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Norton, M., Kellett, S., Huddy, V. orcid.org/0000-0002-0567-8166 et al. (1 more author) (Submitted: 2023) Household factors and prevalence of squalor: meta-analysis and meta-regression. [Preprint - Research Square Platform LLC] (Submitted)

<https://doi.org/10.21203/rs.3.rs-3725049/v1>

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Household Factors and Prevalence of Squalor: Meta-analysis and Meta-regression

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Research Article

Keywords: Squalor, Diogenes Syndrome, Severe Domestic Squalor, Self-neglect

Posted Date: December 16th, 2023

DOI: <https://doi.org/10.21203/rs.3.rs-3725049/v1>

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Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at BMC Public Health on February 15th, 2024. See the published version at <https://doi.org/10.1186/s12889-024-17983-3>.

Abstract

Background

Severe domestic squalor occurs when a person lives in a dwelling that is significantly unclean, disorganised and unhygienic. The limited previous research has primarily focused on the characteristics of those who live in squalor and the associated risk factors. Robust and reliable studies of squalor prevalence have not been conducted. This study sought to produce a reliable estimate of the point prevalence of squalor.

Methods

Using data from 13-years of the English Housing Survey, N = 85681 households were included in a prevalence meta-analysis. Squalor prevalence over time, subgroup analysis and logistic regression investigated the role played by household and community characteristics.

Results

The point prevalence of squalor was estimated to be 0.85% and squalor was seen to decrease significantly over time. Community deprivation, whether the home was owned/rented, income and the number of people in the home was associated with presence of squalor.

Conclusions

Squalor prevalence was higher than previous estimates and supports community care services in associated service planning. The results regarding household characteristics help to inform which households and individuals may be at a higher risk of living in squalid conditions.

Background

The person living in a consistently and significantly unclean and disorganised home is often referred to as suffering from Diogenes Syndrome (DS) or they are residing in Severe Domestic Squalor (SDS). Snowdon suggests that the term SDS should be used when *"...a person's home is so unclean, messy and unhygienic that people of similar culture and background would consider extensive clearing and cleaning to be essential."* (1). For the individual, squalor can lead to physical safety risks, difficulty accessing and receiving services and associated isolation (2) and a raft of associated physical health problems (3, 4). Furthermore, squalor creates significant problems for the individual's family and their neighbours (5, 6). The evidence base for squalor is thin, as it tends to be too narrowly focused on adults over 65 years old (7–10), has small sample sizes, is over-reliant on cross-sectional methods (7, 10–12), rarely have a control group, uses case identification approaches that lack reliability and validity (7, 8, 10, 11) and creates data not pertinent to the focus of the study (11–14). This list of methodological concerns clearly limits understanding and generalisability.

Squalor research has also been too heavily focused on the characteristics of the individual, such as their mental and physical health, their cognitive profile and their awareness of their condition (15–17) and lacks information on the context in which the person lives. Unlike related conditions, such as self-neglect (SN) and Hoarding Disorder (HD), which have researched household and local factors such as deprivation, community profiles, risk of crime, social resources and household income (18–21), squalor has only considered rates of home ownership and living alone. The limited information that is available reports ownership rates between 39–59% (2, 9, 10, 13, 22), although one study reported a much lower rate of 5% (15). In addition, squalor individuals live alone on approximately 65–94% of occasions (2, 7–9, 11, 12, 14, 15, 22, 23), with Ito et al. (23) showing that lone living was significantly higher than in a non-squalor control group. The SN literature (i.e. 24,25), which includes, but is not limited to, people who live in squalor, contains a more comprehensive evidence base with regards household and context factors. Studies found that SN was linked to higher levels of deprivation (18, 26). Furthermore, income and SN have also been shown to be related, with SN more common when income is lower (19, 27–29), though other SN studies contradict these findings (30, 31). Living alone was identified as being significantly more common in individuals who SN (19, 32, 33) and this was also found in the related condition of HD (20, 34, 35).

An improved understanding of the local and household risk factors for squalor would support community services in identifying locations, dwellings and families that have an increased chance of deteriorating into squalid living. However, to effectively identify and support individuals in these circumstances requires an accurate understanding of the scale of the problem and reliable case identification. Unfortunately, the literature is lacking a reliable estimate of the prevalence of squalor due to poor case identification methods. The point, period and lifetime prevalence of squalor is therefore unknown. A different, but related estimate is the 'incidence rate' which, like period prevalence, considers squalor cases over time, but only includes new cases (36). Incidence rates for squalor have been calculated (9, 10, 15, 37) and estimates range from 0.05–0.12% in adults over 60, or 65 years. Only one study considered the occurrence of squalor across all ages (15), reporting an incidence rate of 0.03%. However, these studies had high risk of bias as they calculated incidence, not prevalence, with estimates drawn as a ratio from the number of referred cases per year from a known population size. Therefore, as stated by Snowdon and Halliday (9), true prevalence estimates would likely be "substantially higher".

The present study will provide the first point estimate of squalor based on adults across all ages and furthermore, will base its estimate on a sample in which all types of dwelling are included, not relying on referred suspected cases. Case identification will be robust as this will be based on the valid and reliable methods used by the English Housing Survey (EHS) in which domiciliary visits form part of the robust assessment of the home environment. Also, in using data from multiple years of the EHS this will provide a large random sample from the general population (i.e., not just referred cases) and in adults across all ages (i.e., not just the over 65s). The EHS collects data annually from a random sample of households in England. However, the data does not use the same participants each year and is therefore not truly longitudinal, but does allow an estimate of the point prevalence of squalor year-on-year using a panel study

approach (38). The distribution of prevalence over time therefore also allows identification of possible temporal trends in the prevalence of squalor to be considered for the first time.

Prevalence meta-analyses combine estimates from multiple studies to produce a summary estimate of the rate of a disorder or occurrence (39). In this study, the meta-analysis will synthesise results from 13 annual administrations of the EHS to produce a pooled estimate of the prevalence of squalor. This is novel in the squalor evidence base. Prevalence meta-analyses have become significantly more common in the last decade as they increase precision by minimising the error in the estimates (40). By using this method, an estimate of the point prevalence of squalor can be produced that is more reliable and robust than previous estimates, with reduced heterogeneity due to the same method of case identification being used each year. A more reliable estimate will allow health and social services to effectively plan for the needs of individuals living in the community whose dwellings show signs of squalor (41). Furthermore, by using a meta-analytical approach with subgroup analysis, it will be possible to identify the characteristics of households that have an increased risk of their dwelling becoming squalid. This will further inform services regarding where their resources should be focused to provide support to those most in need. To summarise, the aims of this study were therefore to estimate the point prevalence of squalor in the general population, identify variability of the prevalence of squalor in the general population over time and investigate the relationship between squalor and household factors. The specific hypotheses focusing on the role of household factors were as follows: (1) risk of household squalor will be higher in areas of more severe deprivation and when the household income is lower and (2) the size of the household, whether the home is owned or rented, and whether the individual lives alone will all predict squalor.

Methods

Source data

The current study used data provided by the EHS (42). The EHS is a continuous national UK survey, first conducted in 1967, that collects information about people's housing circumstances. The UK Statistics Authority states that the statistics in the EHS are "produced according to sound methods and managed impartially and objectively in the public interest." (43). Each year a sample of houses are drawn at random and invited to participate. Those that agree take part in a face-to-face interview survey and are invited to take part in the physical survey, where a qualified surveyor comes to the property and completes a visual inspection of the interior, exterior and local area. Around 13,000 households take part in the face-to-face survey and another 6,000 also allow their property to be subject to the physical inspection. This study will include data from the 2007/08 wave of the study, through to the 2019/20 version and so represents data from 13 separate years (44–50).

Measures

The EHS collects data on a significant number of areas and topics. Data on each household is collected from an interview with an individual who lives there. Although the household may have multiple occupants, each residency is included only once, as the study investigates household, rather than individual, characteristics. Several variables from the EHS are included in this research.

Presence of squalor - This is based on a measure from the physical survey of the property. The surveyor rated the risk due to 'domestic hygiene, pests and refuse' inside the property. Potential ratings are 'significantly lower risk than average', 'average', 'significantly higher risk than average' and 'extreme'. For the purposes of this study, any individual deemed to be at 'significantly higher risk' or 'extreme' risk were considered to be living in squalor.

Year - Data is analysed across 13-years of the EHS. The first instance of a question being asked about household cleanliness was in 2007/08. The same question was then asked every year, up to 2019/20. Recent data was not available, as physical inspections stopped due to the Coronavirus pandemic.

Local deprivation - Each area in which individuals were surveyed was given a deprivation score, with values from 1–10 identifying whether the area was in the most deprived 10% of areas, to the least deprived 10% of areas, respectively. The deprivation for each year group was based on data from the Index of Multiple Deprivation (IMD; 51). Due to the low occurrence of squalor in some of the deprivation categories, it was not always appropriate to complete statistical analysis with deprivation separated into ten groups. Therefore, in these instances, the deprivation category was split into three groups; most deprived (Categories 1–3), average deprivation (4–7) and least deprived (8–10).

Gross household income - Total annual income from both the individual and their partner, including savings. Values from £0 to £100000. Values of more than £100000 are still given a value of £100000. To enable a variety of statistical analyses to be completed, the continuous income data was also split into four quartiles to allow for analysis as a categorical variable.

Tenure - The ownership status of the house. Potential responses are owner occupier, private rented, local authority or housing association. Where a binary category was required for analysis and for comparison with previous research, this category was simplified to those who owned their home and those who did not.

Household type and size - These variables give information as to who is present in the household. 6 categories are included; couple with or without children, lone parent, other multi-person household, one person (Under 60 years old) or one person (60 years and older). Where a binary category was required for analysis and for comparison with previous research, this category was simplified to those who live alone and those who live with others. Household size reported the total number of individuals in the household, including children.

Analysis Strategy

Data from 13 years of the EHS were assessed and each separate year was treated as an independent data set. Therefore, analysis assessed 13 sets of EHS results. Initially, a meta-analysis and forest plot were completed, calculating a random effects model estimate of squalor prevalence and measures of heterogeneity. As the identified proportions were all close to 0, meta-analyses throughout the study were run using a Freeman-Tukey double arcsine

transformation, to stabilise the variance (39, 52). Analysis was then split into two areas. Firstly, the role of the variables and their influence on squalor, and secondly, their effect over time. For the first stage, subgroup analysis on participant level data was used to compare the meta-analyses of households based on each independent variable. For each variable (deprivation, home ownership, whether they lived alone, income and household size) the data for each year group was separated by category, a meta-analysis was produced and then prevalences were compared. In addition, variables were also investigated with the complete dataset using logistic regression. As the squalor prevalence values are low, Firth's Bias-Reduced logistic regression (53) was used to account for the rarity of squalor events in the datasets (54). To analyse squalor prevalence over time, fixed prevalence data was calculated for each variable and for each year and displayed in values and as line graphs. Meta-regression was used to investigate whether squalor prevalence showed a significant change over time.

Results

Table 1 summarises the complete dataset. Overall, n = 85681 households were physically surveyed, with n = 763 identified as living in squalor, producing a fixed rate of 0.89%. Households that were squalid had on average 2.4 inhabitants and were more likely to be rented than owned by the resident.

Table 1
Summary of Data Set and Variables

Variable	Representative value
Total sample	85681
Total squalor	0.89%
Average deprivation score	4.966
Average household income	24886
Average household size	2.386
Tenure	
Owner occupied	45.87%
Private rented	18.85%
Local Authority housing	16.05%
Housing Association housing	19.23%
Owned occupied	45.87%
Not owned	54.13%
Household type	
Couple with no children	31.36%
Couple with children	21.42%
Lone parent	9.90%
Other multi-person household	8.04%
One person less than 60	12.41%
One person 60+	16.87%
Living alone	29.28%
Living with others	70.72%

Figure 1 shows the results of the meta-analysis. The 13 yearly datasets totalled n = 85681 households, producing a point prevalence estimate of squalor of 0.85% (95% CI's 0.72 to 1.00). There was a significant and high heterogeneity between years of the EHS ($I^2 = 82\%$, 95% CI 70–89%, $Q = 65.61$, $p < .01$).

Table 2 contains the subgroup analysis results and suggests that all the independent variables, except household type ($Q = 1.54$, $p = 0.2151$), had a significant effect on the presence of squalor. Squalor prevalence was higher in areas with the most deprivation ($Q = 46.32$, $p < .0001$), in households with income in the lowest quartile ($Q = 105.61$, $p < .0001$) and in houses which were not owned by the resident ($Q = 30.31$, $p < .0001$). The number of individuals in the household was also shown to have a significant effect on squalor prevalence, with 2-person households showing the lowest prevalence and households with 5 or more individuals having the highest risk ($Q = 25.61$, $p < .0001$).

Table 2
Subgroup Analysis for Moderators of Squalor Prevalence

Variable	Subgroup	Prevalence	95% CI	p-value	ρ	Q	p-value
Deprivation	Most deprived	1.23%	1.04–1.43%	0.0015	62.3%	46.32	< .0001
	Average deprivation	0.76%	0.59–0.94%	0.0001	69.2%		
	Least deprived	0.38%	0.25–0.53%	0.0025	60.4%		
Income	0–25%	1.31%	1.08–1.57%	0.0019	61.5%	105.61	< .0001
	25–50%	1.05%	0.92–1.19%	0.7414	0.0%		
	50–75%	0.68%	0.49–0.90%	0.0001	69.1%		
	75–100%	0.36%	0.28–0.45%	0.7041	0.0%		
Home ownership	Owned	0.50%	0.41–0.60%	0.0399	44.9%	30.31	< .0001
	Not owned	1.15%	0.93–1.39%	< 0.0001	82.9%		
Household type	Living alone	0.94%	0.82–1.06%	0.2653	17.7%	1.54	.2151
	Living with others	0.82%	0.66–0.99%	< 0.0001	80.7%		
Household size	1 person	0.94%	0.81–1.07%	0.2653	17.7%	25.61	< .0001
	2 people	0.62%	0.52–0.73%	0.2636	17.8%		
	3 people	0.76%	0.53–1.03%	0.0012	63.0%		
	4 people	1.01%	0.76–1.29%	0.0273	47.9%		
	5+ people	1.36%	0.88–1.94%	< .0001	69.5%		

Table 3 demonstrates the regression values when the data was analysed as a single dataset. The only variable which was not found to be a significant predictor of squalor was whether the individual lived in the household alone (OR = 0.91, 95% CI [0.78, 1.06], $p = 0.21$). Deprivation was found to be a significant predictor, suggesting a decrease in the prevalence of squalor of around 13% for each deprivation increment (OR = 0.87, 95% CI [0.84, 0.89], $p < .0001$). Similarly, whether an individual owned the home predicted squalor, with a rented home being 127% more likely to be squalid (OR = 2.27, 95% CI [1.94, 2.67], $p < .0001$). Income and household size were also both significant predictors of whether a household was living in squalor. When all variables were combined to form a model for predicting squalor, significance remained in all cases and whether an individual lived alone was also included as a significant element of the model.

Table 3
Logistic Regression of Independent Variables and Squalor with the Complete Dataset

Variable	Coefficient	Standard Error	Odds Ratio	95% CI	p-value
Variables analysed separately					
Deprivation (1–10)	-0.1422	0.0137	0.8674	0.8442, 0.8909	< .0001
Income (£0-100,000)	-0.0000	0.0000	0.9999	0.9999, 0.9999	< .0001
Household Size	0.1303	0.0813	1.1392	1.0847, 1.1951	< .0001
Living alone/with others	-0.0989	0.0784	0.9058	0.7779, 1.0577	0.2095
Home owned/rented	0.8212	0.0815	2.2732	1.9411, 2.6723	< .0001
Variables analysed together					
Deprivation	-0.0627	0.0149	0.9392	0.9120, 0.9668	< .0001
Income	-0.0000	0.0000	0.9999	0.9999, 0.9999	< .0001
Household size	0.2585	0.0304	1.2950	1.2187, 1.3734	0.0028
Living alone/with other	-0.2230	0.1074	0.8001	0.6481, 0.9881	0.0383
Home owned/rented	0.2673	0.0906	1.3064	1.0953, 1.5637	< .0001

Table 4
Squalor Prevalence Values (%) and Meta-regression by Time.

	Total	Sq. cases	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	All years	β	CI
Total			7883	7640	7872	8175	6211	6058	5950	5901	6054	5870	6093	6110	5864	85681		
Squalor cases			101	108	87	69	65	38	43	35	57	42	44	37	37	763		
Total prevalence	85681	763	1.28	1.41	1.11	0.84	1.05	0.63	0.72	0.59	0.94	0.72	0.72	0.61	0.63	0.89	-0.01	(-0.01, -0.01)
Deprivation																		
Most deprivation	32393	411	1.70	2.24	1.50	1.18	1.25	0.92	1.19	0.92	1.33	1.03	1.09	0.93	0.92	1.27	-0.01	(-0.01, -0.01)
Average deprivation	32335	261	1.33	1.01	0.98	0.96	1.25	0.45	0.41	0.51	1.08	0.57	0.48	0.59	0.51	0.81	-0.01	(-0.01, -0.01)
Least deprivation	20933	90	0.53	0.90	0.79	0.30	0.35	0.42	0.32	0.08	0.07	0.48	0.49	0.14	0.36	0.43	-0.01	(-0.01, -0.01)
Household income																		
0-25%	21421	299	2.15	1.95	1.46	0.97	1.63	0.81	1.10	0.84	1.58	1.01	1.54	0.82	1.32	1.40	-0.01	(-0.01, -0.01)
25-50%	21419	227	1.03	1.69	1.03	1.12	0.91	1.01	1.20	1.08	0.92	0.95	0.91	1.05	0.72	1.06	-0.01	(-0.01, -0.01)
50-75%	21422	158	0.96	1.33	1.20	0.78	1.08	0.39	0.33	0.20	1.07	0.64	0.37	0.50	0.52	0.74	-0.01	(-0.01, -0.01)
75-100%	21419	79	0.47	0.47	0.65	0.49	0.40	0.23	0.16	0.27	0.30	0.40	0.34	0.21	0.30	0.37	-0.01	(-0.01, -0.01)
Tenure																		
Owner occupied	39304	208	0.47	0.78	0.78	0.71	0.54	0.43	0.44	0.36	0.45	0.38	0.59	0.30	0.26	0.53	-0.01	(-0.01, -0.01)
Private rented	16148	212	3.11	2.81	1.92	0.72	1.86	1.00	0.83	0.84	1.03	1.20	0.64	0.71	0.60	1.31	-0.01	(-0.01, -0.01)
Local Authority housing	13756	186	1.92	2.31	1.80	1.47	1.00	0.82	1.04	0.52	1.54	0.62	1.01	0.93	2.03	1.35	-0.01	(-0.01, -0.01)
Housing Association housing	16473	157	1.30	1.24	0.73	0.94	1.33	0.50	0.86	0.88	1.27	1.01	0.83	0.93	0.50	0.95	-0.01	(-0.01, -0.01)
Owned	39304	208	0.47	0.78	0.78	0.71	0.54	0.43	0.44	0.36	0.45	0.38	0.59	0.30	0.26	0.53	-0.01	(-0.01, -0.01)
Not owned	46377	555	2.04	2.10	1.48	1.00	1.42	0.77	0.90	0.76	1.27	0.98	0.81	0.85	0.94	1.20	-0.01	(-0.01, -0.01)

	Total	Sq. cases	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	All years	β
Household type																	
Couple with no children	26870	148	0.61	1.03	0.69	0.55	0.70	0.28	0.57	0.45	0.49	0.59	0.37	0.22	0.38	0.55	-0.00
Couple with children	18355	144	1.49	1.59	1.08	0.72	1.26	0.48	0.24	0.30	0.52	0.31	0.47	0.62	0.59	0.78	-0.00
Lone parent	8484	130	2.43	1.99	1.65	1.52	0.62	0.87	1.76	1.19	2.78	2.15	1.04	0.93	0.60	1.53	-0.00
Other multi-person household	6887	102	2.66	2.29	1.31	2.08	1.70	1.90	0.80	1.00	2.04	0.00	1.16	0.89	0.88	1.48	-0.00
One person < 60	10629	127	1.99	1.60	2.17	0.62	1.52	0.48	1.06	0.61	1.18	1.15	0.68	1.07	0.93	1.19	-0.00
One person \geq 60	14456	112	0.55	1.04	0.79	0.84	0.93	0.80	0.60	0.63	0.49	0.69	1.28	0.64	0.81	0.77	0.00
Living alone	25085	239	1.11	1.30	1.39	0.74	1.20	0.65	0.80	0.62	0.78	0.88	1.04	0.81	0.86	0.95	-0.00
Living with others	60596	524	1.36	1.46	0.99	0.88	0.98	0.62	0.69	0.58	1.01	0.65	0.59	0.52	0.52	0.86	-0.00
Household size																	
1 person	25085	239	1.11	1.30	1.39	0.74	1.20	0.65	0.80	0.62	0.78	0.88	1.04	0.81	0.86	0.95	-0.00
2 people	29474	188	0.91	0.82	0.85	0.55	0.62	0.49	0.64	0.44	0.56	0.79	0.67	0.29	0.49	0.64	-0.00
3 people	13477	113	1.15	1.70	0.50	0.84	0.90	0.73	0.86	0.52	1.80	0.42	0.21	0.33	0.59	0.84	-0.00
4 people	11310	122	1.68	1.60	1.74	0.89	1.93	0.76	0.86	0.84	0.90	0.51	0.75	0.64	0.42	1.08	-0.00
5+ people	6335	101	3.16	3.65	1.40	2.63	1.21	0.69	0.23	0.88	1.40	0.76	0.70	1.72	0.73	1.59	-0.00

Discussion

The squalor evidence base has previously lacked a reliable estimate of the prevalence of squalor and what significantly predicts living in squalid home. Squalor prevalence estimates have been unreliable as they used individuals already identified as living in squalor and have been mostly limited to older adult samples. The current panel study sought to correct these limitations by providing the first reliable estimate of the prevalence of squalor across all ages and over time. The present study therefore took a novel meta-analytic approach, studying a large dataset from a random sample of the general population and using a reliable assessment method. The aims of this study were to provide a reliable estimate of the prevalence of squalor in the general population, to

investigate the relationships between squalor and household factors and to investigate annual trends in the prevalence of squalor. The aims of the study were met, and the results can now be discussed and connected to the extant evidence base.

Squalor Prevalence

The meta-analysis conducted on the EHS data used each yearly dataset as a separate event, generated an estimated squalor prevalence of 0.85%. Previous estimates had been between 0.05–0.12% in older adults (9, 10, 15, 37) and 0.03% across all ages (15). Therefore, the point prevalence rate suggested by the present study is higher than previous estimates and has been achieved using more reliable methods. Previous research has relied on producing squalor rate estimates based on extant referral rates. In each study, the number of cases referred to a service per year and the population of the area was used to calculate prevalence. The present study, which estimated prevalence from the results of surveying over 85000 dwellings therefore used a more reliable and extensive dataset, acquired using robust in situ interviewing methods and actual home visits. In using a meta-analytical approach with a larger dataset, a more reliable and precise estimate of prevalence of squalor has been achieved (55).

Household factors

Deprivation, when broken down into three categories from the most deprived to the least deprived areas, showed a significant relationship with squalor prevalence, with squalor being over three times more likely in the most deprived areas than in the least. This was supported by results of the regression analysis. Deprivation was a significant predictor of squalor, with reduced deprivation being associated with a 13% decrease in the risk of living in a squalid dwelling. These findings support the first hypothesis and previous evidence regarding the role of deprivation in predicting whether an individual lives in squalor (22) and the SN evidence base which has previously identified a relationship with deprivation (18, 26). This suggests that deprivation should now be considered as a risk factor for squalid living and that squalor is not evenly distributed throughout society, but rather is more likely in communities suffering high deprivation. This is in line with numerous other negative outcomes which are also associated with deprivation, including measures of health, child well-being and crime (56–59).

The first hypothesis investigated whether squalor would be more common in households with a lower income and the results found this to be the case. Income has not previously been considered as a main variable in the squalor literature. Households in the lowest quarter of income were more than three times more likely to be squalid than households in the highest income quartile. Income was also related to squalor prevalence in the logistic regression, even when included with other variables. Income appears therefore to be a new variable of interest in squalor evidence base. The findings regarding income do mirror many SN studies that have found poor income to be a risk factor (19, 27–29, 32, 60), whilst all of these studies have been limited to using older adult samples (60+ or 65+). Therefore, the outcomes of the present study are novel in that they investigate squalor, but also, in finding income to be a factor when investigating all adults, not just older individuals. People on low incomes will not be able to employ the cleaning and repair services that would enable a significant change to the home environment.

The second hypothesis suggested that additional household factors, such as whether someone lives alone, home ownership and how many people reside in the dwelling would also predict the home being squalid. Both squalor and SN literature have previously reported on key household factors (19, 23, 29, 32, 33). This current study demonstrated that home ownership and household size were related to squalor prevalence, both in the subgroup analysis and individual regression. Individuals who did not own their own homes had a squalor prevalence more than double that of homeowners. Furthermore, when ownership was included in the regression with income and deprivation, it was still a significant predictor of whether an individual lived in squalor, suggesting that it has an effect beyond other variables. This could potentially be because individuals who own their homes are more likely to look after the property, as they bear the full costs of any wear and tear (61). However, it may also be related to wealth, with homeowners shown to have more non-housing wealth (62), which could be used to afford cleaners or provide more free time for home maintenance.

Squalor prevalence was shown to vary significantly by household size, with the individual regression suggesting that increased household size predicted increased risk of squalor. This may be explained by social loafing, whereby individuals in groups make less effort than when they are working individually (63). However, it is worth noting that squalor did not increase linearly with household numbers. Prevalence calculations in the subgroup analysis showed that the lowest rate of squalor was seen in 2- and 3-person households and the highest in those with 4 or more individuals, with the prevalence in single-person households somewhere in between. Potentially, individuals living alone may struggle to find the time to maintain a household by themselves, or they may have less motivation to do so if no one else is regularly present. Further research in this area would be required to fully understand these findings.

Solitary living is one of the few household variables that has been covered in multiple squalor studies and has also received attention in related disorders, such as SN and HD. Rates of living alone in squalor cases have been shown to be high (2, 7–9, 11, 12, 14, 15, 22, 23). Furthermore, Ito et al. (23) showed that, compared to a control group, individuals living in squalor were more likely to be living alone. Studies have also consistently found that individuals who SN or hoard are more likely to be living alone (19, 20, 32–35). In the present study, the rate of squalor in individuals living alone was higher than multiple-person households. However, the difference was not significant at the .05 level. Furthermore, living alone also showed no relationship with squalor in the logistic regression. The lack of a relationship in the present study appears to disagree with the research base, as it suggests that squalor is not more common in individuals living alone. However, this may be due to the age of the participants in previous studies. The SN studies referenced (19, 32, 33) and the single squalor study which used a control (23) only investigated older adults. Therefore, this may suggest that if the EHS data was limited to older adults, they may have identified significantly higher rates of squalor in individuals living alone. However, further studies on squalor in the general population would need to be completed to identify whether this is the case.

Time trends

Studies that assess squalor over time are extremely rare and are usually conducted unsystematically. Furthermore, they are limited to follow-up data assessing outcomes from identified clinical samples (7, 9, 10, 23, 37, 64) rather than people living in the community. Although this study was not truly

longitudinal because it adopted a panel approach (38), it does represent a significant step in squalor research. This is because it analysed trends for the first time in reliable case identification of squalor prevalence taken over a 13-year period. This identified a significant relationship between squalor prevalence and time, such that squalor appeared to be decreasing over the 13-years. During this study period, the EHS demonstrated an overall decrease in non-decent homes (65), so the decrease in squalid homes may be explained by an overall improvement in housing conditions. As the methods of the EHS have remained the same, then this decrease is unlikely to be due to measurement error or variation.

A significant decrease in squalor prevalence was also observed in many of the variables and categories, such as homeowners, multiple-person households and all deprivation levels. However, others did not show the same pattern. These included those in both of the below-average income groups (0–25% and 25–50%) and several other groups who would be considered to be of a low income, such as those living in local authority or housing authority housing and lone parents. However, the lack of a decrease in prevalence in the lowest income groups was not consistently the case as the most deprived group still saw a significant decrease in squalor over time. Nonetheless, these findings suggest that certain groups of individuals do not see the same improvements in housing conditions as others. Further research into national patterns should be conducted to consider this in more detail.

Strengths and Limitations

The strengths of this study are based around the use of the EHS as a dataset and the analytical methods employed. The EHS has been running annually for over 50 years and reports regularly on technical processes and data quality (66). Therefore, the data included appears robust and reliable and the surveying methods were gold standard in that a domiciliary visit was conducted to identify squalid homes (67). In addition, the significant size of the survey has allowed for a squalor sample to be produced from a general population, even when the prevalence of squalor was likely to be low. This makes the research unique, as no previous study has investigated squalor in a sample of this reliability and size. Secondly, regarding the analysis used in the study, no previous squalor research has been able to use a meta-analytical approach, as this has been the only study using multiple datasets. This has allowed for a robust random effects estimate of squalor prevalence.

In terms of limitations, using the EHS as a source of data on squalor does have some drawbacks. Firstly, all surveyed households must voluntarily agree to be included in the EHS. It is possible that those who refused access to their homes varied significantly from those that agreed, suggesting that the sample used in the present study may have been influenced by selection bias. Individuals living in squalor are socially withdrawn (68–70) and will refuse entry to their property or any form of help (71–73), which would drive avoidance of engagement with the EHS. Secondly, household conditions were measured on a 1–4 scale. However, this is not a validated measure and has not been used in previous squalor research. Therefore, it is difficult to assess whether the individuals considered to be living in squalor in this study had similar living conditions to those identified in other squalor studies. The high heterogeneity reported limits generalisability. Finally, out of over 85000 households, only 763 were identified as living in some form of squalor. This prevalence of less than 1% makes for an unbalanced sample and restricted the use of some analytical procedures. Furthermore, it meant that when data was separated by year, certain categories, such as deprivation, could not remain in their original groupings, as the numbers of squalor cases were low or zero. By creating smaller groupings, some of the accuracy of the data was lost and patterns in the analysis more difficult to identify.

Practical Implications

A better understanding of squalor is vital for those who work in the field. Compared to conditions such as Hoarding Disorder (74) and SN (75, 76), much less is known about individuals who choose to create and live in squalid homes and how they can be supported. A more reliable estimate of prevalence is an important step in supporting individuals living in squalor as it allows services to plan appropriately for the health care needs of these individuals (41). There is an absence of empirically supported and evidence-based interventions for squalor. Evidence that squalor occurs in almost 1% of households enables workforce calculations and emphasises the importance of having professionals who are trained in how to psychologically manage the people and also change the environmental conditions. Interventions are likely multi-disciplinary, and the ratios of professionals and their time is currently unknown. This study has also helped inform the understanding of the local areas and types of households that are most at risk of living in squalor. This can help direct resources into the locations where squalor is most likely, ensuring the available support is used most efficiently and effectively.

Conclusions

This study used a unique approach in squalor prevalence research, investigating adults of all ages, taking from a general population survey and conducting a prevalence meta-analysis using 13-years of panel data. Furthermore, unlike many published squalor studies, it did not focus on the individual level demographics, but instead the household and local area context factors, which have received little previous attention. The study produced a squalor prevalence estimate higher than identified in previous squalor studies, suggesting that squalor could be more common than previously realised. The study showed a significant relationship between squalor prevalence and the variables of local deprivation, household income, home ownership and household numbers. However, no relationship was found when considering whether individuals lived alone, which contradicted previous squalor and SN research. Time trends, which have also received little attention in squalor, were also investigated, finding a significant decrease in squalor prevalence between 2008 and 2020. Robust case assessment methods, engagement strategies and multidisciplinary interventions packages now need to be developed and these interventions be thoroughly evaluated in well controlled outcome studies.

Abbreviations

DS: Diogenes Syndrome

EHS: English Housing Survey

HD: Hoarding Disorder

IMD: Index of Multiple Deprivation

SDS: Severe Domestic Squalor

SN: Self-neglect

Declarations

Ethical approval and consent to participate

The study complied with the requirements of the UK Data Service (77) regarding using their datasets for research purposes. Ethical approval for the use of this secondary dataset was confirmed by self-declaration through University of Sheffield Psychology Department as part of a thesis investigating squalor (78).

Consent for publication

Not applicable.

Availability of data and materials

The datasets analysed during the current study are available in the UK Data Service repository, ukdataservice.ac.uk

The following datasets were analysed in this research:

- 6612 – English Housing Survey 2008: Housing Stock Data
- 7039 – English Housing Survey 2010: Housing Stock Data
- 7511 – English Housing Survey 2012: Housing Stock Data
- 8068 – English Housing Survey 2014: Housing Stock Data: Special Licence Access
- 8387 – English Housing Survey 2016: Housing Stock Data: Special Licence Access
- 8851 – English Housing Survey 2018: Housing Stock Data: Special Licence Access
- 8922 – English Housing Survey 2019: Housing Stock Data: Special Licence Access

Restrictions apply to the availability of some of these datasets, which were used under license for the current study, and so are not publicly available. Datasets 8068, 8387, 8851 and 8922 required completion of an application to access.

Competing interests

The authors declare that they have no competing interests.

Funding

Not applicable.

Authors' contributions

MN, SK and VH were involved in the planning and conception of the study. MN was reliable for analysis of the data and the initial draft of the article. MS-B supported the analysis process. MN, SK and VH were involved in revising the article.

Acknowledgements

Not applicable.

References

1. Snowdon J, Halliday G, Banerjee S. Severe domestic squalor. Cambridge University Press; 2012.
2. McDermott S, Gleeson R. Evaluation of the severe domestic squalor project. 2009; Available from: https://library.bsl.org.au/jspui/bitstream/1/1459/1/SevereDomesticSqualorProject_Final.pdf
3. Lacombe MC, Cossette B. The role of public health in the development of a collaborative agreement with rural and semi-urban partners in cases of severe domestic squalor and hoarding. *Community Mental Health Journal*. 2018;54(6):766–72.
4. Maliszewska A, Banaszczyk K, Owsiany M, Maliszewska P. Diogenes' syndrome. *Journal of Education, Health and Sport*. 2018;8(12):158–62.
5. Gleason A, Perkes D, Wand AP. Managing hoarding and squalor. *Australian Prescriber*. 2021;44(3):79.
6. Cooney C, Hamid W. Diogenes syndrome. *Age and ageing*. 1995;24(5):451–4.
7. Clark A, Mankikar G, Gray I. The Diogenes syndrome. *Nursing Times*. 1975;71(21):800–2.
8. Shaw T, Shah A. Squalor syndrome and psychogeriatric admissions. *International Psychogeriatrics*. 1996;8(4):669–74.

9. Snowdon J, Halliday G. A study of severe domestic squalor: 173 cases referred to an old age psychiatry service. *International Psychogeriatrics*. 2011;23(2):308–14.
10. Wrigley M, Cooney C. Diogenes syndrome—an Irish series. *Irish Journal of Psychological Medicine*. 1992;9(1):37–41.
11. Hurley M, Scallan E, Johnson H, De La Harpe D. Adult service refusers in the greater Dublin area. *Irish medical journal*. 2000;93(7):208–11.
12. Monfort J, Devouche E, Wong C, Pean I, Hugonot-Diener L. Diogenes syndrome: A prospective observational study. *Journal of Aging Research and Clinical Practice*. 2017;6:153–7.
13. Halliday G, Snowdon J. The environmental cleanliness and clutter scale (ECCS). *International Psychogeriatrics*. 2009;21(6):1041–50.
14. Snowdon J, Halliday G, Hunt GE. Two types of squalor: findings from a factor analysis of the Environmental Cleanliness and Clutter Scale (ECCS). *International psychogeriatrics*. 2013;25(7):1191–8.
15. Halliday G, Banerjee S, Philpot M, Macdonald A. Community study of people who live in squalor. *The Lancet*. 2000;355(9207):882–6.
16. Aamodt WW, Terracina KA, Schillerstrom JE. Cognitive profiles of elder adult protective services clients living in squalor. *Journal of Elder Abuse & Neglect*. 2015;27(1):65–73.
17. Gregory C, Halliday G, Hodges J, Snowdon J. Living in squalor: neuropsychological function, emotional processing and squalor perception in patients found living in squalor. *International psychogeriatrics*. 2011;23(5):724–31.
18. Day MR, Mulcahy H, Leahy-Warren P. Prevalence of self-neglect in the caseloads of public health nurses. *British Journal of Community Nursing*. 2016;21(1):31–5.
19. Burnett J, Regev T, Pickens S, Prati LL, Aung K, Moore J, et al. Social networks: A profile of the elderly who self-neglect. *Journal of Elder Abuse & Neglect*. 2006;18(4):35–49.
20. Samuels JF, Bienvenu OJ, Grados MA, Cullen B, Riddle MA, Liang K yee, et al. Prevalence and correlates of hoarding behavior in a community-based sample. *Behaviour research and therapy*. 2008;46(7):836–44.
21. Saxena S, Ayers CR, Maidment KM, Vapnik T, Wetherell JL, Bystritsky A. Quality of Life and Functional Impairment in Compulsive Hoarding. *J Psychiatr Res*. 2011 Apr;45(4):475–80.
22. Lee SM, Lewis M, Leighton D, Harris B, Long B, Macfarlane S. Neuropsychological characteristics of people living in squalor. *International psychogeriatrics*. 2014;26(5):837–44.
23. Ito K, Okamura T, Tsuda S, Awata S. Diogenes syndrome in a 10-year retrospective observational study: An elderly case series in Tokyo. *International Journal of Geriatric Psychiatry*. 2022;37(1).
24. Day MR, Leahy-Warren P, McCarthy G. Perceptions and views of self-neglect: A client-centered perspective. *Journal of elder abuse & neglect*. 2013;25(1):76–94.
25. Poythress EL, Burnett J, Naik AD, Pickens S, Dyer CB. Severe self-neglect: an epidemiological and historical perspective. *Journal of Elder Abuse & Neglect*. 2006;18(4):5–12.
26. Lauder W, Roxburgh M. Self-neglect consultation rates and comorbidities in primary care. *International Journal of Nursing Practice*. 2012;18(5):454–61.
27. Dong L, Sun L. Prevalence of self-neglect and associated factors among disability elderly in China. 2021;
28. Dong X, Simon MA, Evans DA. Prevalence of self-neglect across gender, race, and socioeconomic status: findings from the Chicago Health and Aging Project. *Gerontology*. 2012;58(3):258–68.
29. Yu M, Gu L, Jiao W, Xia H, Wang W. Predictors of self-neglect among community-dwelling older adults living alone in China. *Geriatric Nursing*. 2019;40(5):457–62.
30. Dong X. Sociodemographic and socioeconomic characteristics of elder self-neglect in an US Chinese aging population. *Archives of gerontology and geriatrics*. 2016;64:82–9.
31. Mardan H, Hamid T, Ibrahim R. Correlate of self-care and self-neglect among community-dwelling older adults. *Iranian Journal of Nursing and Midwifery Research*. 2014;19(7 Suppl1):S71.
32. Abrams RC, Lachs M, McAvay G, Keohane DJ, Bruce ML. Predictors of self-neglect in community-dwelling elders. *American Journal of Psychiatry*. 2002;159(10):1724–30.
33. Naik AD, Lai JM, Kunik ME, Dyer CB. Assessing capacity in suspected cases of self-neglect. *Geriatrics*. 2008;63(2):24.
34. Frost RO, Steketee G, Grisham J. Measurement of compulsive hoarding: saving inventory-revised. *Behaviour research and therapy*. 2004;42(10):1163–82.
35. Kim HJ, Steketee G, Frost RO. Hoarding by elderly people. *Health & Social Work*. 2001;26(3):176–84.
36. Smink FR, Van Hoeken D, Hoek HW. Epidemiology of eating disorders: incidence, prevalence and mortality rates. *Current psychiatry reports*. 2012;14(4):406–14.
37. Macmillan D, Shaw P. Senile breakdown in standards of personal and environmental cleanliness. *British Medical Journal*. 1966;2(5521):1032.
38. Lugtig P, Smith PA. The choice between a panel and cohort study design. 2019;
39. Barendregt JJ, Doi SA, Lee YY, Norman RE, Vos T. Meta-analysis of prevalence. *J epidemiol community health*. 2013;67(11):974–8.
40. Suvarnapathaki S. Meta-analysis of prevalence studies using R. *International Journal of Scientific Research*. 2021 Aug 1;10(8).
41. Ward MM. Estimating disease prevalence and incidence using administrative data: Some assembly required. *J Rheumatol*. 2013 Aug;40(8):1241–3.
42. Office for National Statistics. GOV.UK. 2022 [cited 2022 Aug 11]. English Housing Survey. Available from: <https://www.gov.uk/government/collections/english-housing-survey>

43. UK Statistics Authority. Statistics from the English Housing Survey [Internet]. 2010. Available from: https://uksa.statisticsauthority.gov.uk/wp-content/uploads/2015/12/images-assessment-report-57-statistics-from-the-english-housing-survey_tcm97-34184.pdf
44. Department for Communities and Local Government. English Housing Survey, 2008: Housing Stock Data. [data collection]. 4th Edition. UK Data Service. SN: 6612; 2017.
45. Department for Communities and Local Government. English Housing Survey, 2010: Housing Stock Data. [data collection]. 6th Edition. UK Data Service. SN: 7039; 2017.
46. Department for Communities and Local Government. English Housing Survey, 2012: Housing Stock Data. [data collection]. 4th Edition. UK Data Service. SN: 7511; 2017.
47. Department for Communities and Local Government. English Housing Survey, 2016: Housing Stock Data: Special Licence Access. [data collection]. UK Data Service. SN: 8387; 2019.
48. Department for Communities and Local Government. English Housing Survey, 2014: Housing Stock Data: Special Licence Access. [data collection]. 4th Edition. UK Data Service. SN: 8068; 2020.
49. Ministry of Housing, Communities and Local Government. English Housing Survey, 2019: Housing Stock Data: Special Licence Access. [data collection]. UK Data Service. SN: 8922; 2022.
50. Ministry of Housing, Communities and Local Government, CADS Housing Surveys. English Housing Survey, 2018: Housing Stock Data: Special Licence Access. [data collection]. UK Data Service. SN: 8851; 2021.
51. Qi X, Jia Y, Pan C, Li C, Wen Y, Hao J, et al. Index of multiple deprivation contributed to common psychiatric disorders: a systematic review and comprehensive analysis. *Neuroscience & Biobehavioral Reviews*. 2022;104806.
52. Mansfield KE, Sim J, Jordan JL, Jordan KP. A systematic review and meta-analysis of the prevalence of chronic widespread pain in the general population. *PAIN*. 2016 Jan;157(1):55.
53. Firth D. Bias reduction of maximum likelihood estimates. *Biometrika*. 1993;80(1):27–38.
54. Leitgöb H. The problem of modeling rare events in ML-based logistic regression. *European Survey Research Association Ljubljana*. 2013;
55. Møller AM, Myles PS. What makes a good systematic review and meta-analysis? *BJA: British Journal of Anaesthesia*. 2016;117(4):428–30.
56. Zhang X, Cook PA, Lisboa PJ, Jarman IH, Bellis MA. The effects of deprivation and relative deprivation on self-reported morbidity in England: an area-level ecological study. *Int J Health Geogr*. 2013 Jan 29;12:5.
57. Bandyopadhyay A, Whiffen T, Fry R, Brophy S. How does the local area deprivation influence life chances for children in poverty in Wales: A record linkage cohort study. *SSM Popul Health*. 2023 Feb 23;22:101370.
58. Visser K, Bolt G, Finkenauer C, Jonker M, Weinberg D, Stevens GWJM. Neighbourhood deprivation effects on young people's mental health and well-being: A systematic review of the literature. *Social Science & Medicine*. 2021 Feb 1;270:113542.
59. Lightowlers C, Pina-Sánchez J, McLaughlin F. The role of deprivation and alcohol availability in shaping trends in violent crime. *European Journal of Criminology*. 2023 Mar 1;20(2):738–57.
60. Dong XQ, Simon M, Evans D. Cross-sectional study of the characteristics of reported elder self-neglect in a community-dwelling population: Findings from a population-based cohort. *Gerontology*. 2010;56(3):325–34.
61. Harding J, Miceli TJ, Sirmans C f. Do Owners Take Better Care of Their Housing Than Renters? *Real Estate Economics*. 2000;28(4):663–81.
62. Lersch PM, Dewilde C. Homeownership, saving and financial wealth: a comparative and longitudinal analysis. *Housing Studies*. 2018 Nov 17;33(8):1175–206.
63. Simms A, Nichols T. Social loafing: A review of the literature. *Journal of Management*. 2014;15(1):58–67.
64. Chan SMS, Leung PYV, Chiu FKH. Late-onset Diogenes syndrome in Chinese—an elderly case series in Hong Kong. *Neuropsychiatric Disease and Treatment*. 2007;3(5):589.
65. Office for National Statistics. GOV.UK. 2023 [cited 2023 Nov 24]. English Housing Survey data on dwelling condition and safety. Available from: <https://www.gov.uk/government/statistical-data-sets/dwelling-condition-and-safety>
66. Office for National Statistics. GOV.UK. 2020 [cited 2023 Apr 17]. English Housing Survey: guidance and methodology. Available from: <https://www.gov.uk/guidance/english-housing-survey-guidance-and-methodology>
67. Postlethwaite A, Kellett S, Mataix-Cols D. Prevalence of hoarding disorder: A systematic review and meta-analysis. *Journal of affective disorders*. 2019;256:309–16.
68. Fond G, Jollant F, Abbar M. The need to consider mood disorders, and especially chronic mania, in cases of Diogenes syndrome (squalor syndrome). *International psychogeriatrics*. 2011;23(3):505–7.
69. Lee SM, LoGiudice D. Phenomenology of squalor, hoarding and self-neglect: an Australian aged care perspective. *Internal Medicine Journal*. 2012;42(1):98–101.
70. Proctor C, Rahman S. Diogenes syndrome: identification and distinction from hoarding disorder. *Case Reports in Psychiatry*. 2021;2021.
71. Matsuoka T, Kato Y, Shibata K, Nakamura K, Nishimura Y, Narumoto J. Importance of long-term involvement for older people living in severe squalor: A case report. *Asian Journal of Psychiatry*. 2020;52:102146.
72. McDermott S. Ethical decision making in situations of self-neglect and squalor among older people. *Ethics and Social Welfare*. 2011;5(1):52–71.
73. Snowdon J. Severe domestic squalor: Time to sort out the mess. *Aust N Z J Psychiatry*. 2014 Jul 1;48(7):682–4.
74. Frost RO, Steketee G. *The Oxford handbook of hoarding and acquiring*. Oxford University Press; 2014.

75. Day MR, Leahy-Warren P, McCarthy G. Self-Neglect: Ethical Considerations. Annual Review of Nursing Research. 2016 Jan 1;34(1):89–107.
76. Papaioannou ESC, Riih a I, Kivel a SL. Self-neglect of the elderly. An overview. The European journal of general practice. 2012;18(3):187–90.
77. UK Data Service. UK Data Service. [cited 2022 Aug 11]. UK Data Service. Available from: <https://ukdataservice.ac.uk/>
78. Norton M. Understanding People that Live in Squalor: Individual to the Population Level Factors [Unpublished doctoral thesis]. University of Sheffield; 2023.

Figures

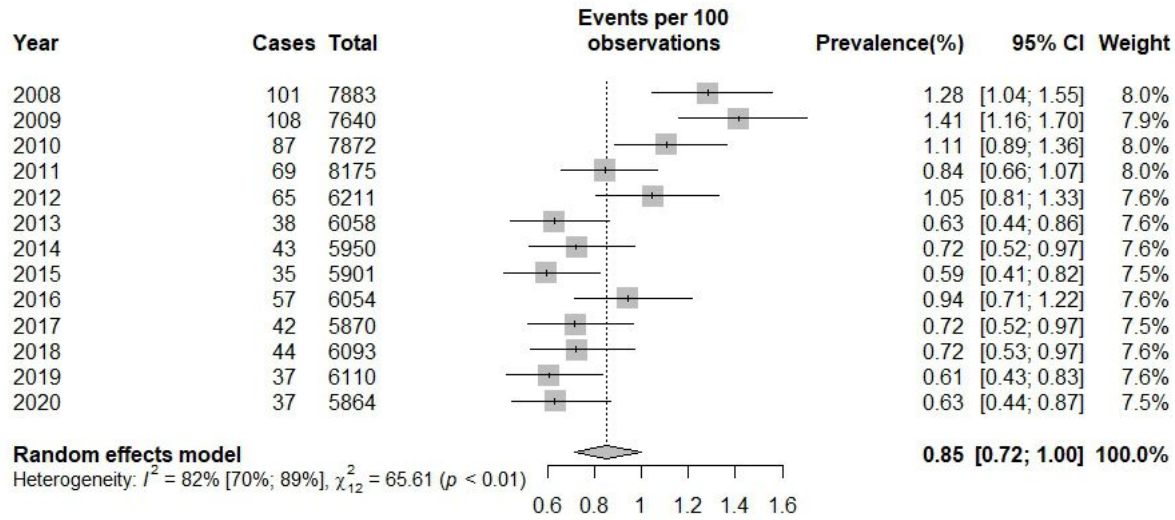


Figure 1

Forest Plot of Squalor Prevalence by Year

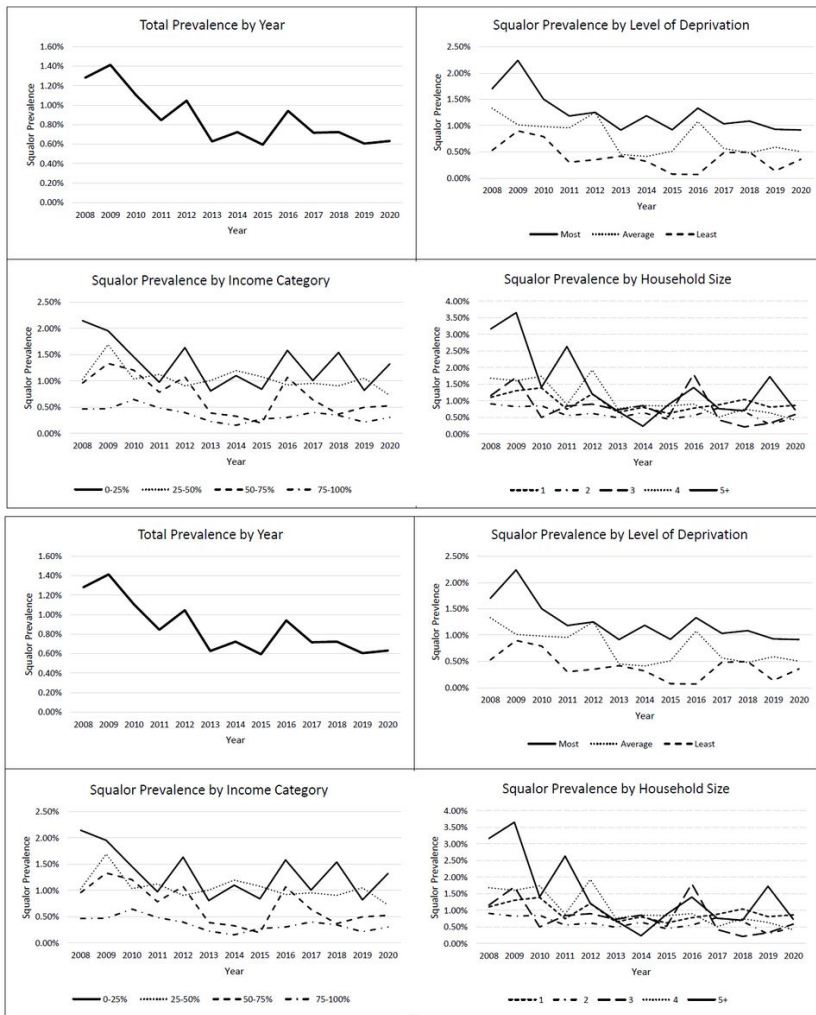


Figure 2
Squalor Prevalence Over Time and by Variable