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Area effects on the level and development of social exclusion in later life

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ABSTRACT

Social exclusion in later life is associated with decreased quality of life and poorer health outcomes. Reducing the number of people at risk of exclusion is a key theme in European social policy, but there is limited understanding of the relationship between neighbourhood characteristics, personal attributes and the level and development of social exclusion in later life. In this paper, cross-classified multilevel growth curve models for predicting exclusion are fitted to seven waves of data from the English Longitudinal Study of Ageing, collected between 2002 and 2015, allowing for the investigation of causal mechanisms linking area characteristics and exclusion in later life, including access to services and amenities, participation in civic, cultural and leisure activities and relationships with friends and family. Results show that living in a deprived area is associated with increased levels of exclusion, and this explained the higher levels of exclusion found for urban compared with rural areas. Population turnover among local residents did not impact on exclusion levels, but length of residence and the degree to which a person feels attached to their neighbourhood did, with ageing in place and stronger attachments predicting lower levels of social exclusion. In terms of individual characteristics, men, those in poor health, people with low levels of wealth or education, and those aged 80 or older, were more likely to experience increased levels of exclusion, while retirement and marriage provided a protective effect. The paper contributes new insights into the pathways through which characteristics of both individuals and neighbourhoods predict social exclusion in later life, and concludes by discussing the policy implications raised by the research.

1. Introduction

Reducing the number of people at risk of social exclusion is a key theme in European social policy, reflecting concern about the social costs which arise when individuals and communities become cut off from wider society (Eurostat, 2017). While the concept of social exclusion is increasingly common in research, a variety of definitions have been identified (Atkinson, 1998; Levitas et al., 2007; Walsh et al., 2017). There do however seem to be four elements that recur in the discussion. The first is that it is a *relative* concept, suggesting that people are excluded in relation to other groups in society and thus cannot be judged to be excluded by looking at their circumstances in isolation (Atkinson, 1998). Second, social exclusion involves *agency,* implying an act of exclusion, and emphasizing the power relations and/or individual factors that might be associated with forms of exclusion (Atkinson, 1998). A third common theme refers to the *multi-dimensional* nature of exclusion, covering domains such as: exclusion from neighbourhood and community; services, amenities and mobility; social relations; material and financial resources; socio-cultural aspects; and civic participation (Buffel et al., 2013; Walsh et al., 2017; Scharf et al., 2005; Van Regenmortel et al., 2016). Finally, social exclusion is *dynamic* or *processual*, with individuals and groups moving in and out of exclusion and experiencing different forms of exclusion over time (Silver, 2007; Walsh et al., 2017).

While some research addresses such questions from a lifecourse perspective (Barnes et al., 2002; 2006), the dominant approach tends to be around children and families and younger adults. As a consequence, important sections of the population vulnerable to multiple disadvantages are under-represented in much of the research literature (Levitas et al., 2007; Buffel et al., 2013). One group that may be especially susceptible to social exclusion are older people who have experienced cumulative disadvantages across their life course (Patsios, 2000; Scharf et al., 2005; Scharf and Keating, 2012). Indeed, research in the UK has shown that age is associated with an increased chance of exclusion (Kneale, 2012), with people aged 80 and over more likely than their younger counterparts to feel excluded from social relationships, and be detached from leisure and cultural activities and basic services (Barnes et al., 2006; Jivraj et al., 2016). Social exclusion in

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later life is associated with a range of adverse health and wellbeing outcomes (Burchardt, 2003; Nazroo, 2017; Tong et al., 2011; Watt et al., 2014), including long term illness, disability and psychological distress (Sacker et al., 2017), lower quality of life, unmet social care needs, and increased risk of loneliness (Kneale, 2012). Poor health is also central to the disadvantages that increase the risk of social exclusion, and interacts with exclusion in a variety of ways. Thus, health is both a risk factor and outcome of social exclusion (Barnes et al., 2006; Jivraj et al., 2016; Sacker et al., 2017). Older adults who have experienced sustained disadvantage over the life course are especially likely to become socially excluded (Jivraj et al., 2016). Age-related transitions, such as decline in income following retirement, loss of partner, family or friends, and deteriorating health and mobility, appear to be crucial to these processes (Kneale, 2012). From both a research and policy perspective, it is therefore important to identify factors that might lead to greater social exclusion in later life.

Previous research examining the factors associated with social exclusion in later life has mainly focused on individual drivers (Van Regenmortel et al., 2016). However, a focus on area effects is also justified given the significance of the neighbourhood to older adults (Bowling and Stafford, 2007; Buffel et al., 2013; Van Cauwenberg et al., 2014; Wanka et al., 2018), as a result of the length of time they are likely to have spent in the same locality (Phillipson, 2013), the amount of time spent in the home and immediate area following retirement (Wahl and Oswald, 2010), and for preserving a sense of identity and independence (Rowles, 1983). Yet there are few quantitative studies that examine the relationship between social exclusion and area characteristics, such as neighbourhood deprivation, population turnover, and a sense of belonging to the area (Van Regenmortel et al., 2016), although there is some, albeit conflicting, evidence regarding urban-rural differences (Ogg, 2005; Shergold and Parkhurst, 2012). Despite evidence suggesting that older people may be particularly vulnerable to environmental pressures and change (Buffel et al., 2018), the impact of neighbourhood characteristics on the development of social exclusion in later life remains under-explored.

The interlinked nature of social exclusion makes it difficult to disentangle the relationships between differing domains, and to tease apart those that are direct risk factors, those that are indicators, and those that are outcomes of exclusion (Sacker et al., 2017). Following Jehoel-Gijsbers and Vroomen (2008), this study aims to uncover causal relationships, and test the influence of poverty and material neighbourhood deprivation on the experience of social exclusion. This follows the broader literature on socioeconomic inequalities in health (Nazroo, 2017) and is in line with Levitas et al. (2007), who analytically separates *poverty* 'being the lack of material resources, especially income', from *social exclusion*, or the lack of participation in social life (operationalised in this paper as participation in civic, cultural and leisure activities; services and amenities and social relationships). But this is in contrast with Walsh et al. (2017), who recommend the inclusion of material resources as part of a conceptual model of social exclusion. What this study aims to show, however, is that an expanded view of risk factors (including both individual and neighbourhood characteristics; material and neighbourhood deprivation) has the potential to reveal causal processes in relation to social exclusion, contributing to the need for 'disentangling the complexity surrounding drivers of exclusion' (Walsh et al., 2017, p. 87). In doing so, this research will contribute to the theoretical development of the concept of social exclusion, through unravelling the relationships between drivers and domains of old-age exclusion.

This study incorporates three key recommendations for further research on social exclusion in old age: first, a focus on the drivers of social exclusion (Walsh et al., 2017); second, the inclusion of several theoretically informed area-level characteristics to test the plausibility of specific mechanisms through which area characteristics might influence social exclusion (Van Regenmortel, 2017); and third, the use of longitudinal data to examine the dynamics of movements into and out of social exclusion (Sacker et al., 2017), which is especially important in the context of healthy ageing strategies designed to reduce the chances of older people becoming separated from mainstream society (WHO, 2015). Longitudinal modelling of area effects facilitates the assessment of a 'dose-response' effect, whereby the influence of neighbourhood attributes on exclusion increases with exposure; additionally, we can better control for neighbourhood selection effects by differentiating between people who move neighbourhoods and those who remain in the same location (Galster et al., 2008). The research questions of interest are: (1) What is the pattern of old-age social exclusion in England across the domains of civic participation, participation in social and leisure activities, social relations, and services and amenities? (2) To what extent is social exclusion related to individual characteristics, such as age, economic position, gender, and health? (3) To what extent is social exclusion in old age influenced by neighbourhood-related measures, such as the degree of urbanisation, neighbourhood deprivation, attachment to place and population turnover?

2. Methods

2.1. Data and sample

We used the first seven waves of data from the English Longitudinal Study of Ageing (ELSA), a panel study administered biannually between 2002/03 and 2014/15 (Banks et al., 2016; Steptoe et al., 2013). Participants were aged 50 and over, lived in private residences, and completed a computer-aided questionnaire and self-completion module. The number of people sampled in each wave ranged from 11391 (Wave 1) to 8249 (Wave 7), with sample members changing as a consequence of both attrition and sample refreshments as new cohorts were brought into the study (Steptoe et al., 2013). The sample used here consisted of respondents who had at least one observation with known values for at least 15 of the 28 measures that comprise the social exclusion outcome variable detailed below (many of which were collected in a self-completion questionnaire), and had full data available for all covariates of interest. This gave a sample size of 11181 respondents with between one and seven observations each, with each observation meeting the data requirements just described. We also drew on UK Census data from 2001 to 2011 (Office for National Statistics [ONS], 2004, 2011) to derive a measure of population turnover, also detailed below.

Middle Super Output area (MSOA) geographical units (ONS, 2012) were used to identify neighbourhoods. MSOAs were developed for the dissemination of census data with the intention of improving the reporting of small area statistics. In total, there were 7194 MSOAs in England and Wales in 2001, with an average population of 7235. Our analytic sample contained 3953 MSOAs with an average of 5.4 respondents per MSOA; literature on sufficient sample sizes for multilevel modelling and the approach adopted in previous papers (Marshall et al., 2014) indicated this was adequate for robust results. Twelve percent of sample members changed MSOA over their observation period, and this was accounted for by fitting cross classified multilevel models. Analysis was done on unweighted data because weighting methods for these types of models have not been developed (Dunn et al., 2015; Raudenbush and Bryk, 2002).

3. Measures

3.1. Measuring social exclusion

A social exclusion index was constructed with 28 items representing four underlying domains:

1. *Access to services and amenities:* Nine items indicate 'very easy' or 'quite easy' access to a bank, post office, general practitioner, dentist, hospital, optician, local shops, shopping centre, and

supermarket.
2. *Civic participation:* Five variables denote membership of a political party, trade union or environmental group; tenants, resident or neighbourhood watch group; church or religious group; charitable association; and participation in voluntary work in the past month.
3. *Cultural and leisure activities:* Five items covering membership of an education, arts or music group or evening class; a social club; sports clubs, gyms or exercise classes; other organisations clubs or societies; and at least monthly participation in exercise. Five additional items capture whether, in the past year, respondents have visited a cinema; theatre; gallery or museum; eaten at a restaurant; or taken a holiday abroad or within the UK.
4. *Social relations:* Four variables indicate whether respondents have a 'very close' or 'quite close' relationship with each of a spouse, children, family, or friends.

For each of these domains an exclusion score was calculated as the number of an individual's observed variables that indicate a negative response divided by the total number of variables that they responded to and, in addition, a total exclusion score was calculated using the same approach, but including the variables from all four domains. Each sample member therefore had a score for each domain and a total exclusion score, for each of their observed waves, of between 0 and 1, with 1 indicating the most severe level of exclusion.

4. Independent variables

Time was measured using an ELSA wave indicator with values 1 to 7. The health, marital and employment covariates detailed below were time dependent, in that values reflected those recorded at the time of observation. All other variables were time invariant and measured at baseline, defined as the time of an individual's first ELSA interview.

4.1. Individual level variables

Socio-demographic: Age at baseline was grouped into four categories: 50–59 (reference category), 60–69, 70–79, and 80 and over. This structure was necessary to avoid collinearity issues with the wave indicator. Marital status was grouped into 'married' (reference category), 'separated, divorced or widowed', or 'never married'. A binary gender indicator had 'female' as the reference category.

Socio-economic: Education was measured using the age at which an individual first left full-time education. Those in the 'low' category left at or before the compulsory school leaving age for their cohort, with people in the 'mid' group leaving after this but before age 19. People who left at or after 19 years were categorised as having a 'high' level and form the reference group. A self-reported employment indicator had options of employed (reference), retired, and other inactive, which encompassed the unemployed, permanently sick or disabled, or looking after home or family. Wealth was measured as family unit non-pension wealth including financial, property and business assets, but net of debt and outstanding mortgages. Individuals were grouped into quintiles from lowest wealth (quintile 1) to highest (quintile 5, reference) at baseline.

Health: Self-reported health was indicated on a five-point scale from excellent (reference) to poor.

Residency: A categorical quintile measure indicated the minimum number of years a person had lived in their neighbourhood at baseline. The first quintile was the reference, formed of people who had resided in their neighbourhood for 40 years or longer. Boundaries for other groups were 30–39 years (quintile 2); 22–29 years (quintile 3); 14–21 years (quintile 4) and 1–13 years (quintile 5).

4.2. Neighbourhood variables

Population turnover: The 2001 UK census included a question on where household members were living in the previous year. We used aggregated data generated from this question to estimate population turnover within each MSOA, defined as the number of moves within, into and out of an area as a percentage of the census population in 2001. Migration out of the UK was not captured in the census and therefore not included.

Neighbourhood deprivation: Deprivation was captured using the 2004 Index of Multiple Deprivation (IMD; The Office of the Deputy Prime Minister, 2004), which is a weighted average of indicators covering the seven domains of income, employment, health and disability, education, housing and services, living environment, and crime. As the IMD was released for lower super output areas we derived estimates for MSOAs by calculating the mean score for the lower super output areas within each MSOA (on average there are 5 LSOAs in each MSOA) (Marshall et al., 2014). Each neighbourhood was assigned a quintile group with the least deprived as the reference group.

Neighbourhood attachment: An overall score of neighbourhood attachment was calculated from four indicators: perceived friendliness in the area, perceived trust in people in the area, feeling part of the neighbourhood, and being able to count on people in the area for help when in trouble. Responses to each question were on a seven-point scale from strongly agree to strongly disagree. A baseline score for each person was derived from the total across all observed indicators, with a high score indicating low levels of attachment. In addition, the neighbourhood attachment indicator was divided into quintile groups for calculating descriptive statistics, with the first containing people with high levels of attachment, and the fifth those with the lowest.

Urban/rural: We used the 2011 Rural-Urban Classification where urban settlements are those with a population of 10000 or more (Bibby and Brindley, 2013).

5. Statistical analysis

Analysis was conducted within a multilevel framework. In a preliminary stage, a standard two-level unconditional growth curve for predicting the total exclusion score was fitted to the data. This had repeated observations nested within individuals, and included a random intercept term at the person level. In the next stage we estimated an unconditional partially cross-classified random acute effects growth curve (Cafri et al., 2015; Luo et al., 2015; Raudenbush and Bryk, 2002) that incorporated neighbourhood clustering. In this model people who remained in the same neighbourhood have a strictly hierarchical structure, with observations grouped within individuals clustered in MSOAs at the third level. The 12% of sample members who changed MSOA had a two-level cross-classified structure with repeated measurements of social exclusion cross-classified by individual and MSOA. Accounting for movement in this way was needed to ensure accurate estimates of random effects, group level variance and fixed effect standard errors (Cafri et al., 2015; Dunn et al., 2015). The effect of area on social exclusion at a given point in time was treated as acute rather than cumulative, in that it was limited to the influence of only the neighbourhood lived in at that time. The need to account for mobility between areas when estimating area effects was tested by comparing the fit of the standard two-level growth model with the cross-classified specification.

The cross-classified model was developed further with the addition of covariates and a random effect for slope (the rate of change in social exclusion across survey waves) at the individual level, to give the final formulation specified in Equation (1) (Hox et al., 2017; Luo and Kwok, 2012):

$$\begin{aligned} \text{Level 1:}\quad & y_{tjk} = \beta_{0jk} + \beta_{1jk}x_{tjk} + e_{tjk} \\ \text{Level 2:}\quad & \beta_{0\text{jk}} = \gamma_{00} + \mu_{0j} + v_{0k} \\ & \beta_{1\text{jk}} = \gamma_{10} + \mu_{1j} \end{aligned} \tag{1}$$

Subscripts j and k index person and area respectively. For the cross-

classified portion of the sample these are conceptually at the same level. y_{tjk} is the total social exclusion score measured on occasion t (t = 1, ….7) when person j (j = 1, ….11,181) is living in area k (k = 1, ….3953); x_{tjk} is the wave variable that takes value 0 for wave 1, 1 for wave two and so on; β_{0jk} and β_{1jk} are the overall mean and growth rate, and e_{tjk} the residual error term assumed $N\sim(0, \sigma^2)$. The intercept β_{0jk} varied across individuals and areas, and the growth rate β_{1jk} varied with individuals. A high number of sample members with single observations in some MSOA precluded the estimation of a neighbourhood level random effect on the growth rate. γ_{00} is the average intercept and γ_{10} the average growth rate; μ_{0j} is the residual error term for individual j relating to the intercept, and μ_{1j} the random effect of individual j relating to the growth rate. v_{0k} is the random effect of area k relating to the intercept.

Full maximum likelihood (FML) estimation methods were used, because both fixed and random components were to be tested and because they allowed use of the Chi-square test for comparing models (Hox et al., 2017; Singer and Willett, 2003). Estimates of the variance components under FML are biased, but in practice differences between these estimates and those obtained using the alternative restricted maximum likelihood (RML) method are trivial; our models were fitted twice, once using FML and again with RML, and estimates were identical to five decimal places.

6. Results

6.1. Descriptive statistics

Tables 1 and 2 contain descriptive statistics (N = 11181) for the total social exclusion score and each of its four domains of access to services and amenities, civic participation, cultural and leisure activities, and social relations. The mean and standard deviation of the social exclusion score for each category of individual level covariates are in Table 1, with Table 2 showing the same for area related variables. Statistics were calculated on baseline values measured at the time of an individual's first ELSA interview.

Patterns in social exclusion scores varied across the individual domains and total score. In the case of deprivation, health and wealth, the trend in the mean total exclusion score reflected that seen in each of the four domains. The mean total score increased monotonically over level of area deprivation from 0.3408 for the least deprived quintile to 0.4556 in the most deprived quintile, reflecting increasing trends in each of the constituent dimensions. Mean scores also increased with worsening health and falling household wealth. Total mean scores ranged from 0.3315 for individuals who reported 'very good or better' health to 0.5448 for those in poor health, and from 0.3112 for the wealthiest households to 0.4832 for the poorest. As with deprivation, these trends in mean total scores across health and wealth reflected those observed within each of the four separate domains. This suggests that people in the most deprived areas, with the poorest health, or lowest level of wealth may face higher barriers and be less able to

Table 1
Social exclusion by individual level covariates (N = 11181). Data: the English Longitudinal Study of Ageing, Waves 1 - 7.

	Freq N (%)	Domain									
		Access services/amenities		Civic participation		Cultural/leisure activities		Social relations		Total social exclusion score	
		Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd
Baseline age											
Age 50 - 59	5248 (46.9)	0.0467	0.1506	0.8030	0.2376	0.4774	0.2136	0.1453	0.2442	0.3721	0.1411
Age 60 - 69	3239 (29.0)	0.0487	0.1562	0.7852	0.2550	0.5034	02181	0.1564	0.2676	0.3602	0.1429
Age 70 - 79	2026 (18.1)	0.0726	0.1972	0.7945	0.2587	0.5765	0.2169	0.1629	0.2779	0.4058	0.1582
Age 80+	668 (6.0)	0.2004	0.3333	0.7859	0.2521	0.6633	0.2006	0.1561	0.2403	0.4872	0.1820
Gender											
Male	5044 (45.1)	0.0504	0.1547	0.8042	0.2395	0.5121	0.2191	0.1803	0.2825	0.3833	0.1461
Female	6137 (54.9)	0.0701	0.1997	0.7880	0.2538	0.5155	0.2224	0.1293	0.2321	0.3802	0.1544
Marital status											
Married	7646 (68.4)	0.0431	0.1465	0.7887	0.2476	0.4925	0.2099	0.1269	0.2123	0.3612	0.1366
Never married	665 (5.9)	0.0898	0.2092	0.7847	0.2533	0.5490	0.2466	0.3244	0.4449	0.4306	0.1663
Sep/div/widow	2870 (25.7)	0.1030	0.2398	0.8152	0.2452	0.5632	0.2340	0.1804	0.2877	0.4249	0.1697
Self rated health											
Very good or better	4751 (42.5)	0.0264	0.0968	0.7684	0.2549	0.4438	0.2007	0.1410	0.2544	0.3315	0.1197
Good or fair	5647 (50.5)	0.0651	0.1828	0.8046	0.2438	0.5458	0.2152	0.1564	0.2564	0.4012	0.1491
Poor	783 (7.0)	0.2453	0.3592	0.8912	0.1951	0.7113	0.2060	0.1916	0.2764	0.5448	0.1803
Education											
High	3141 (28.1)	0.0384	0.1317	0.7023	0.2711	0.3992	0.1913	0.1510	0.2488	0.3183	0.1284
Medium	2891 (25.9)	0.0432	0.1420	0.7880	0.2406	0.4790	0.2022	0.1536	0.2510	0.3634	0.1333
Low	5149 (46.1)	0.0852	0.2193	0.8561	0.2163	0.6037	0.2097	0.1524	0.2659	0.4305	0.1558
Labour market status											
Employed	4425 (39.6)	0.0275	0.0966	0.7924	0.2412	0.4539	0.1972	0.1424	0.2478	0.3531	0.1229
Retired	5057 (45.2)	0.0706	0.1972	0.7864	0.2562	0.5366	0.2237	0.1614	0.2651	0.3881	0.1582
Other non work	1699 (15.2)	0.1204	0.2615	0.8291	0.2348	0.6031	0.2283	0.1513	0.2573	0.4367	0.1744
Household non pension wealth											
Quint 5 (wealthiest)	2566 (22.9)	0.0292	0.1096	0.7064	0.2712	0.4037	0.1905	0.1382	0.2189	0.3112	0.1195
Quint 4	2401 (21.5)	0.0402	0.1390	0.7690	0.2511	0.4634	0.1953	0.1442	0.2595	0.3479	0.1267
Quint 3	2261 (20.2)	0.0515	0.1618	0.8097	0.2313	0.5144	0.2015	0.1459	0.2496	0.3756	0.1329
Quint 2	2169 (19.4)	0.0792	0.2088	0.8461	0.2188	0.5766	0.2096	0.1596	0.2686	0.4250	0.1524
Quint 1 (poorest)	1784 (16.0)	0.1268	0.2636	0.8784	0.2124	0.6643	0.2221	0.1829	0.2957	0.4832	0.1683
Minimum years lived in neighbourhood											
Quint 5 1–13 yrs	3259 (29.1)	0.0693	0.1860	0.8009	0.2483	0.5174	0.2249	0.1633	0.2637	0.3912	0.1519
Quint 4 14–21 yrs	2352 (21.0)	0.0549	0.1693	0.7894	0.2490	0.4926	0.2201	0.1507	0.2366	0.3746	0.1456
Quint 3 22–29 yrs	2477 (22.2)	0.0528	0.1682	0.7844	0.2466	0.4984	0.2139	0.1489	0.2551	0.3696	0.1469
Quint 2 30–39 yrs	1644 (14.7)	0.0474	0.1602	0.7962	0.2442	0.5051	0.2131	0.1490	0.2718	0.3645	0.1406
Quint 1 > 40 yrs	1449 (13.0)	0.0835	0.2238	0.8098	0.2483	0.5780	0.2219	0.1398	0.2615	0.4117	0.1670

Table 2
Social exclusion by area level covariates (N = 11181). Data: the English Longitudinal Study of Ageing, Waves 1 - 7.

	Freq N (%)	Domain									
		Access services/amenities		Civic participation		Cultural/leisure activities		Social relations		Total social exclusion score	
		Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd
Environment											
Rural	2912 (26.0)	0.0674	0.1807	0.7598	0.2407	0.4809	0.2145	0.1486	0.2502	0.3644	0.1454
Urban	8269 (74.0)	0.0591	0.1820	0.8078	0.2630	0.5257	0.2220	0.1536	0.2596	0.3877	0.1521
Population turnover											
9–15%	2185 (19.5)	0.0567	0.1736	0.8075	0.2408	0.5160	0.2222	0.1510	0.2629	0.3822	0.1491
16–17%	2120 (19.0)	0.0591	0.1811	0.7966	0.2515	0.5021	0.2155	0.1384	0.2529	0.3765	0.1478
18–19%	2380 (21.3)	0.0629	0.1804	0.7906	0.2495	0.5180	0.2183	0.1515	0.2489	0.3805	0.1476
20–22%	2185 (19.5)	0.0659	0.1914	0.7935	0.2452	0.5089	0.2189	0.1530	0.2455	0.3823	0.1520
23–88%	2302 (20.6)	0.0614	0.1787	0.7891	0.2505	0.5242	0.2289	0.1671	0.2746	0.3868	0.1567
90–111%	9 (0.1)	0.0159	0.0476	0.7556	0.1944	0.4000	0.1414	0.0370	0.1111	0.2977	0.1236
Index of multiple deprivation											
Quintile 1 (least deprived)	2825 (25.3)	0.0415	0.1394	0.7495	0.2604	0.4482	0.2007	0.1447	0.2345	0.3408	0.1316
Quintile 2	2454 (21.9)	0.0530	0.1635	0.7722	0.2575	0.4838	0.2118	0.1498	0.2553	0.3643	0.1429
Quintile 3	2363 (21.1)	0.0596	0.1729	0.7920	0.2455	0.5072	0.2179	0.1474	0.2710	0.3745	0.1436
Quintile 4	2009 (18.0)	0.0684	0.1945	0.8397	0.2196	0.5578	0.2171	0.1550	0.2557	0.4124	0.1534
Quintile 5 (most deprived)	1530 (13.7)	0.1041	0.2495	0.8635	0.194	0.6369	0.2193	0.1745	0.2793	0.4556	0.1680
Neighbourhood attachment											
Quintile 1 (highest attachment)	2314 (20.7)	0.0517	0.1689	0.7671	0.2686	0.5080	0.2273	0.1344	0.2718	0.3706	0.1499
Quintile 2	2344 (21.0)	0.0464	0.1489	0.7676	0.2613	0.4885	0.2145	0.1312	0.2282	0.3581	0.1450
Quintile 3	2243 (20.1)	0.0559	0.1658	0.7910	0.2429	0.4956	0.2149	0.1455	0.2393	0.3681	0.1376
Quintile 4	2187 (19.6)	0.0644	0.1856	0.8093	0.2301	0.5154	0.2168	0.1529	0.2499	0.3866	0.1463
Quintile 5 (lowest attachment)	2093 (18.7)	0.0909	0.2282	0.8474	0.2193	0.5675	0.2227	0.2025	0.2894	0.4297	0.1645

participate across a wide range of social activities. Although the relationship between neighbourhood attachment and social exclusion was not linear, people with lowest levels of attachment to their neighbourhood had higher mean exclusion scores across all domains compared with those with the highest levels of attachment. For example, the mean total exclusion score for those in the lowest quintile for attachment levels was 0.4297 compared to 0.3706 for people with the highest fifth of attachment scores. Population turnover, however, was not clearly related to social exclusion. Although areas of high turnover did appear to have lower levels of social exclusion (0.2977), differences in mean total exclusion score across the other quintiles of population turnover varied little with values ranging from 0.3756 to 0.3868.

Mean total exclusion scores increased with age, from 0.3721 among those aged 50–59 to 0.4872 in people aged 80+, and this age differential was particularly marked in the 'access to services and amenities' and 'participation in cultural and leisure activities' domains. The difference between average scores of urban and rural dwellers was small. Urban areas had slightly higher social exclusion scores for all indicators with the exception of access to services, with the highest absolute difference in the 'civic participation' domain, with values of 0.8078 in urban and 0.7598 in rural areas. Married people had the lowest average total score (0.3612), compared to the never married (0.4306) and separated/divorced/widowed (0.4249), particularly reflecting differences in the access to services, cultural activities and social relations domains. People who were not working but were not retired had a higher mean total exclusion score (0.4367) than those who were employed (0.3531) or retired (0.3881). However, this difference was greater within the 'access to services and amenities' and 'participation in cultural and leisure' dimensions than in 'social relations' and 'civic participation'.

7. Longitudinal modelling

7.1. Testing for area effects

The null hypothesis of no neighbourhood variation in total exclusion scores was tested using a log likelihood ratio test, which compared the fit of the standard two-level model with the cross classified specification that included MSOA information. The estimated variance of the area effects was 0.002593 and was significantly different from 0 ($\chi_1^2 = 415.56,\ p < 0.001$), indicating social exclusion scores varied according to MSOA and justifying the use of the more complex cross-classified model. According to this model, 11.0% of the total variance was at the area level and 59.9% apportioned to individuals. Model fit was further improved by allowing variation between individuals in the growth rate with a random slope coefficient for time ($\chi_2^2 = 1683.7,\ p < 0.001$). The person slope/intercept correlation in this model was estimated at -0.539; the negative value suggested that individuals with high exclusion scores were likely to have a lower rate of change in scores over time. The data did not allow for a similar testing of variation in growth of exclusion by area. Thus, these models showed that variability in exclusion levels could be attributed to that which occurred within an individual's observations, between individuals, and between MSOAs.

8. Results from conditional models

Table 3 contains parameter estimates from six models for total social exclusion. All models controlled for baseline age and gender. Models 1 to 5 included, in turn, indicators for rural/urban environment, time spent in neighbourhood, neighbourhood attachment score, population turnover, and the index of multiple deprivation. Model 6 additionally included the individual level characteristics of marital status, health, education, employment and wealth. Considering the fixed-parts of model 1, the rural-urban model, the intercept gives the mean social exclusion score at baseline (wave 1) for the reference group (female, aged 50–59 at baseline and resident in an urban area). The 'wave' coefficient captures the rate of change in social exclusion over time. Later models add in additional characteristics and the associated coefficient estimates indicate their impact on the modelled social exclusion score. It is possible that the influence of some of these additional characteristics might have changed over time. We tested this by including in the model interactions between wave and these characteristics, but do not show these results (although we discuss them) because they were neither statistically significant nor large.

The urban/rural indicator was statistically significant in Model 1 ($p < 0.001$). The negative coefficient of -0.0224 indicated exclusion scores were lower for rural dwellers compared to their urban counterparts. This coefficient reduced with the inclusion of additional factors in Models 2–4 and became insignificant and small in Model 5 ($p = 0.710$), which added the index of multiple deprivation. However, after adjusting for individual level factors, the coefficient became significantly positive, with an estimated value of 0.0061 (Model 6, $p = 0.024$), showing slightly higher exclusion scores among people living in rural, rather than urban, areas once differences in both levels of area deprivation and individual characteristics had been accounted for.

Social exclusion was negatively associated with time spent in neighbourhood (Model 2, $p < 0.001$). Longer term dwellers were predicted to have lower scores than the twenty percent of people with the shortest length of residence. The neighbourhood attachment score was significant in Model 3 ($p < 0.001$) indicating that lower levels of attachment predicted higher levels of exclusion. This effect was consistent after adjustments for individual factors (Model 6), although it decreased in magnitude by around a third, from 0.0032 to 0.0019. No association was found between population turnover and social exclusion (Model 4), suggesting older people living in neighbourhoods with a high rate of turnover are no more or less socially excluded than their counterparts residing in areas with more stable populations.

Neighbourhood deprivation was influential for social exclusion (Model 5, $p < 0.001$), with scores increasing with increasing levels of deprivation. This finding persisted after adjusting for marital status, health and socioeconomic factors (Model 6), albeit with lower estimated effects. After controlling for the other individual and area correlates of social exclusion (Model 6), compared to older people living in the least deprived areas, those in the second quintile had predicted scores 0.0094 points higher. The differential for individuals in the third quintile group was similar at 0.0096, whereas the differential for people in the fourth quintile increased to 0.0186. Living in the most deprived quintile raised exclusion scores by an estimated 0.0291 points.

Two additional models (results not shown) tested interaction effects between population turnover and deprivation, and deprivation and the wave indicator for time. No evidence was found for a differential impact of population turnover across IMD quintiles ($\chi_{20}^2 = 13.747,\ p = 0.8431$). The interaction term between deprivation and time was statistically significant ($\chi_4^2 = 9.8233,\ p = 0.04351$), $\chi_1^2 = 415.56,\ p < 0.001$), but only with respect to the fifth quintile. The rate of change in social exclusion over time, therefore, was similar in each of the first to fourth quintiles of deprivation, and differed only for people living in the most deprived areas where a faster growth in social exclusion was observed.

Model 6 was the preferred model of best fit. The wave coefficient in this model was estimated at 0.0068, indicating exclusion scores increased by this amount between waves, which are intervals of approximately two years, if all other variables were held constant. This is likely to be the result of the increasing age of sample members. However, as noted earlier, the rate of change was inversely related to the level of exclusion experienced, as indicated by the consistently negative value for the person slope/intercept correlation. This may be a result of a 'ceiling effect', where those with high levels of social exclusion could only experience relatively small further increases in social exclusion. Age at baseline was also associated with increasing exclusion. Scores for people aged 60–69 were similar to those for 50-59-year olds ($p = 0.094$), but those aged 70–79 had higher predicted scores by

Table 3
Parameter estimates for total social exclusion models containing area and individual level covariates.

	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6		
	Rural/urban			+Years in neighbourhood			+Neighbourhood attachment			+Population turnover			+IMD			+Individual factors		
	B	se	p	B	se	p	B	se	p	B	se	p	B	Se	p	B	Se	p
Fixed Parts																		
Intercept	0.3411	0.0027	< .001	0.3474	0.0028	< .001	0.2855	0.0044	< .001	0.2842	0.0047	< .001	0.2564	0.005	< .001	0.1941	0.0049	< .001
Wave	0.0067	0.0003	< .001	0.0074	0.0004	< .001	0.0072	0.0004	< .001	0.0073	0.0004	< .001	0.0073	0.0004	< .001	0.0068	0.0003	< .001
Baseline age (ref: 50–59)																		
Age 60 - 69	0.0091	0.0029	0.002	0.0101	0.0029	< .001	0.0142	0.0029	< .001	0.0142	0.0029	< .001	0.0131	0.0028	< .001	0.0043	0.0026	0.094
Age 70 - 79	0.0717	0.0034	< .001	0.073	0.0034	< .001	0.08	0.0034	< .001	0.08	0.0034	< .001	0.0781	0.0033	< .001	0.0486	0.0032	< .001
Age 80+	0.158	0.0054	< .001	0.1594	0.0054	< .001	0.1686	0.0054	< .001	0.1686	0.0054	< .001	0.1653	0.0053	< .001	0.1224	0.0049	< .001
Male (ref: female)	0.0043	0.0024	0.07	0.0043	0.0024	0.069	0.0032	0.0023	0.163	0.0032	0.0023	0.165	0.0039	0.0023	0.089	0.0176	0.0021	< .001
Rural (ref: urban)	−0.022	0.0033	< .001	−0.023	0.0033	< .001	−0.015	0.0032	< .001	−0.015	0.0033	< .001	0.0012	0.0031	0.71	0.0061	0.0027	0.024
Minimum years lived in neighbourhood (ref: quintile 5, 1–13 years)																		
Quint 4 14–21 yrs				−0.008	0.0017	< .001	−0.007	0.0017	< .001	−0.007	0.0017	< .001	−0.007	0.0017	< .001	−0.004	0.0016	0.013
Quint 3 22–29 yrs				−0.012	0.002	< .001	−0.011	0.002	< .001	−0.011	0.002	< .001	−0.011	0.002	< .001	−0.006	0.0019	0.004
Quint 2 30–39 yrs				−0.018	0.0024	< .001	−0.016	0.0023	< .001	−0.016	0.0023	< .001	−0.017	0.0023	< .001	−0.011	0.0022	< .001
Quint 1 > 40 yrs				−0.013	0.0028	< .001	−0.011	0.0028	< .001	−0.011	0.0028	< .001	−0.012	0.0027	< .001	−0.007	0.0025	0.008
Neighbourhood attachment score							0.0032	0.0002	< .001	0.0032	0.0002	< .001	0.0026	0.0002	< .001	0.0019	0.0001	< .001
Population turnover (six category, ref: 9–15%)																		
16–17%										0.0011	0.0022	0.614	0.0000	0.0022	0.954	−0.001	0.0021	0.813
18–19%										0.0031	0.0024	0.202	0.0009	0.0024	0.705	0.0002	0.0022	0.94
20–22%										0.0015	0.0027	0.586	−0.002	0.0026	0.445	−0.002	0.0025	0.367
23–88%										0.0002	0.0031	0.958	−0.007	0.003	0.028	−0.005	0.0027	0.08
90–111%										−0.006	0.0341	0.869	−0.015	0.0328	0.653	−0.009	0.03	0.76
Index of multiple deprivation quintile (ref: Quintile 1, least deprived)																		
Quintile 2													0.0228	0.0035	< .001	0.0094	0.0031	0.002
Quintile 3													0.0323	0.0036	< .001	0.0096	0.0032	0.003
Quintile 4													0.0618	0.0039	< .001	0.0186	0.0035	< .001
Quintile 5 (most deprived)													0.1039	0.0044	< .001	0.0291	0.0041	< .001
Marital status (ref: married)																		
Never married																0.0329	0.0041	< .001
Sep/div/widowed																0.0207	0.002	< .001
Self rated health (ref: very good or better)																		
Good or fair																0.0177	0.0011	< .001
Poor																0.0727	0.0024	< .001
Education (ref: high)																		
Low																0.0719	0.0027	< .001
Medium																0.0325	0.0028	< .001
Labour market status (ref: employed)																		
Other non work																0.0081	0.0021	< .001
Retired																−0.006	0.0017	< .001
Household non pension wealth (ref: Quintile 5, wealthiest)																		
Quintile 4																0.0223	0.0031	< .001
Quintile 3																0.0349	0.0033	< .001
Quintile 2																0.0608	0.0035	< .001
Quintile 1 (poorest)																0.0976	0.0039	< .001
Random Parts																		
Within person variance	0.0056			0.0056			0.0056			0.0056			0.0056			0.0057		
Between person intercept variance	0.0163			0.0162			0.016			0.016			0.0158			0.0124		
Between MSOA intercept variance	0.0024			0.0024			0.0021			0.0021			0.0014			0.0009		
Person random slope variance	0.0004			0.0004			0.0004			0.0004			0.0004			0.0004		
Person slope/intercept correlation	−0.5056			−0.5025			−0.5115			−0.5114			−0.516			−0.572		
$N_{Individual}$	11181			11181			11181			11181			11181			11181		

(*continued on next page*)

Table 3 (*continued*)

	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6		
	Rural/urban			+ Years in neighbourhood			+ Neighbourhood attachment			+ Population turnover			+ IMD			+ Individual factors		
	B	se	p	B	se	p	B	se	p	B	se	p	B	Se	p	B	Se	p
N_{MSOA}	3954			3954			3954			3954			3954			3954		
$ICC_{Individual}$	0.6732			0.6711			0.6758			0.6755			0.6934			0.6535		
ICC_{MSOA}	0.0974			0.0983			0.0892			0.0894			0.0608			0.0458		
Observations	44542			44542			44542			44542			44542			44542		
AIC	−72891.683			−72946.3786			−73282.4542			−73274.5519			−73863.5724			−76955.6427		
Deviance	−72915.683			−72978.3786			−73316.4542			−73318.5519			−73915.5724			−77031.6427		
Marginal R^2	0.0644			0.0668			0.0876			0.0877			0.1292			0.2652		

approximately 0.0486 points ($p < 0.001$). The highest exclusion levels were among people aged 80+, with estimated scores 0.1224 points higher than those for 50 to 59-year olds ($p < 0.001$). Evidence was found for a gender difference in exclusion levels, with scores of men approximately 0.0176 higher than those for women ($p < 0.001$).

Social exclusion levels were higher among never married people, and those widowed, divorced or separated, than married individuals (Model 6, $p < 0.001$). Poor health also raised exclusion levels, by an estimated 0.0727 compared to people who reported very good or better health ($p < 0.001$). Lower levels of education were associated with higher exclusion ($p < 0.001$), and a negative relationship was also found between household wealth and exclusion scores. Compared to people in the wealthiest quintile, scores for those in the central wealth group were 0.0349 points higher ($p < 0.001$). The difference in scores between people in the wealthiest and poorest households was nearly three times this, with an estimated coefficient of 0.0976 ($p < 0.001$). The relationship between social exclusion and labour market position depended on status. Compared to employed people, retired individuals were predicted to have lower levels of exclusion ($p < 0.001$). This was not the case for other non-working individuals however; they had on average higher exclusion scores than those in employment ($p < 0.001$).

9. Discussion

This paper focuses on patterns of social exclusion in later life in England, both overall and covering the separate domains of: access to services and amenities; civic participation; cultural and leisure activities; and social relations. It examines the relationship between social exclusion and the characteristics of both individuals and the neighbourhoods in which they live using panel data. This makes it the first longitudinal study that we know of to examine the relationship between environmental context and social exclusion in later life, providing a response to the need for 'disentangling the complexity surrounding drivers of exclusion' (Walsh et al., 2017, p. 87) and to uncover causal relationships (Jehoel-Gijsbers and Vroomen, 2008). Findings demonstrated meaningful variation in risk of social exclusion across neighbourhoods, across individuals and within individuals over time, illustrating the value of this approach.

The study confirms the influence of individual determinants in developing social exclusion in later life. Results indicate that being male, having lower levels of wealth, having poor self-rated health, fewer years in education, or being aged 80 or older predicts higher levels of exclusion. However, effects are not necessarily uniform across all constituent domains. Evidence suggests that while the effects of low wealth and poor health operate across all four subdomains of exclusion, the influence of age is particularly strong when it comes to accessing services and amenities and participating in cultural and leisure activities. Marriage provides some protective effect, and retirement is likely to lower exclusion levels. These findings are largely consistent with previous studies showing the effect of individual characteristics on risk of social exclusion (Barnes et al., 2006; Jivraj et al., 2016; Kneale, 2012; Sacker et al., 2017).

In line with our expectations and findings from previous research, the study shows that neighbourhood deprivation is strongly related to risk of social exclusion. However, this relationship reduced substantially (although it remained significant) once individual characteristics, which included socioeconomic position, were incorporated into the model. The most deprived communities in England are characterised by lower than average incomes, and high rates of unemployment, poor health, disability, crime and environmental decline (Rae et al., 2018). Older people living in these neighbourhoods have the highest levels of social exclusion, independent of the individual correlates of social exclusion in the model, and analysis suggests that this stems from higher levels across each of the four subdomains of exclusion. Thus, deprivation has a wide-reaching impact with barriers to

participation experienced across a range of social activities. An interaction effect between time and multiple deprivation was tested (results not shown), and there was some evidence that the rate at which social exclusion levels change over time varied according to the level of deprivation in the neighbourhood, with a statistically significant faster increase present for people in the most deprived quintile compared to the least, indicating that they are particularly vulnerable to not only a higher risk of social exclusion, but for that higher risk to increase over time. This is consistent with a dose-response effect in relation to area deprivation and exclusion in later life (Galster et al., 2008).

The analysis suggests that individuals living in urban areas have a higher risk of social exclusion, which was in part explained by the lower levels of attachment to the area and fully explained by the higher levels of neighbourhood deprivation in urban areas and the poorer socio-economic position of individuals in urban areas. Indeed, when these factors were accounted for, those living in rural areas had a slightly higher level of social exclusion, perhaps because of the lower availability of 'local opportunity structures' in rural areas (such as services, post offices, corner shops) (Richard et al., 2008). This suggests that alongside tackling neighbourhood deprivation in urban areas, poor people living in deprived rural areas (although less common than in urban areas) should also be a focus for policy intervention.

Individuals' perception of the area as being more neighbourly, friendly and trustworthy, as reflected in both years spent living in the neighbourhood and positive views about the neighbourhood, was related to reduced risk of social exclusion. Moreover, the association between neighbourhood attachment and social exclusion was independent of area deprivation, suggesting that residents' connection with their neighbourhood has the potential to mitigate or exacerbate the influence of neighbourhood deprivation on social exclusion. This supports research which has reported that perceived neighbourhood trust promotes social participation (Buffel et al., 2014) and is associated with higher levels of social activity in later life, independent of socio-economic characteristics of the neighbourhood (Bowling and Stafford, 2007). The importance of area perception for social exclusion also has some parallels with the literature on resilient areas (Mitchell et al., 2009), which have better health outcomes than expected given their deprivation score, and tallies with a similar finding in a recent study on wellbeing in later life (Godhwani et al., 2018).

However, contrary to our expectations and findings from qualitative studies (Buffel and Phillipson, 2019; Burns et al., 2012), population turnover was not related to levels of social exclusion. Taken together, the neighbourhood attachment and turnover results show that while churn among local residents does not impact on exclusion, the extent to which an individual feels part of and belongs to the area does. From this, we conclude it is not necessarily the constant presence of the same people in the neighbourhood that matters for old age exclusion, but rather the perceptions of older people to their area and neighbours, recently arrived or not. The absence of an effect of population turnover on social exclusion may also partly be explained, however, by the nature of the measure we used, derived from census data, which may not sufficiently capture the ways in which certain types of population instability impact on the social fabric of a neighbourhood.

Finally, the study highlighted the importance of ageing in place, with longer periods of living in the same area associated with lower exclusion levels and lower mean scores in the social relations domain. This result is particularly significant when considered alongside the finding that population churn has no influence; while continued residency reduces an older person's level of exclusion, instability among local community members appears to have no effect. What seems to matter is whether an individual relocates in later life, rather than the movement of other people within, into and out of the neighbourhood. This gives some insight into the composition and stability of older people's close social networks. Social contacts likely come from groups that have a stable presence in an older person's life; these are most probably family members or, given that population churn is lower among older people than the wider adult population (Buffel et al., 2018), friends and neighbours of a similar age in the area. Loss of friendships among older, long term residents is more likely to be due to mortality than migration.

Effective development of public health policy requires an understanding of the mechanisms and pathways through which neighbourhood effects impact on individual health and behavioural outcomes (Galster, 2012). This research has shown the influence of both individual and environmental characteristics in predicting higher levels of social exclusion in later life, enabling the most at-risk communities to be identified. A range of initiatives are being developed to address the higher likelihood of particular groups of older people (such as, the oldest old, older men, those on low incomes, and those living alone) to become socially excluded (for example, co-housing projects, 'men in sheds' initiatives, urban community support groups) (Buffel et al., 2018). However, the value of such approaches has yet to be properly assessed, especially in the context of increased diversity and inequality within the older population. The lack of research on what has been effective in reducing old-age exclusion has limited our ability to identify the most successful directions for future policy and practice. This is even more the case given the heterogeneous nature of older populations. Lehning et al. (2017: 53) make the point that many of the above initiatives are 'failing to address the needs of racial and ethnic minorities or those with low incomes; this is of particular concern given that these subgroups of older adults are likely to live in particularly unageing-friendly, under-resourced neighborhoods'.

Our findings suggest that initiatives aimed at preventing social exclusion in later life should primarily target those older people most susceptible to social exclusion who live in areas characterised by high levels of neighbourhood deprivation – an important finding for policy and practice aimed at developing 'age-friendly' communities supportive to the needs of people as they age (Buffel et al., 2018). Previous research has highlighted a growing overlap between socially excluded people and socially excluded places in urban areas (Buffel et al., 2013; Scharf et al., 2005), with policies that target the neighbourhood as a primary focus for promoting social participation (WHO, 2018). The extent to which these will contribute to reducing social exclusion in later life is yet to be examined.

10. Limitations

The research also presents some limitations. First, the definition of social exclusion used indicators of involvement in cultural and leisure activities, access to services and amenities, civic participation, and social relationships. Whilst this operationalisation is in line with previous studies (e.g. Sacker et al., 2017), and has been shown to be the most adequate for exploring the influence of neighbourhood characteristics on old-age exclusion, other studies have included material resources and neighbourhood features in their measurement of social exclusion (Kneale, 2012; Scharf et al., 2005, 2012). In response to Walsh et al.'s (2017) observation about the need to disentangle the 'complexity surrounding the drivers of exclusion', however, this study has considered the influence of individual and neighbourhood related characteristics on social exclusion in later life, rather than incorporating them as dimensions of the measure. This approach has contributed to a better understanding of the interlinked nature of social exclusion. It demonstrates that an expanded view of risk factors has the potential to reveal causal relationships, and disentangling the drivers and domains of exclusion, even though our conceptual approach does not map on to that taken by some others (Walsh et al., 2017).

Second, neighbourhoods analysed in this study are defined by MSOA boundaries, and while these are considered to provide a 'meaningful measure' of neighbourhoods from residents' point of view (Marshall et al., 2014: 203), areas defined using different boundaries may not necessarily lead to the same conclusions. Importantly, neighbourhood selection effects can arise from unobserved characteristics of

individual residents; such effects may not all be captured in the modelling process we used and omission can result in biased parameter estimates (Galster et al., 2008), although we did adjust for relevant observed individual characteristics. Finally, we faced a choice between fitting a well-specified cross-classified multilevel model that accounted for migration across geographical areas, and one that ignored movement but permitted the use of non-response weights to compensate for attrition. Given the focus on neighbourhood characteristics we opted for the cross-classified modelling approach, but parameter estimates may be biased due to dropout. However, many of the variables used to estimate non-response weights were included in our models.

11. Conclusion

Social exclusion in later life is determined both by characteristics of the local neighbourhood and an individual's own personal attributes. Living in a deprived area, in both an urban and rural setting, is associated with increased levels of exclusion. The level of turnover among local residents does not significantly impact on exclusion; what is important, however, is the level of attachment that one feels to their neighbourhood. An older person who feels a sense of belonging to the community, and who perceives other residents as being friendly, trustworthy and helpful, is likely to feel less excluded. Ageing in place is also important, with longer term residents experiencing lower levels of social exclusion, whereas poor health, low levels of education and wealth, being male, and being aged 80 and over are associated with higher levels of exclusion. In terms of scope of influence, people living in a deprived area, with low wealth or in poor health are more likely to be excluded from multiple social contexts, including accessing services and amenities, participating in civic, cultural and leisure activities and social relationships. This analysis incorporated both the multi-dimensional and dynamic nature of social exclusion, and these findings reflect both its relative nature and the power relations that lie behind the relatively higher rate of social exclusion experienced by more deprived groups of the population (Atkinson, 1998). Although the analysis adopted a longitudinal approach, the sample consisted of those who were already aged 50 or older. It would be valuable for future analyses to investigate the cumulative effects of neighbourhood environment and socioeconomic characteristics across the life course on the risk of exclusion in later life.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2019.112722.

Credit statements

Jennifer Prattley: Methodology, formal analysis, data curation, writing – original draft, visualization, and project administration.

Tine Buffel: Conceptualization, writing – original draft, writing –review & editing, supervision, and funding acquisition.

Alan Marshall: Methodology, validation, writing –review & editing, visualization.

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