

Longitudinal patterns of childhood homelessness and early adolescent trajectories of internalising and externalising behaviour

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ABSTRACT

Background Child homelessness has been associated with elevated mental health problems during early adolescence, a period of onset for psychiatric problems. Prior literature has relied on cross-sectional studies, limiting the understanding of temporality and trajectories of psychopathology. We extend prior literature by examining associations between child homelessness and internalising and externalising symptom trajectories in early adolescence, with consideration of timing and persistence of homelessness.

Methods Using population-based longitudinal data from the Avon Longitudinal Study of Parents and Children, we used multilevel models to examine the effects of homelessness prior to age 9, the timing of homelessness (eg, early vs middle childhood) and cumulative exposure to homelessness on internalising and externalising trajectories across ages <0–9 years. We also tested for sex differences in these associations.

Results Of the 8391 participants, 5.5% reported exposure to homelessness at least once before age 9. Children who experienced homelessness had elevated internalising and externalising symptoms compared with their consistently housed peers, with excess risk evident among children who first experienced homelessness in middle childhood (relative to early childhood) and children who experienced recurrent homelessness. We did not observe changes in symptom trajectories over the course of 4 years. Men who experienced homelessness displayed a more pronounced risk of internalising symptoms relative to women and men who did not experience homelessness.

Conclusion Childhood homelessness is associated with persistently elevated internalising and externalising symptoms across early adolescence compared with their consistently housed peers. Interventions and policies to address family homelessness may lead to better mental health among adolescents.

INTRODUCTION

Childhood homelessness is a significant public health concern.^{1,2} More than 120 000 children in England were living in temporary accommodations in 2018, an increase of approximately 80% since 2011.³ Homelessness has a wide range of adverse effects on child development because it can contribute to pervasive disruptions within school and community relationships,⁴ substandard housing conditions,⁵ and unstable family dynamics and routines.⁶ Prior studies indicate that children experiencing homelessness display more emotional

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Previous studies demonstrated that homelessness during childhood is associated with elevated psychiatric problems. However, longitudinal, population-based studies are scarce and often fail to consider the role of timing and repeated occurrence of homelessness on psychopathology.

WHAT THIS STUDY ADDS

⇒ The results of the present study demonstrate that children who experienced homelessness have consistently elevated internalising and externalising problems at age 9 and across early adolescence. These risks are pronounced for those who were homeless in middle childhood (ages 6–8) compared with early childhood (ages <0–5) and those who experienced recurrent homelessness (two times or more prior to age 9).

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These findings point to the importance of preventing family homelessness and developing targeted programmes for preadolescents who experienced or are experiencing homelessness.

and behavioural problems than their consistently housed peers.^{7–9} For example, a 2015 meta-analysis showed that 10%–26% of homeless preschoolers and 24%–40% of homeless school-aged children had mental health problems requiring clinical evaluation.¹ While most research on homelessness and children's mental health is cross-sectional, some evidence suggests that repeated experiences of homelessness are important to consider. A study by Sandel and colleagues found that infants who were homeless both prenatally and postnatally were at the highest risk of developmental delays and poor health,¹⁰ consistent with research documenting the importance of the duration of other forms of childhood adversity, such as poverty.¹¹ Relatedly, other studies indicate potential sensitive periods during which the impact of adverse experiences interact with dynamic brain systems to subsequently alter behaviour and mental health^{12–15}; however, few studies have examined how the timing of the first episode of homelessness impacts mental health outcomes in early adolescence. Furthermore, few studies have examined sex differences in



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associations between homelessness and internalising and externalising behaviour trajectories across early adolescence, even though studies on other forms of childhood adversity suggest this is important to consider.^{16 17} It is possible that differences in the timing of the onset of puberty between men and women partially explains the sex differences in the impact of adverse experiences on the trajectories of internalising symptomatology.¹⁸ More specifically, women tend to exhibit internalising problems, whereas men are more likely to demonstrate externalising problems during adolescence^{19 20}; yet, few studies have examined sex differences in the association between homelessness and mental health trajectories.

In this study, we use prospective data from the Avon Longitudinal Study of Parents and Children (ALSPAC) to examine longitudinal patterns of homelessness exposure in childhood on trajectories of internalising and externalising problems across early adolescence. Emerging evidence from several longitudinal studies suggests that early childhood may be a period during which neurodevelopmental processes (eg, neural development, DNA methylation patterns and cognitive functioning) are particularly vulnerable to the effects of severe adversity.^{21–23} Moreover, early adolescence represents a developmental period in which the onset of and changes in psychopathology are most often observed symptoms.¹⁷ Therefore, to better inform policies and practices, we sought to elucidate how the timing of exposure to homelessness across the early childhood period impacts internalising and externalising symptomatology across early adolescence. We extend prior research on the associations considering childhood homelessness in three ways. First, advancing on studies that consider any life history of homelessness as a dichotomous exposure, we operationalise homelessness to consider (1) any experience of homelessness from prenatal to 9 years of age (ie, ever homeless); (2) the timing of the first episode of homelessness (ie, prenatal, early childhood and middle childhood); and (3) the cumulative frequency of homeless episodes before age 9. Second, building on cross-sectional studies that rely on shelter-based samples,^{7 24 25} we use a population-based cohort to examine the longitudinal associations of child homelessness on trajectories of internalising and externalising symptoms across early adolescence. Third, we assess whether these associations differ between boys and girls. Based on previous literature,¹⁰ we hypothesise that children whose first episode of homelessness occurred prenatally or during early childhood and children with repeated experiences of homelessness will have the highest levels of internalising and externalising symptoms. Given that evidence with regard to sex differences in the association between homelessness and psychopathology is limited, this aim is exploratory.

METHODS

Sample

Data were drawn from ALSPAC, a prospective birth cohort study investigating genetic and environmental influences on health and development, conducted by the University of Bristol.^{26 27} Pregnant women residing in the Avon catchment area of South West England with expected delivery dates between April 1991 and December 1992 were recruited. The initial number of pregnancies enrolled was 14 541, and of these, there were 14 062 live births. Participating mothers, partners and study children were assessed repeatedly with in-person visits and mailed questionnaires (<http://www.bris.ac.uk/alspac/researchers/our-data>).

The analytical sample included 8391 children who had at least partial data on the homelessness variables. Specifically, participants were included if they had at least five complete responses

out of 10 items on homelessness status from prenatal to age 9 years and at least one outcome score at ages 9, 11 or 13 years.

Measures

Homelessness

Mother-reported homelessness was measured by a dichotomous response to the question ‘You became homeless within (time)’ at each wave of data collection—specifically, during pregnancy and at child ages 0.67, 1.5, 2.5, 5.0, 6.0 and 9.0 years. We created three homelessness variables to capture potential differences in associations based on timing and accumulation. The broadest homelessness variable is binary, defined as ever experiencing homelessness from prenatal to 9 years of age versus never experiencing homelessness during this period. The timing of first exposure to homelessness was categorised into three developmental periods, including prenatal and infancy (ages <0–2), early childhood (ages 3–5) and middle childhood (ages 6–8). The variable for the accumulation of homelessness exposure was calculated as the sum of available homelessness reports across age. The sum was then transformed into a categorical variable, indicating none, one, or two or more exposures to homelessness by age 9. Online supplemental STable 1 summarises the coding of the homelessness variables.

Psychopathology symptoms

When children were ages 9, 11 and 13 years, mothers reported on psychopathology symptoms in the past 6 months using the Strengths and Difficulties Questionnaire, a valid and reliable tool for measuring emotional and behavioural difficulties.²⁸ We focused on symptomatology rather than a binary cut-off because a continuous variable allows for better representation of the distribution of the symptoms.²⁹ Consistent with prior studies, we created a 10-item internalising problems scale (ie, emotional and peer relationship problems) and a 10-item externalising problems scale (ie, conduct, hyperactivity and inattention problems).³⁰ Scores were standardised to have a mean of 0 and an SD of 1.

Confounding variables

Potential confounders were measured via maternal self-report during and after pregnancy and included maternal education, number of financial difficulties at 32 weeks’ gestation (based on a checklist of five material needs), parity at the time of pregnancy, maternal age at child’s birth and child ethnicity (white vs non-white). We adjusted for ethnicity, which is correlated with child homelessness and psychopathology independently (reflecting structural and interpersonal discrimination), as a potential confounder. Maternal postnatal depression was measured by the Edinburgh Postnatal Depression Score questionnaire (continuous scale of 0–30).³¹ Child sex was obtained from the birth certificate.

Statistical analysis

Pearson’s correlation was used to establish the relationship between internalising and externalising symptom scores at each time point. We used restriction maximum likelihood estimation to estimate a series of multilevel linear regression models with growth curves (repeated psychopathology symptom measurements nested within individuals) to investigate the effects of homelessness on internalising and externalising behaviour trajectories in early adolescence. The intercept was set to the initial point, corresponding to symptom scores at age 9. First, we modelled trajectories of psychopathology symptoms across

time with a linear slope term age and random effects for age. Confounders were included as fixed effects. Second, to test differences in the slopes of internalising and externalising symptoms over time, an interaction term between homelessness and age was included. Identical sets of models were repeated for each of the three homelessness variables and the two study outcomes. To examine sex differences, an interaction term between child sex and any experience of homelessness by age 9 years was added to the model.

To minimise selection bias, multivariate multiple imputation by chained equations was used to impute missing data on covariates and outcomes in all participants who met the study's inclusion criteria. The imputation models included all variables used in the main analyses, as well as auxiliary variables (eg, marital status, parent alcohol use and number of major life events) that were predictive of incomplete variables and/or missingness. We generated 20 imputation datasets.³² The distribution of variables in observed and imputed data were similar (online supplemental table 2). We used Rubin's rules to produce a single estimate unbiased to differential losses to follow-up.³³

As a sensitivity test of our approach to missing data and modelling approach, after applying the same inclusion and exclusion criteria, we assumed that data were missing at random and used full information maximum likelihood (FIML) with latent growth curve modelling.³⁴ Latent growth curve models estimate the mean trajectory (ie, intercept and slope) as well as individual variation. In these models, the internalising or externalising symptom scores at 9, 11 and 13 years of age were indicators of two latent factors: (1) an intercept representing initial levels of symptoms at 9 years of age and (2) a linear slope representing growth rates in internalising or externalising symptom scores across ages 9–13 years. The same confounders as previously described were included. We also estimated the covariance between the intercept and slope to reflect the strength and direction of the associations. Robust SEs were used to correct for skewness in the variables.

All statistical analyses were conducted in R V.3.6.2.

RESULTS

Descriptive results

The distribution of demographic characteristics by homelessness are shown in table 1. Of the 8391 participants, 461 experienced homelessness by age 9. Among children who experienced any homelessness, the majority (72%) was first exposed to homelessness before age 3 years; 18% was first exposed between ages 3 years and 5 years; and 10% was first exposed between ages 6 years and 8 years. Of those who had been homeless by age 9, 83% reported experiencing homelessness once; 17% experienced homelessness two or more times. Internalising and externalising symptoms were correlated concurrently and over time (online supplemental SFigure 1).

Effect of homelessness, age of first episode and persistence on the development of psychopathology

Figure 1 presents the observed mean psychopathology symptoms by homelessness exposure. For both groups, we observed a slight increase in externalising and internalising symptoms across ages 9–13.

Internalising symptoms

Children who experienced homelessness exhibited higher levels of internalising symptoms at 9 years of age compared with those who never experienced homelessness by age 9, after

Table 1 Mental health outcomes and sociodemographic characteristics by child exposure to homelessness*

	Never homeless (n=7930)	Ever homeless (n=461)	Overall (N=8391)
Child behavioural problems score			
Internalising age 9, mean (SD)	2.57 (2.68)	3.40 (3.09)	2.61 (2.71)
Missing, n (%)	864 (10.9)	67 (14.5)	931 (11.1)
Internalising age 11, mean (SD)	2.50 (2.67)	3.53 (3.22)	2.55 (2.71)
Missing, n (%)	1458 (18.4)	121 (26.2)	1579 (18.8)
Internalising age 13, mean (SD)	2.58 (2.77)	3.42 (3.00)	2.62 (2.79)
Missing, n (%)	1717 (21.7)	136 (29.5)	1853 (22.1)
Externalising age 9, mean (SD)	4.14 (3.12)	5.23 (3.63)	4.19 (3.15)
Missing, n (%)	863 (10.9)	69 (15.0)	932 (11.1)
Externalising age 11, mean (SD)	3.88 (3.11)	4.86 (3.50)	3.93 (3.14)
Missing, n (%)	1463 (18.4)	123 (26.7)	1586 (18.9)
Externalising age 13, mean (SD)	4.07 (3.13)	5.21 (3.54)	4.13 (3.16)
Missing, n (%)	1721 (21.7)	137 (29.7)	1858 (22.1)
Sociodemographic variables at child birth			
Female, n (%)	3896 (49.1)	248 (53.8)	4144 (49.4)
Ethnicity, n (%)			
White	7367 (92.9)	375 (81.3)	7742 (92.3)
Non-white	276 (3.5)	37 (8.0)	313 (3.7)
Missing	287 (3.6)	49 (10.6)	336 (4.0)
Maternal education level n (%)			
CSE/None	1051 (13.3)	97 (21.0)	1148 (13.7)
Vocational	662 (8.3)	52 (11.3)	714 (8.5)
O level	2755 (34.7)	169 (36.7)	2924 (34.8)
A level	2026 (25.5)	88 (19.1)	2114 (25.2)
Degree	1271 (16.0)	29 (6.3)	1300 (15.5)
Missing	165 (2.1)	26 (5.6)	191 (2.3)
Financial difficulties at child birth, mean (SD)	2.41 (3.23)	5.07 (4.28)	2.55 (3.35)
Missing, n (%)	347 (4.4)	40 (8.7)	387 (4.6)
Parity at child birth	0.785 (0.920)	0.680 (0.893)	0.779 (0.919)
Missing, n (%)	195 (2.5)	36 (7.8)	231 (2.8)
Edinburgh Postnatal Depression Score, mean (SD)	5.74 (4.55)	7.70 (5.66)	5.84 (4.64)
Missing, n (%)	316 (4.0)	39 (8.5)	355 (4.2)
Maternal age at child birth, mean (SD)	29.2 (4.48)	25.9 (5.16)	29.0 (4.57)
Missing, n (%)	258 (3.3)	35 (7.6)	293 (3.5)

*Summary statistics come from preimputed data

adjustment for individual and maternal characteristics and potential confounders ($\beta=0.179$, 95% CI 0.092 to 0.266; see table 2 and online supplemental STable 3 for the full model). The slope indicated that internalising symptom scores were stable during adolescence; the interaction between homelessness exposure and time was not statistically significant, indicating that childhood homelessness was not associated with changes in internalising symptoms over time.

With respect to the timing, children who first experienced homelessness during middle childhood had the highest internalising symptom scores compared with those who were never homeless ($\beta=0.413$, 95% CI 0.152 to 0.674). There were

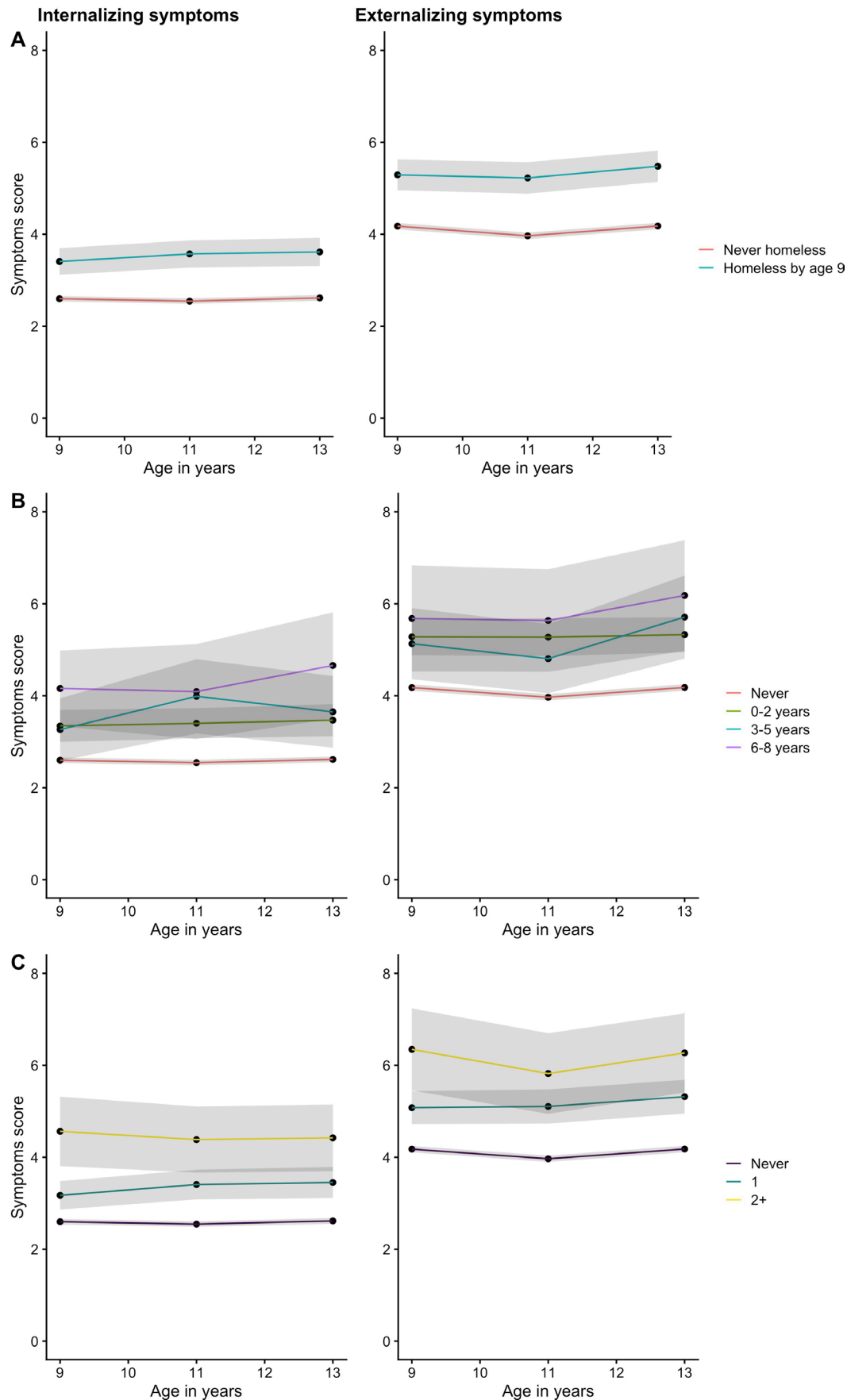


Figure 1 Observed mean internalising (left) and externalising (right) symptoms by homelessness exposure status (A), timing of first occurrence of homelessness (B) and number of reported homelessness exposures (C). All models adjusted for child ethnicity and sex, maternal education, number of financial difficulties, parity, maternal depression and maternal age.

Table 2 Results of multilevel models showing the association between homelessness and trajectories of early adolescent internalising problems†

Fixed effect parameters	Estimate (95% CI)	Estimate (95% CI)
Never/ever homeless by age 9		
(Intercept)	-0.180 (-0.333 to 0.027)*	-0.176 (-0.329 to 0.023)*
Age	0.004 (-0.002 to 0.009)	0.003 (-0.002 to 0.009)
Never homeless by age 9	Ref	Ref
Homeless by age 9	0.179 (0.092 to 0.266)***	0.097 (-0.185 to 0.379)
Sex (female)	0.031 (-0.006 to 0.068)	0.031 (-0.006 to 0.068)
Age×homeless by age 9		0.008 (-0.018 to 0.033)
By first exposure to homelessness		
(Intercept)	-0.177 (-0.33 to 0.024)*	-0.173 (-0.326 to 0.019)*
Age	0.004 (-0.002 to 0.009)	0.003 (-0.002 to 0.009)
Never homeless by age 9	Ref	Ref
First homeless ages 0–2	0.141 (0.039 to 0.243)**	0.054 (-0.267 to 0.375)
First homeless ages 3–5	0.206 (0.017 to 0.395)*	0.173 (-0.499 to 0.844)
First homeless ages 6–8	0.413 (0.152 to 0.674)**	0.284 (-0.632 to 1.2)
Sex (female)	0.031 (-0.007 to 0.068)	0.031 (-0.007 to 0.068)
Age×first homeless ages 0–2		0.008 (-0.021 to 0.037)
Age×first homeless ages 3–5		0.003 (-0.057 to 0.063)
Age×first homeless ages 6–8		0.012 (-0.072 to 0.096)
Persistent homelessness		
(Intercept)	-0.178 (-0.331 to 0.025)*	-0.174 (-0.327 to 0.021)*
Age	0.004 (-0.002 to 0.009)	0.003 (-0.002 to 0.009)
Never homeless by age 9	Ref	Ref
Reported homeless one time by age 9	0.134 (0.041 to 0.227)**	0.002 (-0.304 to 0.308)
Reported homeless 2+ times by age 9	0.406 (0.204 to 0.607)***	0.57 (-0.074 to 1.213)
Sex (female)	0.031 (-0.006 to 0.068)	0.031 (-0.006 to 0.068)
Age×reported homeless one time by age 9		0.012 (-0.016 to 0.04)
Age×reported homeless 2+ times by age 9		-0.015 (-0.073 to 0.043)

*P=0.05, **P=0.01, ***P=0.001.
†All models adjusted for child ethnicity and sex, maternal education, number of financial difficulties, parity, maternal depression and maternal age.
Ref, reference group.

similar, but less pronounced, associations for those who first experienced homelessness in early childhood ($\beta=0.206$, 95% CI 0.017 to 0.395) and infancy ($\beta=0.141$, 95% CI 0.039 to 0.243). There was no interaction between changes in internalising symptoms over time and the timing of first episode of childhood homelessness.

Considering repeated homelessness, we observed a dose-response association between the number of homelessness experiences and internalising symptoms. Specifically, children who experienced homelessness two or more times by 9 years of age displayed the highest internalising symptom scores ($\beta=0.406$, 95% CI 0.204 to 0.607) compared with those who were never homeless. There was no interaction between changes in internalising symptoms over time and cumulative exposure to homelessness.

Externalising symptoms

Children who experienced homelessness by age 9 had, on average, higher externalising symptoms than those who had never experienced homelessness by age 9, after adjusting for

Table 3 Results of multilevel models showing the association between homelessness and trajectories of early adolescent externalising problems†

Fixed effect parameters	Estimate (95% CI)	Estimate (95% CI)
Never/ever homeless by age 9		
(Intercept)	0.324 (0.171 to 0.476)***	0.329 (0.176 to 0.482)***
Age	0.001 (-0.004 to 0.005)	0 (-0.005 to 0.005)
Never homeless by age 9	Ref	Ref
Homeless by age 9	0.167 (0.081 to 0.253)***	0.073 (-0.184 to 0.331)
Sex (female)	-0.312 (-0.349 to 0.275)***	-0.312 (-0.349 to 0.275)***
Age×homeless by age 9		0.009 (-0.014 to 0.031)
By first exposure to homelessness		
(Intercept)	0.325 (0.172 to 0.478)***	0.33 (0.17 to 0.483)***
Age	0.001 (-0.004 to 0.005)	0 (-0.004 to 0.005)
Never homeless by age 9	Ref	Ref
First homeless ages 0–2	0.159 (0.059 to 0.259)**	0.119 (-0.163 to 0.401)
First homeless ages 3–5	0.118 (-0.073 to 0.310)	-0.187 (-0.731 to 0.358)
First homeless ages 6–8	0.322 (0.047 to 0.597)*	0.218 (-0.582 to 1.019)
Sex (female)	-0.312 (-0.35 to 0.275)***	-0.312 (-0.35 to 0.275)***
Age×first homeless ages 0–2		0.004 (-0.021 to 0.028)
Age×first homeless ages 3–5		0.028 (-0.019 to 0.075)
Age×first homeless ages 6–8		0.01 (-0.06 to 0.08)
Persistent homelessness		
(Intercept)	0.325 (0.173 to 0.478)***	0.33 (0.178 to 0.483)***
Age	0.001 (-0.004 to 0.005)	0 (-0.004 to 0.005)
Never homeless by age 9	Ref	Ref
Reported homeless one time by age 9	0.130 (0.037 to 0.223)**	0.008 (-0.274 to 0.291)
Reported homeless 2+ times by age 9	0.353 (0.156 to 0.551)***	0.398 (-0.16 to 0.956)
Sex (female)	-0.312 (-0.349 to 0.275)***	-0.312 (-0.349 to 0.275)***
Age×reported homeless one time by age 9		0.011 (-0.014 to 0.036)
Age×reported homeless 2+ times by age 9		-0.004 (-0.053 to 0.045)

*P=0.05, **P=0.01, ***P=0.001.
†All models adjusted for child ethnicity and sex, maternal education, number of financial difficulties, parity, maternal depression and maternal age.
Ref, reference group.

potential confounders ($\beta=0.167$, 95% CI 0.081 to 0.253); see table 3 and online supplemental file 1 for the full model). Externalising symptoms remained stable across ages 9–13 years.

In terms of timing of homelessness, children whose first exposure to homelessness occurred between ages 6 and 8 showed the highest externalising symptoms at age 9 ($\beta=0.322$, 95% CI 0.047 to 0.597) compared with those who had never experienced homelessness. Similarly, those whose first exposure to homelessness occurred between prenatal and 2 years of age also showed elevated externalising symptom scores at age 9 ($\beta=0.159$, 95% CI 0.059 to 0.259). No effect on externalising symptoms at age 9 was found when the first exposure to homelessness occurred between ages 3 years and 5 years ($\beta=0.118$,

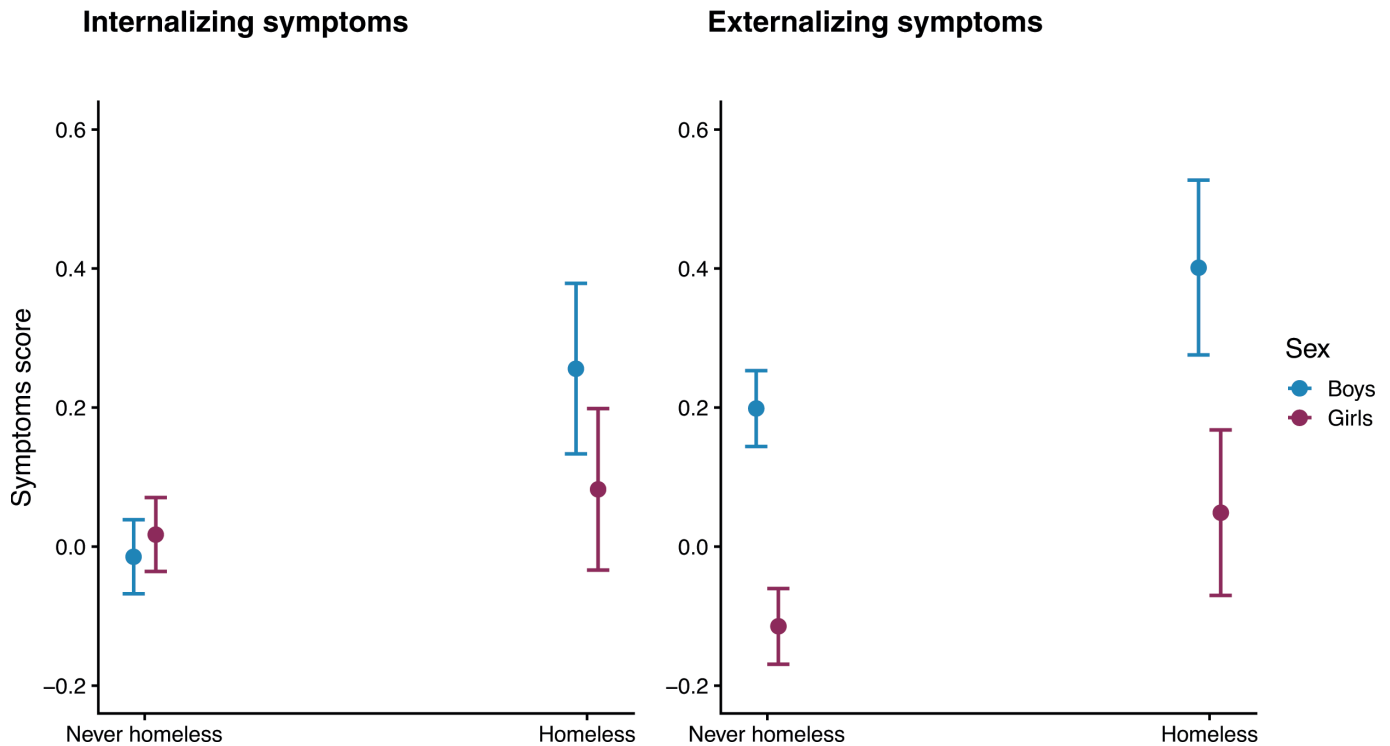


Figure 2 Interaction plot for estimated internalising and externalising symptoms. The point estimates and CIs are derived from the mixed model with homelessness exposure by age 9 and sex interaction as fixed effects, after adjusting for confounders. All models adjusted for child ethnicity and sex, maternal education, number of financial difficulties, parity, maternal depression and maternal age.

95%CI -0.073 to 0.310). There was no interaction between changes in externalising symptoms over time and the timing of first episode of homelessness.

Considering cumulative exposure to homelessness, children who reported two or more exposures to homelessness by age 9 exhibited the highest externalising symptoms compared with those who had never experienced homelessness ($\beta=0.353$, 95%CI 0.156 to 0.551); similar trends were found among those who reported one episode of homelessness ($\beta=0.130$, 95%CI 0.037 to 0.223). There was no interaction between changes in externalising symptoms over time and cumulative exposure to homelessness.

Differences in associations by sex

We tested differences by sex in the association between the broadest definition of exposure to homelessness by age 9 and psychopathology symptoms (figure 2). No sex differences were observed for the association between homelessness exposure and internalising symptoms ($\beta=0.031$, 95%CI -0.006 to 0.068), whereas sex differences were observed for externalising symptoms. Specifically, homeless women had lower externalising symptoms relative to homeless men ($\beta=-0.312$, 95%CI -0.349 to 0.275).

Sensitivity analysis using latent growth curve analysis

Latent growth curve analyses of internalising and externalising symptoms showed consistent results as the results derived from multilevel linear models. Exposure to homelessness was associated with higher internalising symptoms at 9 years of age ($\beta=0.219$, SE= 0.057 , $p<0.001$), but it was not associated with the slope (table 4). Similarly, for externalising problems, exposure to homelessness was associated with higher externalising

problems at 9 years of age ($\beta=0.211$, SE= 0.057 , $p<0.001$), but it was not associated with the slope.

DISCUSSION

Using prospective data from the ALSPAC cohort, childhood homelessness from pregnancy up to 9 years of age was associated with elevated internalising and externalising problems at age 9, and these associations were maintained after adjustment for individual maternal characteristics and potential confounders. Across both models examining the association between homelessness and internalising and externalising symptoms, the standardised effect size for homelessness was consistently larger than all other covariates associated with either increased internalising or externalising symptoms (online supplemental STable 3 and STable 4). However, given that we examined trajectories of

Table 4 Results from latent growth curve models for internalising and externalising symptoms and homelessness*

Parameters	Homeless versus never homeless	
	β (SE)	P value
Model of internalising trajectories		
Intercept (age 9)	0.219 (0.057)	<0.001
Slope	0.005 (0.028)	0.867
Covariance between intercept and slope	-0.042 (0.013)	0.001
Model of externalising trajectories		
Intercept (age 9)	0.211 (0.057)	<0.001
Slope	0.016 (0.027)	0.559
Covariance between intercept and slope	-0.039 (0.010)	<0.001

*All models adjusted for child ethnicity and sex, maternal education, number of financial difficulties, parity, maternal depression and maternal age.

symptomatology as opposed to clinical diagnoses, these differences in standardised effect sizes cannot be directly translated as clinically meaningful for mental health diagnoses. When we examined timing of homelessness, childhood homelessness first occurring between ages 6 years and 8 years demonstrated the largest association with internalising and externalising problems at age 9, relative to those who had never experienced homelessness, as compared with those with first experiences of homelessness earlier in the life course. As hypothesised, children with repeated experiences of homelessness showed the highest internalising and externalising symptoms compared with those who had never experienced homelessness. We observed neither changes in trajectories of psychopathology problems for the study population nor an effect of homelessness on these trajectories; the symptoms were relatively stable across the observation period. Our tests for effect modification revealed that the association between homelessness and externalising symptoms was more pronounced for boys than girls; differences in the association by sex were not observed for internalising symptoms.

Our results are consistent with a meta-analysis focused on younger children, which found that school-aged children (ages 6–11) who had experienced homelessness had elevated internalising and externalising problems compared with low income-housed children of the same age.¹ Building on this meta-analysis, we focused on developmental trajectories across early adolescence and found that differences in internalising and externalising symptoms among youths with and without histories of homelessness were evident and stable into adolescence. Our findings related to age of first homelessness experience suggest that recent exposures are more strongly associated with elevated internalising and externalising symptoms during early adolescence relative to more distant experiences. Prior literature on the role of timing of first exposure is mixed. For example, consistent with our results, a population-based sample of Norwegian children with repeated information across childhood and adolescence found that in any given developmental period, high levels of externalising problems were concurrently associated with high family risk exposures.³⁵ As such, psychopathology symptoms might be associated with recent stressors, including homelessness, regardless of the developmental period. In contrast, other evidence suggests that developmental timing of homeless experiences is relevant: a study by Castro and colleagues found that a younger age of first episode of homelessness is associated with elevated internalising symptoms relative to older ages of first episode.³⁶ Finally, our results indicating that repeated experiences of homelessness is associated with the heightened internalising and externalising symptoms support prior literature that has linked increased frequency and duration of homelessness for youths with more mental health problems.³⁶ Taken together, our analyses to evaluate timing and frequency of homelessness align with prior research using ALSPAC, which found that child psychopathology symptoms are better explained by recency and accumulation models relative to sensitive period models.¹²

Our study fills several gaps in the literature, including use of a population-based cohort to study homelessness, and consideration of symptom trajectories across early adolescence. Many previous studies of homelessness and children's mental health draw on samples of families living in shelters. Our use of a population-based study allows for an enhanced understanding of the risk of homelessness on early adolescent psychopathology by minimising biases inherent to recruiting participants from homeless shelters (eg, over-representation of families with characteristics that select individuals to use shelters). Furthermore, our nuanced consideration of timing and repeated experiences

of homelessness indicate that interventions should prioritise children with repeated experiences of homelessness and individuals with recent histories of homelessness.

This study has several limitations. First, we cannot rule out selection bias due to loss in follow-up. Participants retained in the sample were more likely to be wealthier and healthier than those lost from the study. To reduce selection bias, we used multiple imputation. Additionally, latent growth modelling using FIML as an alternative approach to missing data replicated results from the multilevel models. Second, the majority of participants in this study were white and resided in the former county of Avon; this limits the generalisability of findings to other populations. Furthermore, participants were recruited in the early 1990s, and given that homelessness rates and social safety net programmes have changed since then, future studies could advance the results of our study by using a more generalisable and more recent sample. Third, the cumulative exposure to homelessness was defined as the number of reported homeless experiences across waves, which captures the number of reoccurrences; however, this exposure does not capture duration of homelessness. Fourth, given that child psychopathology symptoms were reported by the mother, there is potential for reporter bias; studies have shown that parents often underestimate the severity of their children's symptoms of depression and emotional difficulties.^{37,38} Fifth, due to lack of available ethnicity data and small numbers of minoritised children in the cohort, we were unable to examine race and ethnicity in more detail. Finally, given that we examined trajectories of symptomatology as opposed to clinical diagnoses, future studies could assess if these results are clinically meaningful.

In conclusion, by longitudinally examining the role of early homelessness for emotional and behavioural development across preadolescence, this study advances understanding of the trajectories of symptomatology and documents the risk associated with timing and repeated occurrences of homelessness. In comparing young adolescents with and without histories of homelessness, and looking at specific patterns of homelessness across early and middle childhood, we found that homelessness is associated with stable, elevated internalising and externalising symptoms across early adolescence. Increased accumulation of homelessness and first episode of homelessness during middle childhood were associated with elevated levels of psychopathology symptoms, which suggests that attention to frequency and timing is important for future research to characterise the population more accurately and for interventions to better identify target populations. Additional research is needed to determine whether psychopathology symptoms remain elevated throughout late adolescence and adulthood.

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REFERENCES

- Bassuk EL, Richard MK, Tsertsvadze A. The prevalence of mental illness in homeless children: a systematic review and meta-analysis. *J Am Acad Child Adolesc Psychiatry* 2015;54:86–96.
- Edidin JP, Ganim Z, Hunter SJ, et al. The mental and physical health of homeless youth: a literature review. *Child Psychiatry Hum Dev* 2012;43:354–75.
- Ministry of Housing, Communities & Local Government. *Statutory homelessness and prevention and relief, January to March (Q1) 2018*. England (Revised): Hous Stat Release, 2018.
- Fantuzzo JW, LeBoeuf WA, Chen C-C, et al. The unique and combined effects of homelessness and school mobility on the educational outcomes of young children. *Educational Researcher* 2012;41:393–402.
- Coker TR, Elliott MN, Kanouse DE, et al. Prevalence, characteristics, and associated health and health care of family homelessness among fifth-grade students. *Am J Public Health* 2009;99:1446–52.
- Shinn M, Gibbons-Benton J, Brown SR. *Poverty, homelessness, and family break-up*. 2018.
- Buckner JC, Bassuk EL, Weinreb LF, et al. Homelessness and its relation to the mental health and behavior of low-income school-age children. *Dev Psychol* 1999;35:246–57.
- Buckner JC, Mezzacappa E, Beardslee WR. Characteristics of resilient youths living in poverty: the role of self-regulatory processes. *Dev Psychopathol* 2003;15:139–62.
- Yoder KA, Longley SL, Whitbeck LB, et al. A dimensional model of psychopathology among homeless adolescents: suicidality, internalizing, and externalizing disorders. *J Abnorm Child Psychol* 2008;36:95–104.
- Sandel M, Sheward R, Ettinger de Cuba S, et al. Timing and duration of pre- and postnatal homelessness and the health of young children. *Pediatrics* 2018;142:e20174254.
- Brooks-Gunn J, Duncan GJ. The effects of poverty on children. *Future Child* 1997;7:55–71.
- Dunn EC, Soare TW, Raffeld MR, et al. What life course theoretical models best explain the relationship between exposure to childhood adversity and psychopathology symptoms: recency, accumulation, or sensitive periods? *Psychol Med* 2018;48:2562–72.
- Bornstein MH. Sensitive periods in development: structural characteristics and causal interpretations. *Psychol Bull* 1989;105:179–97.
- Andersen SL, Teicher MH. Stress, sensitive periods and maturational events in adolescent depression. *Trends Neurosci* 2008;31:183–91.
- Gee DG, Casey BJ. The impact of developmental timing for stress and recovery. *Neurobiol Stress* 2015;1:184–94.
- Daughters SB, Gorka SM, Matusiewicz A, et al. Gender specific effect of psychological stress and cortisol reactivity on adolescent risk taking. *J Abnorm Child Psychol* 2013;41:749–58.
- Lewis AJ, Kremer P, Douglas K, et al. Gender differences in adolescent depression: differential female susceptibility to stressors affecting family functioning. *Australian Journal of Psychology* 2015;67:131–9.
- Ullsperger JM, Nikolas MA. A meta-analytic review of the association between pubertal timing and psychopathology in adolescence: are there sex differences in risk? *Psychol Bull* 2017;143:903–38.
- Achenbach TM, Howell CT, Quay HC, et al. National survey of problems and competencies among four- to sixteen-year-olds: parents' reports for normative and clinical samples. *Monogr Soc Res Child Dev* 1991;56:1–131.
- Ormel J, Oldehinkel AJ, Ferdinand RF, et al. Internalizing and externalizing problems in adolescence: general and dimension-specific effects of familial loadings and preadolescent temperament traits. *Psychol Med* 2005;35:1825–35.
- Dunn EC, Soare TW, Zhu Y, et al. Sensitive periods for the effect of childhood adversity on DNA methylation: results from a prospective, longitudinal study. *Biol Psychiatry* 2019;85:838–49.
- McLaughlin KA, Sheridan MA, Lambert HK. Childhood adversity and neural development: deprivation and threat as distinct dimensions of early experience. *Neurosci Biobehav Rev* 2014;47:578–91.
- Richards M, Wadsworth MEJ. Long term effects of early adversity on cognitive function. *Arch Dis Child* 2004;89:922–7.
- Zima BT, Wells KB, Freeman HE. Emotional and behavioral problems and severe academic delays among sheltered homeless children in Los Angeles County. *Am J Public Health* 1994;84:260–4.
- San Agustin M, Cohen P, Rubin D, et al. The Montefiore community children's project: a controlled study of cognitive and emotional problems of homeless mothers and children. *J Urban Health* 1999;76:39–50.
- Boyd A, Golding J, Macleod J, et al. Cohort profile: the "children of the 90s" -- the index offspring of the Avon longitudinal study of parents and children. *Int J Epidemiol* 2013;42:111–27.
- Fraser A, Macdonald-Wallis C, Tilling K, et al. Cohort profile: the Avon longitudinal study of parents and children: ALSPAC mothers cohort. *Int J Epidemiol* 2013;42:97–110.
- Goodman R. Psychometric properties of the strengths and difficulties questionnaire. *J Am Acad Child Adolesc Psychiatry* 2001;40:1337–45.
- Hankin BL, Fraley RC, Lahey BB, et al. Is depression best viewed as a continuum or discrete category? A taxometric analysis of childhood and adolescent depression in a population-based sample. *J Abnorm Psychol* 2005;114:96–110.
- Goodman A, Lamping DL, Ploubidis GB. When to use broader internalising and externalising subscales instead of the hypothesised five subscales on the strengths and difficulties questionnaire (SDQ): data from British parents, teachers and children. *J Abnorm Child Psychol* 2010;38:1179–91.
- Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression: development of the 10-item Edinburgh postnatal depression scale. *Br J Psychiatry* 1987;150:782–6.
- Sterne JAC, White IR, Carlin JB, et al. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ* 2009;338:b2393.
- Rubin DB. *Multiple imputation for nonresponse in surveys*. John Wiley & Sons, 2004.
- Duncan TE, Duncan SC. The ABC's of LGM: an introductory guide to latent variable growth curve modeling: the ABC's of LGM. *Soc Personal Psychol Compass* 2009;3:979–91.
- Kjeldsen A, Nes RB, Sanson A, et al. Understanding trajectories of externalizing problems: stability and emergence of risk factors from infancy to middle adolescence. *Dev Psychopathol* 2021;33:264–83.
- Castro AL, Gustafson EL, Ford AE, et al. Psychiatric disorders, high-risk behaviors, and chronicity of episodes among predominantly African American homeless Chicago youth. *J Health Care Poor Underserved* 2014;25:1201–16.
- Makol BA, Polo AJ. Parent-Child endorsement discrepancies among youth at chronic-risk for depression. *J Abnorm Child Psychol* 2018;46:1077–88.
- Madjar N, Mansbach-Kleinfeld I, Daeem R, et al. Discrepancies in adolescent-mother dyads' reports of core depression symptoms: association with adolescents' help-seeking in school and their somatic complaints. *J Psychosom Res* 2020;137:110222.