51)	91 (71)	<0.001**
Two or more physical conditions	402 (81)	287 (78.8)	115 (86)	0.056+

[1] Each multivariable model was controlled for age (continuous), age of first homelessness age (continuous), gender, ethnicity (Aboriginals, Caucasian, Other), marital status (Single vs. Other) and language spoken in childhood home (English vs. Other).
**p≤0.001
*p≤0.05
+ p≤0.10

Learning problems and disabilities

Table 3: Comparisons of substance use and service utilization between participants who reported childhood learning problems or disability (LD-Yes; n=133) and those who did not (LD-No; n=364). [1]

Variable	Total sample N (%)	LD-No N (%)	LD-Yes N (%)	p value
Substance Use (past month)				
IV drug use	88 (18)	53 (15)	35 (27)	0.003*
Daily substance use (including alcohol)	143 (29)	91 (25)	52 (39)	0.002*
Daily drug use (no alcohol)	126 (25)	78 (21)	48 (36)	0.001*
Daily hard drug use (no alcohol, no marijuana)	74 (15)	45 (12)	29 (22)	0.009*
Daily alcohol use	26 (5)	17 (5)	9 (7)	0.367
Polysubstance use (no alcohol)	188 (38)	128 (35)	60 (45)	0.050+
Age first drunk (<14 years)	212 (45)	142 (42)	70 (56)	0.007*
Age of first drug use (<14 years)	178 (40)	114 (35)	64 (52)	0.001*
Sold drugs	50 (10)	32 (9)	18 (14)	0.140
Shop-lifting	62 (13)	34 (10)	28 (21)	0.001*
Service Use (past 6 months)				
Psychiatrist	134 (27)	109 (30)	25 (19)	0.013*
Addiction counselor	18 (4)	10 (3)	8 (6)	0.084+
Seen by a health/social service provider	384 (78)	276 (76)	108 (82)	0.204
Talked with a health/social service provider	112 (23)	69 (19)	43 (32)	0.002*
ER visit (yes/no)	281 (58)	204 (57)	77 (60)	0.594
Multiple ER visits (three or more)	107 (22)	71 (20)	36 (28)	0.058+
Ambulance (yes/no)	195 (40)	147 (41)	48 (36)	0.381
Police detention (yes/no)	80 (19)	61 (19)	19 (17)	0.610
Arrested (yes/no)	172 (36)	124 (35)	48 (38)	0.603
Multiple arrests (two or more)	75 (16)	48 (14)	27 (21)	0.044+
Court appearance	172 (35)	127 (36)	45 (35)	0.932
Justice program	48 (11)	30 (9)	18 (16)	0.076+

[1] Each multivariable model was controlled for age (continuous), age of first homelessness age (continuous), gender, ethnicity (Aboriginals, Caucasian, Other), marital status (Single vs. Other) and language spoken in childhood home (English vs. Other).

**p≤0.001

*p≤0.05

+ p≤0.10

Learning problems and disabilities

Table 4: Logistic regression analyses for socio-demographics, mental disorders, substance use and service utilization related outcomes based on early learning problems or disability (n=497).

Outcome Variable	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[1]
Age of first homelessness (<25 years)[2]	1.96 (1.30, 2.95)**	1.52 (0.95, 2.44)
Lifetime duration of homelessness (>3 years)[#]	2.11 (1.40, 3.18)**	1.90 (1.19, 3.06)*
Education level (Grade 8 or less)	2.38 (1.43, 3.95)	2.20 (1.28, 3.81)
Type of Mental Disorder		
Major Depressive Episode	1.64 (1.10, 2.45)*	1.64 (1.07, 2.52)*
Manic or Hypomanic Episode	1.55 (0.96, 2.49)	1.51 (0.91, 2.51)
Panic Disorder	2.02 (1.28, 3.19)*	1.86 (1.15, 3.02)*
Alcohol dependence	1.67 (1.07, 2.59)*	1.69 (1.06, 2.69)*
Two or more mental disorders	2.10 (1.40, 3.15)**	2.06 (1.33, 3.19)**
High suicidality	1.89 (1.16, 3.09)*	1.93 (1.15, 3.24)*
Less severe cluster of mental disorders	2.10 (1.38, 3.16)**	1.95 (1.25, 3.04)*
Physical Health		
Blood-borne infectious diseases	1.76 (1.16, 2.66)*	1.75 (1.11, 2.74)*
Migraine	2.57 (1.70, 3.90)**	2.50 (1.62, 3.88)**
Seizures	2.11 (1.23, 3.61)*	2.23 (1.25, 4.00)*
Multiple physical illness	1.71 (0.98, 2.99)	2.16 (1.16, 4.02)*
Overall health (fair/poor)	1.57 (1.06, 2.35)*	1.90 (1.24, 2.92)*
History of head injury	2.33 (1.51, 3.59)*	2.23 (1.42, 3.50)*
Substance Use		
IV drug use	2.07 (1.28, 3.36)*	2.01 (1.19, 3.39)*
Daily drug use (no alcohol)	2.07 (1.34, 3.19)**	1.77 (1.12, 2.80)*
Daily drug use (no alcohol, no marijuana)	1.98 (1.18, 3.31)*	1.79 (1.03, 3.11)*
Daily substance use (including alcohol)	1.93 (1.26, 2.94)*	1.70 (1.09, 2.65)*
Poly-substance use (no alcohol)	1.50 (1.00, 2.24)	1.27 (0.82, 1.97)
Age first drunk (<14 years)	1.75 (1.16, 2.65)*	1.37 (0.88, 2.14)
Age of first drug use (<14 years	1.98 (1.30, 3.02)**	1.60 (1.02, 2.50)*
	2.53 (1.46, 4.36)**	2.31 (1.30, 4.11)*
Service Use		
Talked with a health/social service provider	1.99 (1.30, 3.11)*	2.00 (1.25, 3.21)*
Multiple ER visits (three or more)[#]	1.12 (0.74, 1.68)	1.04 (0.67, 1.60)
Multiple arrests (two or more)[#]	1.70 (1.01, 2.87)*	1.65 (0.95, 2.86)
Justice program	1.76 (0.94, 3.92)	1.34 (0.59, 3.08)

[1] Each multivariable model was controlled for age (continuous), age of first homelessness age (continuous), gender, ethnicity (Aboriginal, Caucasian, Other), marital status (Single, Other) and language spoken in the childhood home (English, Other).

Learning problems and disabilities

[2] This multivariable model was controlled for age (continuous), gender, ethnicity (Aboriginal, Caucasian, Other), marital status (Single, Other), and language spoken in the childhood home (English, Other).
[#] Dichotomized based on median value.
**p≤0.001
*p≤0.05