

Residential mobility amongst children and young people in Wales: A longitudinal study using linked administrative records

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Abstract

Background

Child poverty remains a major global concern and a child's experience of deprivation is heavily shaped by where they live and the stability of their local neighbourhood. This study examines frequencies and patterns of residential mobility in children and young people (CYP) at a population level using novel geospatial techniques to assess how often their physical environment changes and to identify geographical variations in social mobility.

Methods

We used routinely collected administrative records held in the Secure Anonymised Information Linkage (SAIL) Databank for CYP aged under 18 years living in Wales between 2012 and 2022. We calculated the Moran's I statistic to assess the magnitude of Lower layer Super Output Area (LSOA)-level geographic variation in residential mobility and used the Local Indicator of Spatial Association (LISA) to identify clusters of LSOAs where there are higher rates of residential mobility.

Results

This study included 923,531 CYP, with 58% having moved at least once during the study period. A total number of 1,209,102 house moves were recorded, 59% of which occurred between the ages of 0 and 5 years. Almost 10% of the cohort resided in five or more dwellings before the age of 18 years. In terms of area-level (LSOA) deprivation, 75% of house moves were to areas with the same or higher levels of deprivation, leaving only 25% of house moves that achieved upward social mobility. Clustering of residential mobility was identified predominantly in areas of high deprivation.

Conclusion

The findings of this study show that residential mobility is linked with socio-economic circumstances and is experienced by over half of CYP in Wales. Understanding where CYP live, their mobility patterns and which areas have high levels of influx and efflux is crucial for policymakers to generate well-informed, targeted and effective child-focused interventions.

Keywords

residential mobility; children & young people; poverty; deprivation; social mobility

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Introduction

Global rates of child poverty showed a sharp increase between 2014 and 2021. Twenty percent of children are currently living in poverty across 40 of the world's wealthiest countries, with the United Kingdom (UK) ranking one of the worst [1]. Poverty can have a profound impact on a child's wellbeing and given that half of those living in poverty are living in persistent poverty [2], this can have severe long-term effects on a child's health as well as their cognitive, social and emotional development [3, 4]. Whilst some countries have seen a reduction in child poverty, the number of children experiencing destitution in the UK has almost tripled in the last five years with South Wales being one of the worst affected areas [5]. Over a quarter of children in Wales are living in relative poverty – a rate that has been consistently higher than in Northern Ireland and Scotland for the past 20 years and has only recently fallen below that of England [6]. As a result, child poverty is one of the greatest challenges faced by policymakers in Wales.

The characteristics of a child's neighbourhood and surrounding environment can have a profound impact on their experience of poverty and can either help or hinder upward social mobility [7]. Understanding these contextual factors based on where children live can inform policy and interventions that aim to reduce child poverty [8, 9]. It is widely recognised that disparities exist across geographical regions in terms of access to education, healthcare and community resources [10], and children living in these areas face a cycle of poverty that is difficult to escape due to limited opportunities and resources [11]. Research has shown that poverty also limits the ability to secure stable long-term housing [12, 13], which can lead to higher frequencies of house moves as families strive to break free from economic hardship. Understanding these patterns of residential mobility will help policymakers to assess and understand the dynamic nature of poverty and its impact more comprehensively on individuals and communities.

To date, little is known about the characteristics of where children and young people (CYP) in Wales live and their longitudinal patterns of residential mobility. Whilst some studies have examined residential mobility at the household level, there is limited research that has focused specifically on CYP. Previous research on residential mobility has primarily utilised cross-sectional data [14, 15], where methods used to determine the number of house moves may be subject to underestimation. Other studies have focused on using house moves as a binary measure and fail to capture the dynamic nature of residential mobility [16].

Residential mobility is often examined primarily as an exposure leading to a range of educational and behavioural outcomes associated with housing changes [3, 14, 17–20]. However, understanding the frequency with which CYP move home also provides valuable first insights into the stability of their environment, as well as the impact of changing residences – both home and area – on such outcomes.

The use of longitudinal, administrative data provides an opportunity to develop unique and novel insight of CYP's mobility throughout their life-course and to subsequently build a more complete residential address history for each child. This information will aid our understanding of where CYP live in

Wales, whether there is variation in residential mobility across Wales and how residential mobility may be driven by poverty.

The aim of this study was therefore to use population-level administrative data to quantify residential mobility in CYP and to identify geographical variations in upward social mobility where CYP move to a more affluent deprivation quintile. Our objectives were to (i) derive complete address history for each child and to quantify the proportion of known residency from birth to 18 years of age; (ii) assess the frequency of house moves among CYP and the ages when moves are recorded and; (iii) analyse variation in residential mobility across different geographies and socio-demographic groups.

Methods

Study design

This was a retrospective observational study utilising routinely collected administrative data held in the Secure Anonymised Information Linkage (SAIL) Databank, hosted at Swansea University [21–23]. The SAIL Databank is a unique resource of anonymised, linked longitudinal health, socioeconomic and environmental data relating to the people of Wales, which are accessed via a Trusted Research Environment. One of the core linkage mechanisms used by the SAIL Databank is the Residential Anonymised Linkage Field (RALF), which allows researchers to link individuals with their place of residence [24, 25] and record house moves over time based on address registration data. House moves are defined as a change in recorded residential address at the point of accessing primary care.

Data sources

Two data sources were used to conduct the analyses. The Welsh Demographic Service (WDS) dataset is based on GP registrations in Wales and were used to extract demographic information such as age, gender, week of birth and week of death. The WDS also contains residential information, which is address matched to a Unique Property Reference Number (UPRN) and double encrypted to a RALF, allowing the start and end dates along with the Lower layer Super Output Area (LSOA) of each residence to be captured.

The WDS data were linked with the Welsh Index of Multiple Deprivation (WIMD) 2019 [26] using the LSOA to obtain area-level characteristics of each residence including overall deprivation quintile.

House moves

The study group consisted of all CYP (aged under 18 years old) with an address registration in Wales between 1st January 2012 and 27th November 2022, the latest point at which data were available. All known residential addresses were extracted from the WDS using the RALF identifiers associated with each individual (i.e. address records from as far back as 1994 were extracted for all CYP aged 17 years in 2012). Each change in RALF was recorded as a new residence and ordered by date, with the first residence assigned a sequence number of 0 (i.e. their place of residence at birth). Those who did not have

a complete address history up to the age of 18 years were excluded. Similarly, those who migrated in or out of Wales during the study period were also excluded.

Gaps in address history were identified in the data ranging from 2 days to 16 years. Gaps of fewer than 30 days between the previous end date and the new start date were removed as these were deemed to be administrative gaps rather than gaps in address history. Any CYP in the cohort with gaps greater than 30 days were considered to have an incomplete address history and were removed.

Discrepancies were identified where start and end dates for Welsh and non-Welsh addresses were found to be overlapping. As we were unable to identify which record represented the current address, these CYP were also considered to have an incomplete address history and were subsequently removed from the cohort.

CYP in the cohort were followed up until either the date that they turned 18 years, a date of death was recorded or the last date at which data were available. Each change in RALF was used to calculate the total number of house moves for each CYP between birth and their applicable end date. Non-movers were identified as those who only ever had one residence. CYP who had more than one residence were counted as movers. For the remainder of the analyses, counts of house moves were presented rather than counts of individual movers (i.e. each child could have multiple moves) to capture the extent of CYP's mobility across Wales.

Statistical analysis

Descriptive statistics

Statistics describing the overall pattern of house moves are reported as: the number and percentage of all CYP with at least one house move, the distribution of total house moves per person, the number and frequencies of house moves by age group and the mean age; at first house move and all moves. We compared the total number (and percentage) of CYP who moved at least once (movers) with those who only had one address record (non-movers) by deprivation quintile.

Patterns of house moves were explored visually using a chord diagram, produced using the Circlize package in R [27] to visualise mobility between deprivation quintiles as defined by WIMD 2019. All non-movers were excluded from this part of the analysis.

Geospatial analyses

To assess the magnitude of LSOA-level geographic variation (spatial autocorrelation) in residential mobility, the global Moran's I statistic was computed. This enabled an assessment of the degree to which rates of house moves were similar or dissimilar across geography. Moran's I is defined as:

$$I = \frac{n}{S_0} \frac{\sum_{i=1}^n \sum_{j=1}^n w_{ij} z_i z_j}{\sum_{i=1}^n z_i^2}$$

Where i is the observation, j is the average of the surrounding areas, z_i is the deviation from the mean, w_{ij} is the spatial weight between i and j , n is the total number of features and

S_0 is the aggregate of all the spatial weights:

$$S_0 = \sum_{i=1}^n \sum_{j=1}^n w_{ij}$$

Moran's I values range from -1 to +1, which represent extreme negative and positive spatial correlation, respectively and 0 represents spatial randomness. To test the null hypothesis of no spatial correlation, a Monte Carlo simulation was used with 1,000 random permutations to produce the rank of observed Moran's I in relation to the simulated values, with $p < 0.05$ indicating statistical significance.

The location of LSOA clusters with significantly lower ('cold spots') or higher ('hot spots') rates of residential mobility were identified by measuring whether residential mobility in each LSOA was closer to the rates of its neighbouring LSOAs or to the national average. We calculated this using the Local Indicator of Spatial Association (LISA) which is defined as:

$$I_i = z_i \sum_{j=1}^n w_{ij} z_j$$

The statistical significance of LISA estimates was tested using a Monte Carlo simulation which compares the observed LISA values for each LSOA with the distribution of the randomised values. We created LISA significance maps to identify clusters of LSOAs with significantly higher or lower rates of residential mobility compared with their neighbours. All geospatial analyses were conducted using spdep package in R (version 4.3.2).

Results

The final cohort consisted of 923,531 CYP. Of those, 539,330 (58%) moved at least once, whilst 384,201 (42%) remained in the same residence throughout the study period (Figure 1). The total number of house moves recorded during the study were 1,209,102. Almost 60% of all moves in CYP occurred between the ages of 0 and 5 years, and the number of moves decreased with increasing age. The average age of a child's first house move was aged three years, whilst the average age of all moves in CYP was five years. A table containing number of house moves by age can be found in Supplementary Appendix 1.

Table 1 shows the number of CYP by number of residences across the study period. Those with only one residence represent the 42% of CYP who have never moved. As anticipated, the number of CYP who resided in multiple residences dropped with each additional dwelling. Despite this, almost 10% of the cohort had resided in five or more dwellings. Just over 1% of the cohort were found to have had nine or more residences with some children having had up to 30 different addresses recorded in their address history.

In terms of deprivation, over a quarter of CYP were residing in the most deprived quintile at birth, with fewer numbers of CYP residing in each subsequent quintile. Only 16.8% of CYP were residing in the least deprived quintile. A full table containing the number of CYP living in each deprivation quintile at birth can be found in Supplementary Appendix 2.

Figure 1: Cohort consort diagram

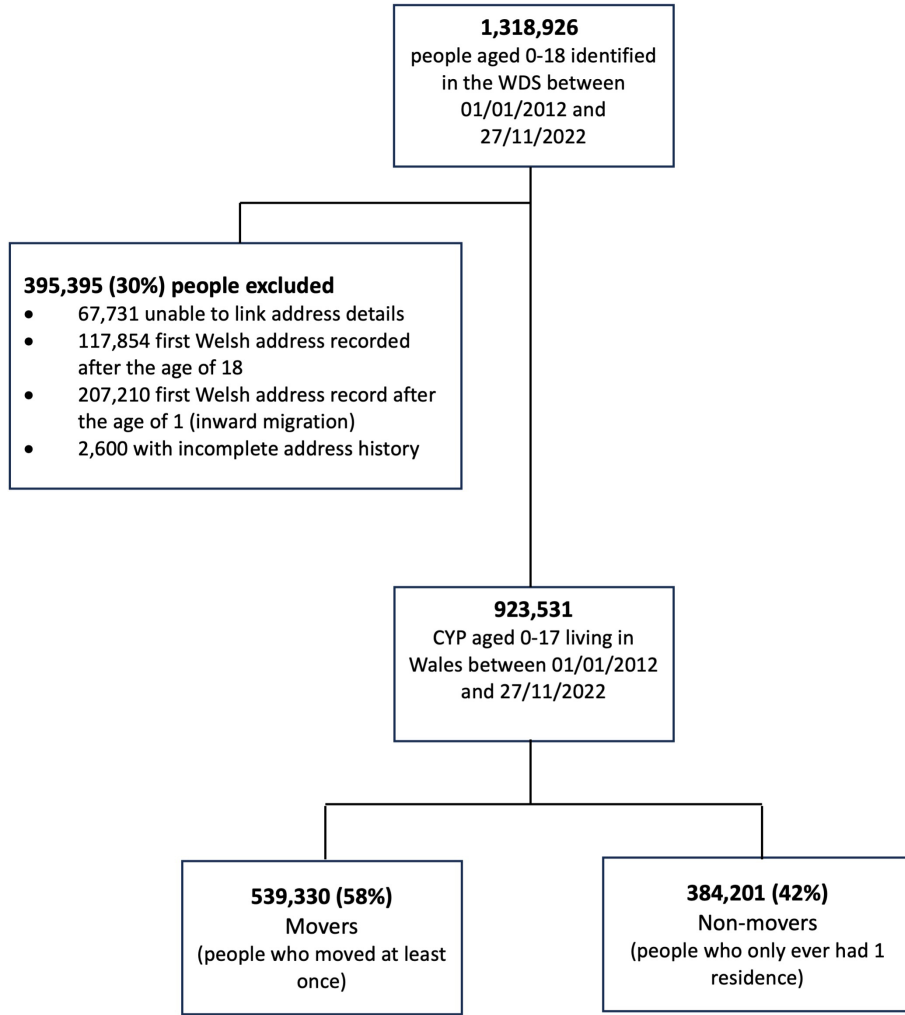


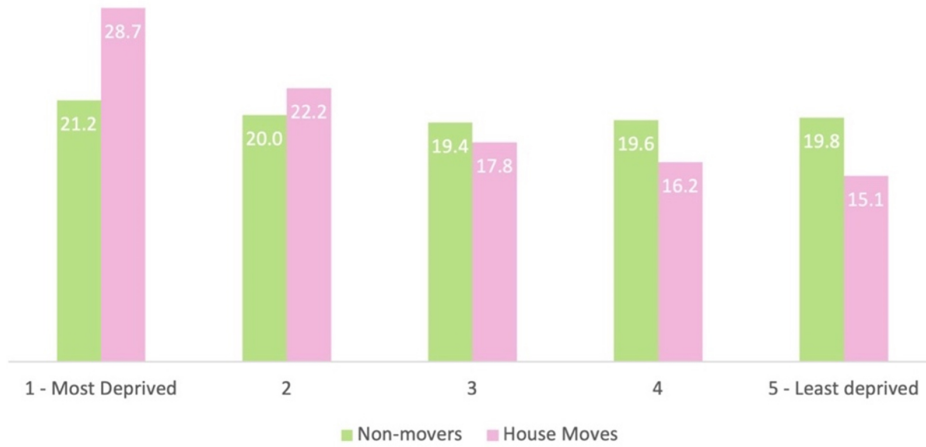
Table 1: Number of residences per child

Number of residences	Count of CYP	Percentage
1	384,201	41.60
2	252,223	27.31
3	126,582	13.71
4	68,534	7.42
5	38,679	4.19
6	22,206	2.40
7	12,645	1.37
8	7,553	0.82
9	4,473	0.48
10	2,551	0.28
11	1,518	0.16
12	965	0.10
13	548	0.06
14+	853	0.09
All	923,531	100

The most deprived quintiles also had higher levels of mobility, as shown in Figure 2. The number of house moves was highest in the most deprived quintile where 28.7% of all moves took place, compared to 15.1% in the least deprived quintile. The

percentage of non-movers remained similar across all quintiles. A chi-square test of independence revealed that there was a statistically significant difference between the two groups by deprivation quintile, $X^2 = 13,139$, $p < 0.05$.

Figure 2: Percentage of non-movers vs number of house moves by quintile

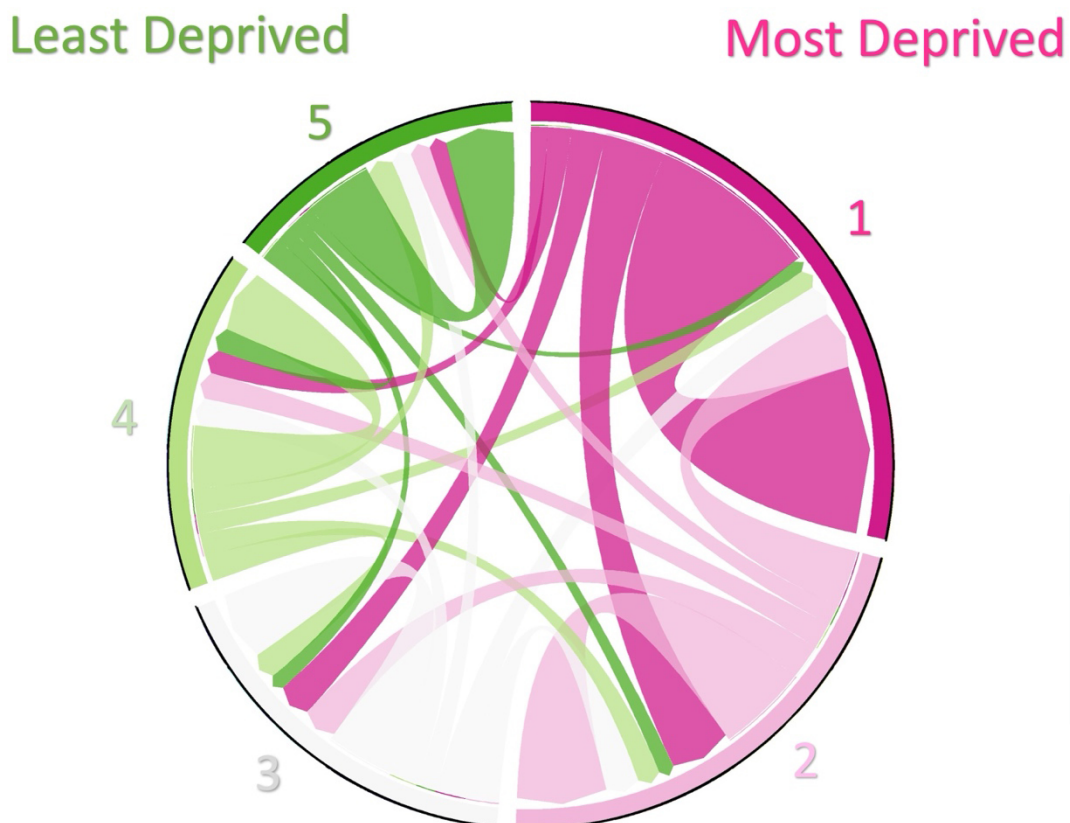


The chord diagram shown in Figure 3 shows levels of residential mobility between and within deprivation quintiles with arrows representing the direction of movement. The size of the flow (i.e. number of CYP who moved house) is represented by the width of the arrow at its base. The dark pink segment represents movement out of and within the most deprived quintile (quintile 1) whereas movement out of and within the least deprived quintile (quintile 5) are shown in dark green. Overall, results indicate that 75% of house moves were to areas with either the same or higher levels of deprivation. Almost half (46%) of all house moves occurred within the same quintile whilst 29% of moves showed a downward social

trajectory towards areas with higher levels of deprivation. Only 25% of moves showed upward social mobility (i.e. moves to quintiles with lower levels of deprivation).

As indicated in the diagram, residential mobility was more prominent in the most deprived quintile where almost 30% of all house moves occurred. Almost 60% of house moves that occurred in the most deprived quintile are merely relocations within the same quintile indicating that people living in these areas continue to reside in areas with the same or similar sociodemographic characteristics. The least deprived quintile shows the lowest amount of mobility and very few moves compared to other quintiles.

Figure 3: Chord diagram of residential mobility by deprivation quintile



The Moran's I global statistic was 0.46 ($p < 0.001$), indicating that there is a moderate clustering of residential mobility (similar values at neighbouring locations) in Wales and that the spatial distribution of residential mobility is non-random. The results from the Monte-Carlo simulation of Moran's I indicated that the null hypothesis of non-spatial correlation can be rejected (the rank of the observed Moran's I = 1,000: the pseudo p -value = 0.001). A scatter plot visually demonstrating the positive spatial autocorrelation across Wales is included in Supplementary Appendix 3.

The findings from the LISA analysis are presented in Figure 4, which depicts the pattern of clustering of LSOAs with significantly higher (hot spots) and lower (cold spots)

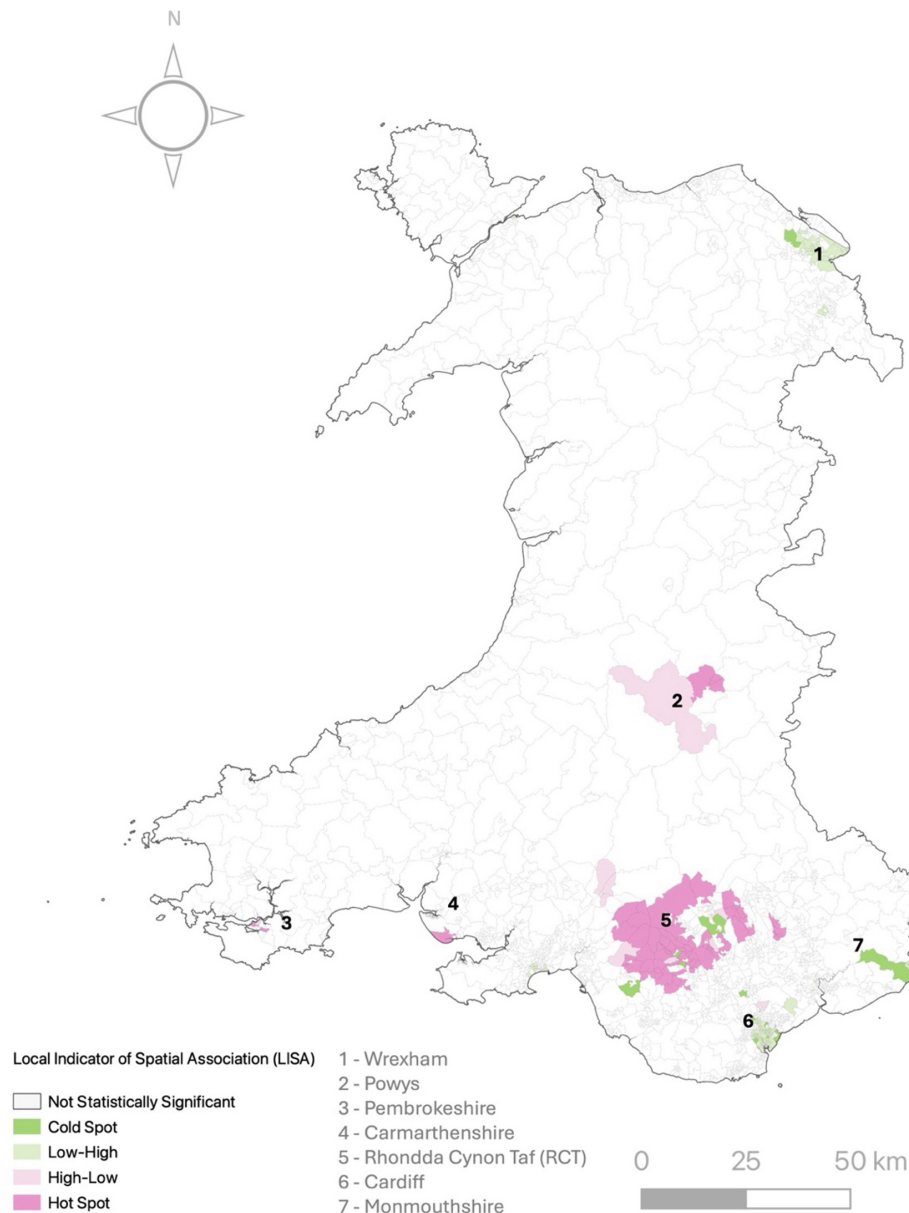
rates of residential mobility. This enables us to define where small area level clustering represents higher or lower than average rates. Areas indicated as high-low represent LSOAs with high rates of residential mobility surrounded by LSOAs with lower-than-average rates (e.g. in a rural town or village). Similarly, areas indicated as low-high represent LSOAs with lower rates of residential mobility surrounded by LSOAs with higher-than-average rates.

As shown on the map, there was a large cluster of LSOAs with higher-than-average rates of residential mobility in the South Wales valleys (Rhondda Cynon Taf (RCT)). Additional 'hot spots' are located in Powys, in Pembrokeshire and near the coast in Carmarthenshire. Four clusters of LSOAs across Wales with lower-than-average rates of residential mobility

Figure 4: Residential mobility amongst children and young people in Wales

Local Indicator of Spatial Association (LISA)

This illustrates the clusters of similar values in geographical space and identifies outliers or regions of interest where there is unusual levels of residential mobility (either high or low).



ONS LSOA 2011 Data, LISA Data exported from SAIL Databank

were identified in Monmouthshire, Flintshire and two other areas in close proximity to the 'hot spots' around RCT.

Discussion

Residential mobility in Wales was highest during the first five years of life and became less frequent as CYP got older. This is consistent with previous evidence [19, 28] and suggests that residential mobility is heightened during the pre-school years. Whilst the majority of CYP in this study were found to have had fewer than three dwellings recorded during their childhood, 10% of CYP resided in five or more dwellings, which could be an indicator of family disruption, instability, and/or persistent poverty [29].

Childhood deprivation continues to be a concern in Wales with almost half of all CYP residing in the two most deprived quintiles at birth. Residential mobility was more prominent in these areas, particularly in South Wales where deprivation levels are high. Whilst there are smaller 'hot spots' of mobility shown in the more affluent areas of Powys, Pembrokeshire and Carmarthenshire, increased levels of inward mobility to these areas could be explained by the rurality of their neighbouring LSOAs.

Whilst house moves can be beneficial to some families, house moves within or between deprived areas can add to family stressors with children within those families experiencing higher risk of emotional and behavioural problems [14, 17]. Only 25% of house moves were to areas with lower levels of deprivation indicating that rates of upward social mobility in Wales are relatively low. Given that previous research suggests that people from disadvantaged backgrounds tend to have fewer opportunities to climb the socio-economic ladder and break the cycle of poverty [30], residing in the most deprived quintiles at birth could be a barrier for upward social mobility. Hansen [28] found that parents were prepared to pay significantly more to buy a house near a better performing primary school catchment area, which leads to greater inequalities between the most and least deprived areas as families are essentially priced out of good areas and, subsequently, better education.

The higher rates of residential mobility observed between the ages of 0 and 5 years – is also a time when children experience some of the key developmental phases of their lives. Moving could therefore have long-term implications on children's well-being, as residential stability allows CYP to actively engage and invest in their social relationships, education and communities. High rates of residential mobility occurring within and between the most deprived areas of Wales are likely to be affecting the establishment of such relationships and hindering opportunities to achieve upward social mobility to areas where crime rates are typically lower, facilities are more accessible, and communities are more cohesive.

Results from this study indicate that frequencies of residential mobility were higher in the most deprived quintiles, which is consistent with previous findings, where residential instability is found to be more common amongst low-income families [29, 31]. There is a demonstrable link between residential mobility and socio-economic circumstances, as highlighted by the clustering of mobility around the South

Wales valleys area. Only one in four CYP in this study experienced upward social mobility where their indicative socio-economic circumstances had improved because of a house move. This reinforces the notion of persistent poverty and the cyclical nature of economic disadvantage [32]. Use of geospatial clustering methods has allowed us to explore residential mobility in novel ways, demonstrating the value of using spatial data analysis methods alongside administrative data to understand population dynamics.

Understanding the prevalence of residential mobility and its association with place is crucial for policymakers and community leaders to implement targeted interventions that address the unique challenges faced by children living in different regions. It provides critical insights into the dynamic nature of the environments in which CYP are growing up and its' potential impact on their wellbeing and development. Child poverty continues to affect a large proportion of CYP in Wales and the results of this study indicate that there are clear links between residential mobility and socio-economic circumstances. Using well-established information on LSOA deprivation does not offer the same dynamic insights into population movement as it merely captures a snapshot of socio-economic circumstances at a given time. Knowledge about the frequency of relocations, the areas where CYP are more likely to reside and areas with higher rates of influx helps educators, social workers, and policymakers tailor support systems to target areas in need of more child-focused interventions where they will have the biggest impact. This would further allow policymakers to address challenges related to changing schools, building new social connections, and coping with the potential emotional difficulties associated with frequent moves and instability. These interventions may assist in breaking the cycle of poverty faced by CYP living in deprived areas.

Strengths and limitations

Utilising large-scale administrative data to examine residential mobility has uniquely enabled a complete residential address history to be constructed for many CYP in Wales and has offered valuable insights into population movement and social patterns at population level. 16% of records were lost to follow-up due to missing data or migration out of the Welsh NHS system, but overall, these were very small numbers compared to the population level data that we were able to capture.

Further work is required to examine the very frequent movers, such as those with up to 30 dwellings. Linkage to other administrative and social care datasets may provide further insight into their characteristics and circumstances, such as social housing, rented accommodation or vulnerable CYP in the care system for whom placement instability may have the greatest negative impact. Acquiring additional demographic information such as ethnicity and housing tenure also would allow comparisons to be made between movers and non-movers. Further analyses could also build on this work by examining the impact of changing residential environments on health outcomes, such as childhood obesity.

Conclusion

In conclusion, the findings of this study contribute to our understanding of where CYP live, their experiences of residential mobility and the extent to which mobility varies at a population scale. CYP develop alongside their environment, and it is important to understand how often they are exposed to changes in that environment as a result of residential mobility. Our research has shown that changes to environmental exposures attributed to residential mobility are more likely in the early years, before the age of five, and those who are born into disadvantaged neighbourhoods. Understanding the dynamics of residential mobility is crucial for policymakers to address the multifaceted challenges of poverty and social exclusion.

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Conflict of interests

The authors have no conflict of interests to declare.

Ethics statement

This study was approved by SAIL Information Governance Review Panel (project 1001) in Wales. All data were anonymised (de-identified) prior to access and analysis. In

accordance with Health Research Authority guidance, ethical approval is not mandatory for studies using only anonymised data and so was not obtained for this study.

Availability of data and materials

The data sources are described in detail in the methods, which were accessed and analysed within a Trusted Research Environment (TRE). Extracting data from the TRE is prohibited as a condition of use. Accredited researchers can apply to access the Secure Anonymised Information Linkage Databank via a governed approval process and is independent of the study authors (<https://saildatabank.com/>).

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Abbreviations

LSOA:	Lower layer Super Output Area
WIMD:	Welsh Index of Multiple Deprivation
CYP:	Children & Young People
LISA:	Local Indicator of Spatial Association



Supplementary Appendices

Supplementary Appendix 1: Number of house moves by age

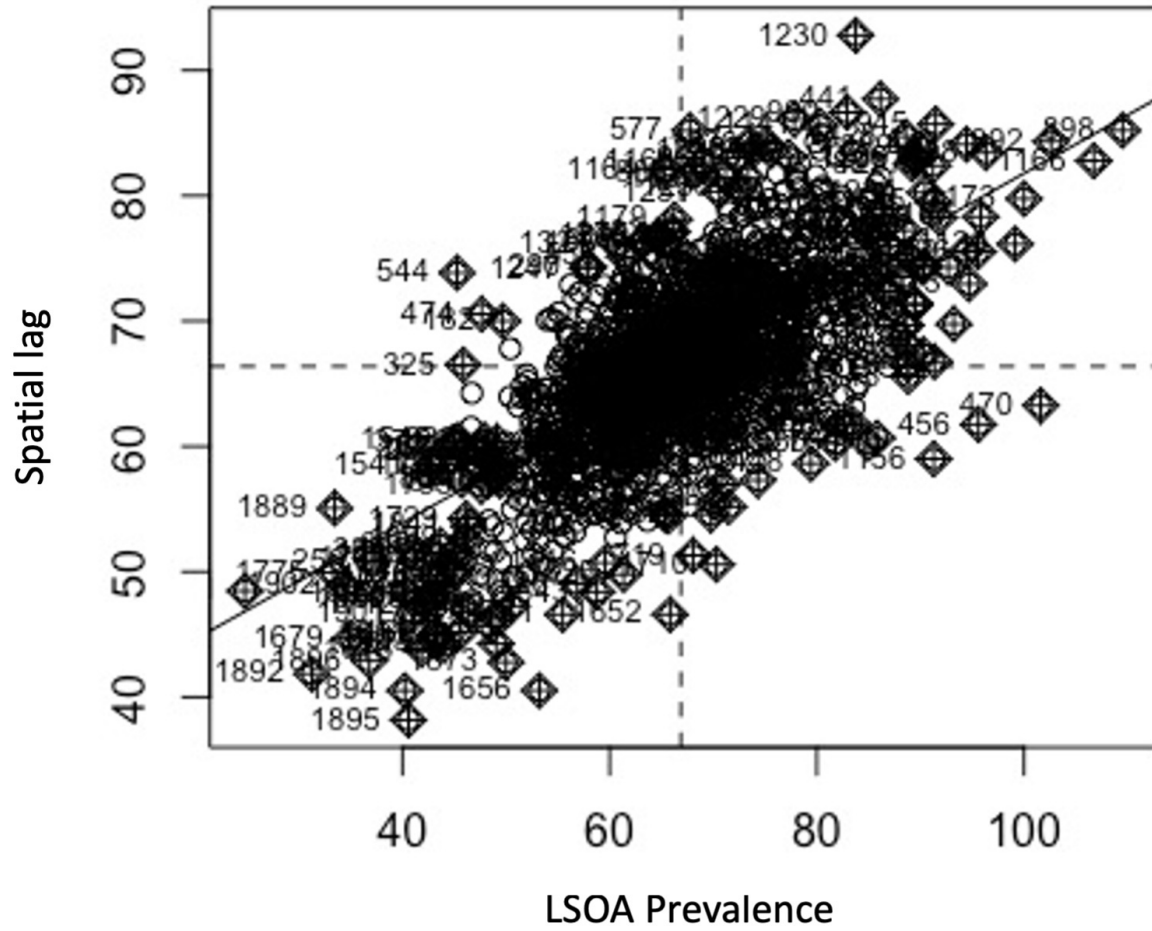
Age	Number house moves	% of all house moves
0	142,395	11.78
1	154,878	12.81
2	129,338	10.70
3	114,307	9.45
4	92,182	7.62
5	79,999	6.62
6	70,533	5.83
7	62,783	5.19
8	56,355	4.66
9	49,601	4.10
10	44,719	3.70
11	40,302	3.33
12	35,282	2.92
13	32,316	2.67
14	28,956	2.39
15	26,045	2.15
16	25,142	2.08
17	23,969	1.98
All ages	1,209,102	100

Supplementary Appendix 2: Number of CYP residing in each deprivation quintile based on first recorded address

Quintile	Number of CYP	Percentage
1 - Most deprived	237,225	25.7
2	195,741	21.2
3	172,780	18.7
4	162,734	17.6
5 - Least deprived	155,051	16.8
Total	923,531	100



Supplementary Appendix 3: Moran's I Scatter plot



This scatter plot demonstrates that there is a positive spatial autocorrelation in residential mobility across Wales and that its spatial distribution is non-random.

