



# Childhood residential mobility and health in late adolescence and adulthood: findings from the West of Scotland Twenty-07 Study

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## ABSTRACT

**Background** The relationship between childhood residential mobility and health in the UK is not well established; however, research elsewhere suggests that frequent childhood moves may be associated with poorer health outcomes and behaviours. The aim of this paper was to compare people in the West of Scotland who were residentially stable in childhood with those who had moved in terms of a range of health measures.

**Methods** A total of 850 respondents, followed-up for a period of 20 years, were included in this analysis. Childhood residential mobility was derived from the number of addresses lived at between birth and age 18. Multilevel regression was used to investigate the relationship between childhood residential mobility and health in late adolescence (age 18) and adulthood (age 36), accounting for socio-demographic characteristics and frequency of school moves. The authors examined physical health measures, overall health, psychological distress and health behaviours.

**Results** Twenty per cent of respondents remained stable during childhood, 59% moved one to two times and 21% moved at least three times. For most health measures (except physical health), there was an increased risk of poor health that remained elevated for frequent movers after adjustment for socio-demographic characteristics and school moves (but was only significant for illegal drug use).

**Conclusions** Risk of poor health was elevated in adolescence and adulthood with increased residential mobility in childhood, after adjusting for socio-demographic characteristics and school moves. This was true for overall health, psychological distress and health behaviours, but physical health measures were not associated with childhood mobility.

## INTRODUCTION

Previous work has shown that residential mobility is strongly related to household characteristics, such as housing tenure,<sup>1</sup> area deprivation,<sup>2</sup> income<sup>3</sup> and family structure.<sup>4,5</sup> Family members, especially children, may find moving a stressful experience, particularly when coupled with other significant family events.<sup>6</sup> For some, moving home can be a positive experience as it may lead to improved family circumstances and given the correct support,<sup>7</sup> the negative effects of moving frequently in childhood can be reduced. For others, moving may disrupt social ties leading to poorer health outcomes and behaviours.

Frequent childhood residential moves have been shown to be related to poorer self-reported health<sup>8</sup> and well-being<sup>9</sup> in adulthood and to increased drug

use<sup>10</sup> and smoking,<sup>11</sup> attempted suicide<sup>12</sup> and risk of emotional and behavioural problems<sup>13</sup> in adolescence, although it has been suggested that any association between residential mobility and problem behaviours is driven by school, rather than residential, mobility.<sup>14</sup> A recent systematic review<sup>15</sup> found childhood residential mobility to be a potentially useful marker for the clinical risk of behavioural and emotional problems. The only UK study included in the review<sup>16</sup> found little or no association between moving home and the well-being of children, while other UK research has suggested a possible link between moving house and childhood asthma.<sup>17,18</sup> Pearce *et al*,<sup>19</sup> using data from the UK Millennium Cohort Study, found that frequently mobile children were less likely to be immunised against measles, mumps and rubella, suggesting that frequent moves could prevent the development of relationships with health professionals. Other research using data from the Millennium Cohort Study found mobility in childhood (between sweeps of the study) to be higher in Scotland (27.6%) than in England (23.4%) or Wales (18.9%) but lower than in Northern Ireland (29.7%).<sup>20</sup> At the 2001 Scottish census, 9.5% of all children, aged 0–18 years, had moved in the previous year. The figure was highest for 0–4-year-olds (14.9%) reflecting the high mobility of parents with young children,<sup>21</sup> with 7.8% of 5–15-year-olds moving and 7.4% of 16- and 17-year-olds.

Our aim in this paper was to examine the relationship between childhood residential mobility and a broad range of health outcomes (overall health, psychological distress and physical health measures) and behaviours in late adolescence (age 18) and adulthood (age 36), controlling for socio-demographic factors that might be related to both childhood residential mobility and health. This work brings together a wider range of health outcomes than has previously been considered and allows us to examine the extent to which associations between childhood mobility and health in adolescence remain in adulthood.

## METHODS

### The sample

This analysis is based on the West of Scotland Twenty-07 Study, which has followed three age cohorts, aged around 15, 35 and 55 years old at baseline in 1987/1988, for a period of 20 years with the fifth wave of data collected during 2007/2008. Each cohort was selected using two-stage stratified sampling, based on postcodes and individuals within postcodes, with samples drawn from



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Strathclyde Region's Voluntary Population Survey. See Benzeval *et al*<sup>22</sup> for a detailed description of the study. Here, we analysed data from the youngest cohort. At baseline, the sample size of the youngest cohort (age 15) was 1515, reducing to 1343 at wave 2 (age 18) in 1990/1992. At wave 5 (age 36), the sample size was 941 respondents (this includes respondents previously lost to follow-up between earlier waves of the study). In total, 889 respondents participated at baseline, wave 2 and wave 5. There were 30 respondents who completed only a partial questionnaire at wave 5, and nine respondents whose childhood residential histories were not available. These respondents were excluded from the analysis. The final sample size, therefore, was 850 respondents leaving in total 665 respondents who were not included in this analysis. Data collection included face-to-face interviews conducted by nurse interviewers and, in addition, a parental questionnaire was completed at baseline.

## Measures

### Residential mobility

Residential mobility was derived from the number of addresses at which respondents had lived between birth and age 18 based on self-reported data from parents at baseline and respondents at wave 2. At wave 2, 13.5% of individuals no longer lived in the family home. We assume that only the most recent move was out of the family home and exclude one move from the total number of moves reported by those respondents as we are interested in family moves here. The maximum number of household residential moves in childhood was six (mode=1).

### Health variables

#### Physical health measures

We examined body mass index, waist:hip ratio, respiratory lung function and mid-blood pressure. All physical health measures were taken by nurses and are included here as continuous variables. Body mass index was calculated as weight in kilograms divided by height in metres squared, and waist:hip ratio was calculated as waist measurement divided by hip measurement. Lung function, the volume of air (in litres) exhaled in 1 s was measured three times. The maximum of those values was standardised by height squared. Our fourth physical health measure was mid-blood pressure, a strong predictor of stroke mortality.<sup>23</sup> Mid-blood pressure is defined as (systolic blood pressure (SBP) + diastolic blood pressure (DBP))/2. Two blood pressure readings were taken after the main interview and a period of sitting quietly for 5 min. There was a machine change between waves 2 and 5 of the study, from a manual to an automated blood pressure monitor,<sup>24</sup> so we used published equations<sup>25</sup> to convert the manual readings at wave 2 to equivalent readings that would have been obtained using an automated device. Finally, a constant was added (10 and 5 mm Hg to SBP and DBP readings, respectively)<sup>26</sup> for those who reported taking antihypertensive medication. The average of two readings for each of SBP and DBP at each wave were used to calculate respondents' mid-blood pressure measurement.

#### Overall health

The overall health measures examined were limiting long-term illness (yes or no), and subjective assessment of general health as rated on a 4-point scale (fair/poor or excellent/good).

#### Psychological distress

Psychological distress was assessed using the 12-item General Health Questionnaire (GHQ-12), with a cut-off score of 3 or more used to indicate caseness.<sup>27</sup> Second, we also examined suicidal ideation. At wave 2, respondents were asked whether

they had *ever* thought about actually taking an overdose of drugs or had injured themselves deliberately, while at wave 5, respondents were asked about *the last time* they had thought about taking an overdose of drugs or had injured themselves deliberately. At wave 5, suicidal ideation within the last 5 years was examined. Our third measure of psychological distress was anxiety as measured on the subscale on the Hospital Anxiety and Depression Scale, with an overall score of 11 or more indicating moderate or severe anxiety.<sup>28</sup>

#### Health behaviours

The health behaviours examined were heavy drinking, drug use and smoking. Given the generally high prevalence of drinking in the sample, heavy drinking was defined as having exceeded the maximum recommended weekly safe limits of 21 units for women and 28 units for men.<sup>29</sup> We defined illegal drug use as having *ever* tried drugs at wave 2 or as having taken drugs *in the past year* at wave 5. Finally, current smokers were compared to those who have never smoked and ex-smokers.

#### Socio-demographic characteristics

We adjusted for respondents' family and household circumstances in childhood based on information provided by parents at baseline since these circumstances may be confounders in the observed relationship between childhood residential mobility and health. Area-level deprivation was calculated at postcode sector level using 1991 census-based Carstairs deprivation categories (DepCats).<sup>30</sup> There are seven DepCats with DepCat1 being the least deprived and DepCat7 being the most deprived. Housing tenure was classified as homeowner or non-homeowner. Social class was derived from the occupations of mothers and fathers classified according to the Registrar General's Classification of Occupations (1980). Head of household (HoH) social class was coded as the father's occupation or mother's occupation where there is no father or where the father had no current or last occupation. Family structure was classified as intact family or non-intact family. We also adjusted for number of siblings. The maximum number of siblings was 10 (mode=1).

School mobility was considered as a potential mediator. School mobility was derived from the number of primary schools (ages 5–11) and secondary schools (ages 11–16) attended. Taking into account school moves in addition to residential moves gives some insight as to whether residential moves were local or long distance as it is more likely that longer distance residential moves would require a change of school and therefore cause more disruption. The maximum number of school moves made was six (mode=0).

We also examined the importance of own adult HoH social class (I, II and III (non-manual), III (manual) or IV and V), educational attainment (degree level or above, below degree level or no qualifications) and marital status (married, widowed or divorced or never married) in the relationship between childhood residential mobility and health in adulthood (aged around 36). If childhood residential mobility is associated with poorer health outcomes in adolescence and remains so in later life, then it is possible that own socioeconomic factors in adulthood could mitigate this adverse relationship.

#### Analyses

Our sample was compared with those respondents not followed-up at waves 2 and 5 using the  $\chi^2$  test of association. This test was also used to examine the association between socio-demographic characteristics and number of residential moves. Among those included in the analysis, there were no

missing data across any of the socio-demographic variables; however, there were missing data across some of the health variables. For health variables with missing data, missingness ranged from 0.2% to 4.1% and was distributed evenly among the residential mobility categories. We used multilevel regression models to assess the relationship between childhood residential mobility and health, taking account of the clustering of individuals within 62 postcode sectors and adjusting for socio-demographic characteristics and frequency of school moves. Multilevel linear regression models were fitted using maximum likelihood estimation, and multilevel logistic regression models were fitted using second-order penalised quasi-likelihood estimation (MLwiN 2.20). The baseline model adjusted for age and sex. Childhood variables were then added to the model to assess their effect on the relationship between childhood residential mobility and health at around age 18 and 36. Finally, we add adulthood variables (and prior health as measured at wave 2) separately to assess their independent effect on the relationship between childhood mobility and health at around age 36.

## RESULTS

The sample followed-up at waves 2 and 5 was compared with those not followed-up in table 1. Of those lost to follow-up, 4.7% had only completed a partial questionnaire at wave 5 and so were excluded, 4.9% had died or were incapacitated, 42.5% could not be contacted again at one or both waves and 47.9% had been contacted again during at least one of the follow-up

waves but had refused to respond to the questionnaire. The sample followed-up differed from those lost to follow-up across a number of socio-demographic characteristics. More males had dropped out of the study than females. Dropout was also relatively high among those whose parents were non-homeowners or in manual social classes and for those living in deprived areas in childhood.

Of the 13.5% of respondents who had moved out of the family home by around age 18, 39.1% had moved into their own home, 8.7% had moved into lodgings and 52.2% had moved into student accommodation. Those moving out of the family home by around age 18 had been more residentially mobile during childhood than those still staying with family ( $p=0.03$ ). In total, 22.0% of respondents remained residentially stable, 59.6% moved once or twice and 18.4% moved at least three times. More frequent moves were made by those from the most deprived areas (table 2). Those in single parent or step-families and those with two or three siblings were significantly more likely to move, while respondents with at least four siblings were more likely to remain residentially stable during childhood. There did not appear to be a relationship between parental housing tenure or social class and increased residential moves. Residential moves were highly associated with school mobility with those moving home most frequently more likely to change schools at least three times.

Results from multilevel regression analyses are shown in table 3. There was no association between childhood mobility and physical health measures at wave 2. Adjusting for age and

**Table 1** Childhood socio-demographic characteristics of baseline sample, respondents lost to follow-up and respondents followed-up at waves 2 and 5

	All participants at baseline (n = 1495)*		Not followed-up (n = 645)*		Followed-up at waves 2 and 5 (n = 850)		p Value†
	n	%	n	%	n	%	
Sex							
Male	730	48.8	348	53.9	382	44.9	<0.001
Female	765	51.2	297	46.1	468	55.1	
Area-level deprivation							
DepCat 1–3 (least deprived)	434	29.0	153	23.7	281	33.1	<0.001
DepCat 4–5	567	37.9	227	35.2	340	40.0	
DepCat 6–7 (most deprived)	494	33.1	265	41.1	229	26.9	
Housing tenure							
Homeowner	644	43.1	222	34.5	422	49.6	<0.001
Non-homeowner	850	56.9	422	65.5	428	50.4	
Head of household social class							
I, II and III (non-manual)	593	39.8	202	31.6	391	46.0	<0.001
III (manual)	564	37.9	268	42.0	296	34.8	
IV and V	332	22.3	169	26.4	163	19.2	
Family structure							
Intact family	1194	79.9	501	77.7	693	81.5	0.066
Non-intact family	301	20.1	144	23.3	157	18.5	
Number of siblings							
None	74	5.0	32	5.0	42	4.9	0.003
One	541	36.2	212	32.9	329	38.7	
Two to three	643	43.0	274	42.5	369	43.4	
Four or more	237	15.8	127	19.7	110	13.0	
Number of school moves							
None	957	64.0	387	60.0	570	67.1	0.007
One to two	482	32.2	226	35.0	256	30.1	
Three or more	56	3.8	32	5.0	24	2.8	

\*In the baseline sample (and in the sample that was not followed-up), there were 20 individuals who had missing data across at least half of the socio-demographic characteristics and so were excluded from this table. In addition, there was one missing housing tenure response and six missing responses for questions relating to the construction of the head of household social class variable.

†p Value for the  $\chi^2$  test of association of those followed-up at waves 2 and 5 with those not followed-up.

**Table 2** Mean (SD) age at wave 2 is shown by number of childhood residential moves

	All respondents (N = 850)	Number of childhood residential moves		
		0 Moves	1–2 Moves	3+ Moves
<b>Sex</b>				
Male	44.9	47.1	46.1	38.5
Female	55.1	52.9	53.9	61.5
<b>Childhood characteristics</b>				
Age at wave 2	18.58 (0.32)	18.55 (0.30)	18.57 (0.32)	18.62 (0.33)
Area-level deprivation*				
DepCat 1–3 (least deprived)	33.1	31.5	35.1	28.2
DepCat 4–5	40.0	47.1	37.1	41.0
DepCat 6–7 (most deprived)	26.9	21.4	27.8	30.8
Housing tenure				
Homeowner	49.6	53.5	48.3	49.4
Non-homeowner	50.4	46.5	51.7	50.6
Head of household social class				
I, II and III (non-manual)	46.0	47.1	44.6	49.4
III (manual)	34.8	32.1	36.5	32.7
IV and V	19.2	20.8	18.9	17.9
Family structure**				
Intact family	81.5	85.6	82.1	75.0
Non-intact family	18.5	14.4	17.9	25.0
Number of siblings**				
None	4.9	4.8	5.1	4.5
One	38.7	37.4	39.5	37.8
Two to three	43.4	38.5	42.8	51.3
Four or more	13.0	19.3	12.6	6.4
Number of school moves***				
None	67.1	88.8	69.0	34.6
One to two	30.1	11.2	30.6	51.3
Three or more	2.8	0.0	0.4	14.1
<b>Adult characteristics</b>				
Head of household social class*				
I, II and III (non-manual)	65.3	66.7	66.0	61.2
III (manual)	22.2	22.6	22.9	19.4
IV and V	12.5	10.7	11.1	19.4
Educational attainment				
Degree level or above	4.1	5.4	3.6	4.5
Below degree level	62.5	57.7	64.1	62.8
No qualifications	33.4	36.9	32.3	32.7
Marital Status*				
Married	60.1	64.7	59.8	55.8
Widowed or divorced	6.7	7.0	6.7	6.4
Never married	33.2	28.3	33.5	37.8

For all other variables, sample percentages are shown.

\* $p < 0.1$ , \*\* $p < 0.05$  and \*\*\* $p < 0.01$  for  $\chi^2$  test (F test for age) of association between socio-demographic characteristics and increased number of residential moves.

sex only, the odds of scoring at least 3 on the GHQ-12 were significantly increased for those who moved at least once compared to those who remained residentially stable. For suicidal ideation, illegal drug use and smoking, the odds were significantly increased but only for those who moved at least three times. Adjusting for parents' socio-demographic circumstances had little effect on the relationship between childhood mobility and health, while taking school mobility into account helped to explain the relationship with GHQ-12, suicidal ideation and smoking. After adjusting for parents' socio-demographic characteristics and number of school moves together, only GHQ-12, for one or two moves compared to no moves (OR=1.62 (95% CI 1.11 to 2.35)), and illegal drug use, for three or more moves compared to no moves (OR=2.44 (95% CI 1.45 to 4.10)), remained significant. Odds of having a limiting long-term illness and of suicidal ideation remained elevated for those moving at least once, while odds remained elevated for

heavy drinking and smoking for those moving at least three times.

There was also no evidence of an association between childhood mobility and physical health measures at wave 5 when respondents were aged approximately 36. After adjusting for age and sex, frequent movers were significantly more likely to report a limiting long-term illness and increased illegal drug use. Frequent moving remained independently associated with an increased risk of illegal drug use (OR=1.92 (95% CI 1.00 to 3.69)), after adjusting for socio-demographic characteristics and school moves, while the risk of reporting a limiting long-term illness was attenuated when taking into account school mobility. Odds of poor health across other measures (with the exception of physical health measures) remained elevated, for increasing number of residential moves, after adjustment for parents' socio-demographic characteristics and frequency of school moves.

Table 3 Multilevel regression results of poor health by the number of childhood residential moves made

	M1: age and sex			M2: M1 + socio-demographic factors*			M3: M1 + number of school moves			M4: M1 + socio-demographic factors* and number of school moves		
	1-2 moves	3+ moves	/CC†	1-2 moves	3+ moves	/CC†	1-2 moves	3+ moves	/CC†	1-2 moves	3+ moves	/CC†
Wave 2												
Physical health measures‡												
BMI	-0.17 (-0.73 to 0.40)	-0.30 (-1.01 to 0.42)	0.000	-0.22 (-0.79 to 0.34)	-0.38 (-1.10 to 0.34)	0.000	-0.18 (-0.75 to 0.39)	-0.33 (-1.12 to 0.45)	0.000	-0.24 (-0.81 to 0.34)	-0.44 (-1.23 to 0.35)	0.000
Waist:hip ratio	0.01 (-0.00 to 0.02)	-0.00 (-0.02 to 0.01)	0.000	0.01 (-0.00 to 0.02)	-0.00 (-0.02 to 0.01)	0.000	0.01 (-0.00 to 0.02)	0.00 (-0.01 to 0.01)	0.000	0.01 (-0.00 to 0.02)	-0.00 (-0.02 to 0.01)	0.000
Lung function (L/m <sup>2</sup> )	-0.01 (-0.03 to 0.02)	-0.03 (-0.06 to 0.01)	0.000	-0.00 (-0.03 to 0.03)	-0.02 (-0.06 to 0.01)	0.000	-0.00 (-0.04 to 0.02)	-0.04 (-0.08 to 0.00)	0.000	-0.00 (-0.04 to 0.02)	-0.04 (-0.07 to 0.00)	0.000
Mid-blood pressure (mm Hg)	0.84 (-0.68 to 2.36)	-0.21 (-2.17 to 1.71)	0.015	0.76 (-0.77 to 2.29)	-0.03 (-2.30 to 1.62)	0.010	0.96 (-0.59 to 2.51)	-0.05 (-2.16 to 2.07)	0.015	0.88 (-0.67 to 2.43)	-0.17 (-1.97 to 0.92)	0.010
Overall health	1.31 (0.74 to 2.31)	1.67 (0.85 to 3.26)	0.000	1.24 (0.70 to 2.20)	1.52 (0.77 to 3.01)	0.000	1.35 (0.76 to 2.39)	1.49 (0.70 to 3.15)	0.000	1.27 (0.71 to 2.27)	1.34 (0.62 to 2.88)	0.000
Limiting long-term illness	0.90 (0.63 to 1.30)	0.99 (0.63 to 1.56)	0.000	0.88 (0.61 to 1.28)	0.98 (0.61 to 1.57)	0.000	0.90 (0.62 to 1.29)	0.97 (0.59 to 1.60)	0.000	0.88 (0.60 to 1.28)	0.97 (0.58 to 1.62)	0.000
Fair/poor general health§												
Psychological distress												
GHQ-12 (3+)	<b>1.65 (1.15 to 2.37)</b>	<b>1.60 (1.02 to 2.52)</b>	0.012	<b>1.65 (1.14 to 2.38)</b>	<b>1.62 (1.02 to 2.57)</b>	0.003	<b>1.60 (1.11 to 2.32)</b>	<b>1.54 (0.94 to 2.52)</b>	0.012	<b>1.62 (1.11 to 2.35)</b>	<b>1.58 (0.96 to 2.62)</b>	0.004
HADS anxiety (11+)	0.89 (0.55 to 1.45)	1.00 (0.54 to 1.85)	0.039	0.85 (0.52 to 1.39)	1.00 (0.54 to 1.85)	0.013	0.85 (0.52 to 1.39)	0.79 (0.40 to 1.56)	0.035	0.81 (0.49 to 1.33)	0.79 (0.40 to 1.59)	0.011
Suicidal ideation§¶	1.23 (0.62 to 2.45)	<b>2.74 (1.29 to 5.80)</b>	0.046	1.19 (0.60 to 2.35)	<b>2.77 (1.30 to 5.89)</b>	0.000	1.16 (0.58 to 2.33)	2.11 (0.92 to 4.81)	0.044	1.11 (0.56 to 2.24)	2.18 (0.95 to 5.01)	0.000
Health behaviours												
Heavy drinking	0.89 (0.53 to 1.49)	1.54 (0.82 to 2.89)	0.000	0.91 (0.54 to 1.54)	1.68 (0.88 to 3.21)	0.000	0.89 (0.53 to 1.51)	1.43 (0.72 to 2.87)	0.000	0.92 (0.54 to 1.57)	1.58 (0.77 to 3.22)	0.000
Illegal drug use**	1.10 (0.75 to 1.60)	<b>2.09 (1.32 to 3.32)</b>	0.000	1.11 (0.75 to 1.63)	<b>2.05 (1.28 to 3.29)</b>	0.000	1.14 (0.77 to 1.67)	<b>2.46 (1.48 to 4.09)</b>	0.000	1.15 (0.78 to 1.70)	<b>2.44 (1.45 to 4.10)</b>	0.000
Smoking	1.01 (0.70 to 1.47)	<b>1.71 (1.09 to 2.69)</b>	0.019	1.01 (0.69 to 1.47)	<b>1.75 (1.10 to 2.79)</b>	0.010	0.97 (0.66 to 1.41)	1.52 (0.92 to 2.50)	0.019	0.97 (0.66 to 1.43)	1.57 (0.94 to 2.62)	0.011
Wave 5												
Physical health measures‡												
BMI	0.47 (-0.48 to 1.41)	0.28 (-0.93 to 1.49)	0.011	0.37 (-0.57 to 1.31)	0.16 (-1.04 to 1.37)	0.000	0.46 (-0.50 to 1.42)	-0.01 (-1.34 to 1.32)	0.011	0.38 (-0.57 to 1.33)	-0.10 (-1.42 to 1.22)	0.000
Waist:hip ratio	0.01 (-0.00 to 0.02)	0.01 (-0.00 to 0.03)	0.000	0.01 (-0.00 to 0.02)	0.01 (-0.00 to 0.02)	0.000	0.01 (-0.00 to 0.02)	0.01 (-0.01 to 0.03)	0.000	0.01 (-0.00 to 0.02)	0.01 (-0.01 to 0.03)	0.000
Lung function (L/m <sup>2</sup> )	-0.01 (-0.04 to 0.02)	-0.03 (-0.07 to 0.01)	0.000	-0.00 (-0.03 to 0.03)	-0.02 (-0.06 to 0.02)	0.000	-0.01 (-0.04 to 0.02)	-0.02 (-0.06 to 0.02)	0.000	-0.00 (-0.03 to 0.03)	-0.02 (-0.06 to 0.03)	0.000
Mid-blood pressure (mm Hg)	-0.18 (-2.16 to 1.81)	-1.29 (-3.81 to 1.23)	0.001	-0.36 (-2.34 to 1.62)	-1.66 (-4.19 to 0.87)	0.000	-0.02 (-2.03 to 1.99)	-1.50 (-4.26 to 1.26)	0.001	-0.17 (-2.17 to 1.84)	-1.81 (-4.58 to 0.96)	0.000
Overall health	1.38 (0.98 to 1.95)	<b>1.88 (1.21 to 2.91)</b>	0.000	1.35 (0.95 to 1.92)	<b>1.80 (1.15 to 2.82)</b>	0.000	1.35 (0.95 to 1.92)	1.57 (0.97 to 2.54)	0.000	1.32 (0.92 to 1.89)	1.50 (0.92 to 2.45)	0.000
Limiting long-term illness	1.33 (0.85 to 2.07)	1.47 (0.86 to 2.52)	0.096	1.34 (0.86 to 2.10)	1.52 (0.88 to 2.63)	0.052	1.29 (0.82 to 2.03)	1.36 (0.76 to 2.45)	0.097	1.32 (0.84 to 2.07)	1.43 (0.79 to 2.59)	0.052
Fair/poor general health												
Psychological distress												
GHQ-12 (3+)	1.13 (0.73 to 1.76)	1.49 (0.88 to 2.55)	0.021	1.15 (0.74 to 1.80)	1.55 (0.90 to 2.67)	0.002	1.10 (0.70 to 1.72)	1.29 (0.71 to 2.32)	0.020	1.12 (0.72 to 1.77)	1.35 (0.74 to 2.45)	0.000
HADS anxiety (11+)	1.49 (0.89 to 2.49)	1.66 (0.89 to 3.09)	0.000	1.51 (0.90 to 2.53)	1.67 (0.89 to 3.14)	0.000	1.52 (0.90 to 2.56)	1.62 (0.82 to 3.19)	0.000	1.55 (0.91 to 2.61)	1.63 (0.82 to 3.25)	0.000

Continued

Table 3 Continued

	M1: age and sex		M2: M1 + socio-demographic factors*		M3: M1 + number of school moves		M4: M1 + socio-demographic factors* and number of school moves				
	1-2 moves	3+ moves	ICC†	1-2 moves	3+ moves	1-2 moves	3+ moves	1-2 moves	3+ moves	ICC†	
Health behaviours											
Heavy drinking	1.02 (0.67 to 1.55)	1.56 (0.93 to 2.61)	0.000	1.04 (0.68 to 1.59)	1.60 (0.95 to 2.69)	1.03 (0.67 to 1.57)	1.53 (0.87 to 2.68)	1.04 (0.68 to 1.60)	1.57 (0.88 to 2.78)	0.000	0.000
Illegal drug use**	1.17 (0.72 to 1.91)	<b>2.11 (1.19 to 3.76)</b>	0.041	1.10 (0.67 to 1.82)	<b>1.90 (1.05 to 3.44)</b>	1.20 (0.73 to 1.97)	<b>2.12 (1.13 to 3.98)</b>	1.14 (0.68 to 1.89)	<b>1.92 (1.00 to 3.69)</b>	0.039	0.039
Smoking	0.94 (0.64 to 1.39)	1.39 (0.86 to 2.24)	0.029	0.95 (0.63 to 1.41)	1.46 (0.89 to 2.40)	0.96 (0.64 to 1.42)	1.41 (0.83 to 2.39)	0.97 (0.65 to 1.46)	1.53 (0.89 to 2.64)	0.030	0.030

The mean difference is shown for physical health measures and ORs are shown for all other health measures. 95% CIs are given in brackets.

The reference category is 0 moves. Statistically significant results are given in bold.

\*Socio-demographic variables adjusted for are area-level deprivation, housing tenure, head of household social class, family structure and number of siblings.

†Intraclass correlation coefficient (area-level variance as a proportion of the total variance). Individual variance is approximated by  $\pi^2/3$ .

‡There were missing values for BMI (11 at wave 2 and 20 at wave 5), waist:hip ratio (2 at wave 2 and 25 at wave 5), lung function (10 at wave 2 and 35 at wave 5) and mid-blood pressure (1 at wave 2 and 2 at wave 5).

§There was one missing response to the general health question and 12 missing responses to the question about suicidal ideation at wave 2.

¶At wave 2, the question asked 'have you ever thought about taking an overdose or injuring yourself', while at wave 5, the response relates to whether the respondent has thought about doing so in the last 5 years.

\*\*At wave 2, the question asked 'have you ever tried drugs', while at wave 5, the response relates to whether the respondent has taken drugs in the last year.

BMI, body mass index; GHQ-12, 12-item General Health Questionnaire.

We examined whether own socio-demographic characteristics (HoH social class, educational attainment and marital status) at wave 5 or prior health at wave 2 could help to explain elevated poor health in adulthood for those making frequent childhood moves (table 4). We are being rather conservative as these models adjust for both parents' socio-demographic characteristics and frequency of school moves before taking into account own socio-demographic characteristics in adulthood and prior health. Odds that were elevated after taking into account parents' socio-demographic circumstances and frequency of school moves remained elevated but were attenuated after taking into account HoH social class, educational attainment, marital status or prior health. Adjusting for own social class, marital status or prior illegal drug use helped to attenuate the relationship between illegal drug use and moving frequently in childhood. Prior illegal drug use attenuated this relationship most. The risk of having a limiting long-term illness, reporting fair or poor general health, anxiety or suicidal ideation remained elevated for those moving at least once, while the risk of poor mental health (GHQ-12) or heavy drinking or smoking remained elevated for those moving at least three times in childhood, after accounting for own socio-demographic circumstances and prior health.

## DISCUSSION

Increased childhood residential moves were associated with elevated poor overall health, psychological distress and poor health behaviours in late adolescence and adulthood, although many of these relationships could be explained in part by parents' socio-demographic characteristics or the frequency of school moves (the exception being illegal drug use). School mobility appeared to be more important than parents' socio-demographic characteristics in attenuating the relationship between childhood mobility and health. Long-distance residential moves involving a change of school may cause more disruption to education and family life than a residential move alone, and it is possible that strong social bonds and networks may be lost or lower in frequent residential movers who also change school.

The relationship between childhood residential mobility and poorer health appeared to be stronger in adolescence than adulthood for some of the health measures. It is possible that own socioeconomic and residential factors in adulthood may have mitigated this relationship over time. The only health outcome that remained significantly associated with frequent childhood residential moves in both late adolescence and adulthood was illegal drug use, which in adulthood was attenuated most by prior use (rather than by own social class, educational attainment or marital status), suggesting that frequent childhood moves may lead to experimentation with drugs in adolescence and then to drug use in adulthood. DeWit<sup>10</sup> also found evidence that those moving frequently in childhood were at increased risk of early illegal drug use and of subsequent progression to drug-related problems.

Bures<sup>9</sup> examined the effects of childhood residential mobility on self-rated health and found an association between increased childhood mobility and reporting poor general health in adulthood. The odds of reporting a limiting long-term illness were elevated in both adulthood and late adolescence; however, we only observe an elevated risk of reporting fair or poor general health in adulthood. Poorer subjective general health in adulthood could be a consequence of poorer health behaviours experienced by those who were residentially mobile. In this study, there was an elevated risk of illegal drug use, heavy drinking and smoking in late adolescence and adulthood for those moving

**Table 4** Multilevel regression results of poor health at wave 5 by the number of childhood residential moves made

	M4* + HoH social class at wave 5			M4* + Educational attainment at wave 5		
	1-2 moves	3+ moves	ICC†	1-2 moves	3+ moves	ICC†
Physical health measures‡						
BMI	0.38 (-0.57 to 1.33)	-0.10 (-1.42 to 1.22)	0.000	0.38 (-0.57 to 1.33)	-0.10 (-1.43 to 1.22)	0.000
Waist:hip ratio	0.01 (-0.00 to 0.02)	0.01 (-0.01 to 0.03)	0.000	0.01 (-0.00 to 0.02)	0.01 (-0.01 to 0.03)	0.000
Lung function (L/m <sup>2</sup> )	-0.00 (-0.03 to 0.03)	-0.02 (-0.06 to 0.03)	0.000	-0.00 (-0.03 to 0.03)	-0.02 (-0.06 to 0.02)	0.000
Mid-blood pressure (mm Hg)	-0.17 (-2.17 to 1.84)	-1.81 (-4.58 to 0.96)	0.000	-0.20 (-2.18 to 1.78)	-1.51 (-4.03 to 1.01)	0.000
Overall health						
Limiting long-term illness	1.32 (0.92 to 1.89)	1.50 (0.92 to 2.45)	0.000	1.33 (0.92 to 1.90)	1.44 (0.88 to 2.37)	0.000
Fair/poor general health	1.32 (0.84 to 2.07)	1.43 (0.79 to 2.59)	0.052	1.33 (0.84 to 2.10)	1.38 (0.76 to 2.53)	0.057
Psychological distress						
GHQ-12 (3+)	1.12 (0.72 to 1.77)	1.35 (0.74 to 2.45)	0.000	1.13 (0.72 to 1.78)	1.29 (0.70 to 2.35)	0.000
HADS anxiety (11+)	1.55 (0.91 to 2.61)	1.63 (0.82 to 3.25)	0.000	1.55 (0.91 to 2.62)	1.60 (0.80 to 3.20)	0.000
Suicidal ideation	2.40 (0.90 to 6.41)	2.25 (0.68 to 7.47)	0.000	2.37 (0.89 to 6.36)	2.04 (0.61 to 6.79)	0.000
Health behaviours						
Heavy drinking	1.04 (0.68 to 1.60)	1.57 (0.88 to 2.78)	0.000	1.05 (0.68 to 1.61)	1.56 (0.88 to 2.78)	0.000
Illegal drug use	1.14 (0.68 to 1.89)	<b>1.92 (1.00 to 3.69)</b>	0.044	1.14 (0.68 to 1.91)	1.73 (0.89 to 3.36)	0.047
Smoking	0.97 (0.65 to 1.46)	1.53 (0.89 to 2.64)	0.011	0.97 (0.64 to 1.47)	1.44 (0.82 to 2.52)	0.022
	<b>M4: + Marital status at wave 5</b>			<b>M4: + Health measure at wave 2</b>		
	1-2 moves	3+ moves	ICC†	1-2 moves	3+ moves	ICC†
Physical health measures‡						
BMI	0.38 (-0.57 to 1.33)	-0.11 (-1.44 to 1.21)	0.000	0.61 (-0.27 to 1.48)	0.32 (-0.90 to 1.54)	0.000
Waist:hip ratio	0.01 (-0.00 to 0.02)	0.01 (-0.01 to 0.03)	0.000	0.01 (-0.00 to 0.02)	0.01 (-0.01 to 0.03)	0.000
Lung function (L/m <sup>2</sup> )	-0.00 (-0.03 to 0.03)	-0.02 (-0.06 to 0.03)	0.000	-0.00 (-0.03 to 0.03)	0.00 (-0.03 to 0.04)	0.000
Mid-blood pressure (mm Hg)	-0.26 (-2.24 to 1.72)	-1.42 (-3.97 to 1.13)	0.000	-0.49 (-2.40 to 1.43)	-1.26 (-3.70 to 1.18)	0.000
Overall health						
Limiting long-term illness	1.31 (0.91 to 1.88)	1.47 (0.90 to 2.41)	0.000	1.30 (0.90 to 1.88)	1.47 (0.89 to 2.42)	0.000
Fair/poor general health	1.29 (0.81 to 2.03)	1.36 (0.75 to 2.48)	0.045	1.35 (0.84 to 2.13)	1.44 (0.79 to 2.64)	0.061
Psychological distress						
GHQ-12 (3+)	1.09 (0.69 to 1.72)	1.30 (0.71 to 2.39)	0.000	1.03 (0.65 to 1.62)	1.25 (0.68 to 2.28)	0.000
HADS anxiety (11+)	1.53 (0.90 to 2.59)	1.60 (0.80 to 3.19)	0.000	1.66 (0.97 to 2.84)	1.76 (0.88 to 3.56)	0.000
Suicidal ideation	2.31 (0.86 to 6.19)	2.17 (0.65 to 7.29)	0.000	2.28 (0.83 to 6.24)	1.71 (0.49 to 5.87)	0.000
Health behaviours						
Heavy drinking	1.04 (0.68 to 1.60)	1.57 (0.88 to 2.78)	0.000	1.05 (0.68 to 1.62)	1.49 (0.83 to 2.66)	0.000
Illegal drug use	1.06 (0.63 to 1.79)	1.75 (0.89 to 3.43)	0.041	1.10 (0.65 to 1.85)	1.52 (0.77 to 2.99)	0.028
Smoking	0.94 (0.62 to 1.42)	1.46 (0.84 to 2.54)	0.014	0.96 (0.61 to 1.53)	1.25 (0.67 to 2.32)	0.012

The mean difference is shown for physical health measures and ORs are shown for all other health measures. 95% CIs are given in brackets.

The reference category is 0 moves. Values for M4 are taken from the last columns of table 3 for respondents at wave 5. Individual characteristics at wave 2 and prior health measure at wave 2 are each added to M4 separately. Statistically significant results are given in bold.

\*Model results as in final columns of table 3 (wave 5).

†Intraclass correlation coefficient (area-level variance as a proportion of the total variance). Individual variance is approximated by  $\pi^2/3$ .

‡There were 20 missing values for BMI, 25 for waist:hip ratio, 35 for lung function and 2 for mid-blood pressure.

BMI, body mass index; GHQ-12, 12-item General Health Questionnaire.

most frequently. There was no association between childhood residential mobility and the physical health measures examined in this paper. This finding is in line with other work that found that childhood residential mobility was not associated with growth development in children.<sup>32</sup>

Residential mobility in childhood was related to family structure, number of siblings and area deprivation, but no association was found with parental housing tenure or social class. Among non-homeowners, private renters are the most residentially mobile.<sup>33</sup> In this study, only 3.4% rented privately (the others were social renters or lived in work-tied housing) so this could perhaps explain the lack of association. Previous work has shown that both the frequency of moves and the distance of moves are strongly related to social class.<sup>34</sup> We used frequency of school moves as a proxy for distance of residential moves (local or longer distance), but neither frequency of residential moves nor school moves ( $p=0.71$ ) were related to social class.

This study has some limitations. We have no information on reasons for moving home. Not all moves influence children equally; children are more likely to be negatively affected when families move because of disruption or financial problems rather than to seek better schools or employment opportunities. Children's residential histories may be further complicated when families break up if children live in two locations alternately. We did not know whether a change of residential address necessarily resulted in a change of school. In total, 11.2% of respondents had changed school without moving home, while 34.6% of respondents who moved home at least three times did not change school. We have tried to include a wide range of health outcomes; however, our list is not comprehensive and so our conclusions relate only to the measures examined. Further limitations include parental reporting of moves prior to baseline, which may be subject to recall bias, especially for moves made when respondents were very young. Highly mobile children are

frequently omitted from research studies and administrative data sets. Of those who took part in this study, it is likely that the most mobile dropped out after baseline so the effects of childhood residential mobility on health reported here may be underestimated. Despite the small final sample size, we observed effect sizes that were raised and in the same direction across many of the health measures.

Strengths include the longitudinal design of the study. We were able to examine the effects of childhood residential mobility across a wide range of health measures in both late adolescence and adulthood. Our findings suggest that there is an elevated risk of poor health in late adolescence that remains in adulthood for those moving in childhood, even after adjusting for socio-demographic characteristics and school mobility. School moves accompanying a change of residential address, and the reasons for moving home, should be taken into consideration in any future work looking at the association between childhood residential mobility and health.

In conclusion, we have shown that the risk of poor health in adolescence and adulthood was elevated for those making residential moves in childhood. Risk remained elevated for overall health measures, psychological distress and health behaviours after adjusting for socio-demographic characteristics and school mobility, but the physical health measures examined were not associated with childhood mobility.

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**Competing interests** None.

**Ethics approval** Ethical approval for the baseline study was granted in 1986 by the GP Subcommittee of Greater Glasgow Health Board and the ethics subcommittee of the West of Scotland Area Medical Committees, as was Wave 2. Wave 5 was approved by Tayside Committee on Medical Research Ethics A.

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## What is already known on this subject

- Residential mobility is common in childhood.
- Moving home can affect social ties and relationships with health professionals.
- Frequent residential moves in childhood can lead to poorer health status and health behaviours.

## What this study adds

- Moving frequently in childhood is associated with adverse health behaviours and outcomes, although these may in part be attributable to moving schools.
- Frequent residential moves remained independently associated with an increased risk of illegal drug use in late adolescence and adulthood, after adjustment for parents' socio-demographic characteristics and frequency of school moves.
- The risk of poorer overall health, psychological distress and heavy drinking and smoking was elevated in late adolescence and adulthood for frequent movers.
- There was no association between childhood residential moves and the physical health measures examined here.



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