

Prevalence of Self-Neglect across Gender, Race, and Socioeconomic Status: Findings from the Chicago Health and Aging Project

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Key Words

Self-neglect · Hoarding · Hygiene · Squalor · Environmental hazards · Population-based study

Abstract

Background: Self-neglect is the behavior of an elderly person that threatens his/her own health and safety, and it is associated with increased morbidity and mortality. However, the scope of the self-neglect in the community population remains unclear. We examined the prevalence of self-neglect and its specific behaviors of hoarding, hygiene and other environmental hazards in a community-dwelling elderly population. **Methods:** A population-based cohort study conducted from 2007 to 2010 in a single cycle in a geographically defined community of 4 adjacent neighborhoods in Chicago, Ill., USA. Participant's personal and home environment was rated on hoarding, personal hygiene, house in need of repair, unsanitary conditions, and inadequate utility. Prevalence estimates were presented across gender, race/ethnicity, education and income levels. **Results:** There were 4,627 older adults in the cohort. The prevalence of self-neglect and specific personal and environmental hazards varied significantly by race/ethnicity and by levels of education and income. For race/ethnicity, black old-

er adults (men 13.2%; women 10.9%) had a significantly higher prevalence of self-neglect than white older adults (men 2.4%; women 2.6%). For those with less than high school education, the prevalence of the self-neglect was 14.7% in men and 10.9% in women. For those with an annual income of less than USD 15,000, the prevalence of self-neglect was 21.7% in men and 15.3% in women. **Conclusion:** The prevalence of self-neglect and specific behaviors of hoarding, poor hygiene, and other environmental hazards are higher among black older adults and among those with lower levels of education and income.

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Introduction

Elder self-neglect is an important public health issue that occurs across sociodemographic and socioeconomic strata. According to the National Center on Elder Abuse, self-neglect is defined '... as the behavior of an elderly person that threatens his/her own health and safety' [1]. In addition, reports from the National Adult Protective Services Agency also suggest that elder self-neglect is on the rise [2]. However, our existing knowledge has mostly relied on case studies and case reports to the social ser-

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vices agencies [3, 4]. Although such reports make an invaluable contribution to the field, they likely represent the 'tip-of-the-iceberg' and more comprehensive and systematic studies are needed, so that the problem can be more precisely defined, better solutions developed, and appropriate policy established.

Prior studies from these cases reported to social services agencies suggest that these self-neglecting behaviors are associated with the increased burden of morbidity and premature mortality [5–8]. Moreover, social services agency data suggest that minority older adults and those with lower levels of socioeconomic status may be at higher risk of being reported to authorities for these behaviors [4, 9, 10]. However, there remain significant gaps in our current understanding of the scope of these issues in representative populations. Improved understanding of these issues is critical to inform research, education, practice and policy to provide targeted prevention, screening and interventions within specific subgroups.

In this report, we build on the existing literature to examine the prevalence of self-neglect as well as specific self-neglecting behaviors across the sociodemographic and socioeconomic strata in a community-dwelling population of older adults.

Methods

Design and Participants

The study population consists of participants in the Chicago Health and Aging Project (CHAP), which is a population-based study in a geographically defined community population, and is designed to identify risk factors for Alzheimer's disease and other common chronic health problems in older age. Details of the CHAP study design have been described previously [11, 12]. Briefly, the study enrolled residents aged 65 years and older of adjacent neighborhoods on the south side of Chicago. The interviews include standardized questionnaires and home observational assessment of personal and environmental hazards. From 2007 to 2010, a total of 4,627 older adults participated in the CHAP study. Written informed consent was obtained and the study was approved by the Institutional Review Board at Rush University Medical Center.

Self-Neglect: Personal and Environmental Assessments

Personal and environmental observations were uniformly assessed by trained interviewers in 5 domains: hoarding; poor basic personal hygiene; house in need of repair; unsanitary conditions, and inadequate utilities. Hoarding was assessed by the presence of excessive accumulation of newspapers or magazines, boxes, bags, or bottles, accumulation of trash, and accumulation of pets. Personal hygiene was assessed by presence of dirty skin or nails, dirty or ungroomed hair, dirty cloth, and presence of fecal or

urine smells. House needing repair included the assessment of interior walls or doors, stairs, flooring or carpets, bathroom or kitchen, appliances or lighting, and exteriors including windows, doors, and yards. Unsanitary conditions included being extremely dirty or cluttered, spoiled or rotten food, many dirty dishes, insect or rodent infestation, and foul odor. Inadequate utilities were assessed by inadequate heat or air conditioning for the house, inadequate water, and electrical services.

All 8 survey interviewers went through uniform training on these 21 items by the principle investigator and the project coordinator. Then, the project coordinator accompanied the survey interviewers during the first in-home interview. The assessment of self-neglect and its specific behaviors for any given participants were conducted by a single interviewer. The 21 items were assessed at the end of the CHAP population survey. Survey interviewers are retrained annually to ensure these standards are met and to reduce potential measure bias.

Reliability was assessed for each of the 5 domains with Cronbach's α of 0.98 for hoarding, 0.98 for poor basic personal hygiene, 0.97 for unsanitary conditions, 0.98 for house in need of repair, and 0.97 for inadequate utility. Cronbach's α was calculated as the squared correlation between observed score and the true score variance. Overall self-neglect was defined as the presence of any of the 5 domains in the areas of hoarding, poor basic personal hygiene, house in need of repair, unsanitary conditions and inadequate utilities. Content validity was measured by an expert panel of researchers, clinicians, and social services agencies. Construct validity was tested in the same study population and was found to be closely correlated with cognitive impairment (coefficient 0.10, $p < 0.001$), physical function impairment (coefficient 0.05, $p < 0.001$) and depressive symptoms (coefficient 0.12, $p < 0.001$), further supporting its convergent validity.

Study Variables

Demographic variables include age (in years), sex, and race/ethnicity. In this article, race/ethnicity is operationalized as black (non-Hispanic black) or white (non-Hispanic white). The race/ethnicity variable was self-reported in accordance with the US census as well as other large-scale epidemiological studies, i.e. the Established Populations for the Epidemiologic Studies of the Elderly (EPESE) project. We also collected information from the participants on educational attainment (years of education completed), and annual income categories (in USD: 1 = 0–4,999; 2 = 5,000–9,999; 3 = 10,000–14,999; 4 = 15,000–19,999; 5 = 20,000–24,999; 6 = 25,000–29,999; 7 = 30,000–34,999; 8 = 35,000–49,999; 9 = 50,000–74,999, and 10 = 75,000 and over).

Statistical Analysis

Univariate analyses were performed to examine the study population across age groups (65–74, 75–84, and 85 or more years) and sex. Prevalence estimates were calculated for men and women across race/ethnicity, education and income levels. Approximate 95% confidence intervals for prevalence estimates were obtained by inverting the corresponding Wald test constructed using the standard errors. Logistic regression was used to model the likelihood of having overall self-neglect as well as the specific self-neglect phenotypes as the outcomes of interest. These models included variables of age groups, race/ethnicity, education and income as covariates and were estimated separately for men and women. In addition to the continuous variables of socioeconomic

Table 1. Characteristics of the 4,627 participants

	Age 65–74 years		Age 75–84 years		Age 85 or more years	
	men (n = 635) % (95% CI)	women (n = 1,140) % (95% CI)	men (n = 802) % (95% CI)	women (n = 1,334) % (95% CI)	men (n = 208) % (95% CI)	women (n = 508) % (95% CI)
Race/ethnicity						
White	31.2 (27.6–34.8)	26.7 (24.1–29.3)	33.8 (30.5–37.1)	33.7 (31.2–36.3)	55.3 (48.5–62.1)	53.9 (49.6–58.3)
Black	68.7 (65.1–72.3)	72.8 (70.2–75.4)	65.9 (62.7–69.2)	65.9 (63.4–68.5)	44.7 (37.9–51.5)	45.5 (41.1–49.8)
Education, years						
0–11	20.9 (17.7–24.0)	15.5 (13.4–17.6)	31.1 (27.9–34.3)	24.2 (21.9–26.5)	33.2 (26.8–39.6)	27.5 (23.6–31.4)
12	30.9 (27.4–34.6)	33.9 (28.6–33.9)	25.1 (22.1–28.1)	32.3 (29.8–34.8)	23.1 (17.4–28.8)	34.7 (30.4–38.7)
13–16	33.7 (29.9–37.3)	41.5 (38.6–44.3)	29.9 (26.8–33.1)	35.3 (32.7–37.9)	29.8 (23.6–36.0)	30.0 (26.1–34.0)
17 or >	14.5 (11.8–17.3)	11.8 (9.9–13.7)	13.9 (11.5–16.3)	8.3 (6.8–9.7)	13.9 (9.2–18.7)	7.9 (5.6–10.3)
Income (USD)						
0–9,999	1.5 (0.5–2.4)	5.3 (3.9–6.7)	4.8 (3.3–6.3)	13.2 (11.4–15.1)	5.5 (2.3–8.7)	17.9 (14.5–21.4)
10,000–19,000	13.4 (10.7–16.1)	21.3 (18.8–23.7)	17.0 (14.4–19.6)	30.4 (27.9–32.9)	22.0 (16.3–27.7)	31.5 (27.3–35.6)
20,000–29,999	23.1 (19.8–26.4)	27.0 (24.4–29.7)	27.9 (24.9–31.1)	28.1 (25.7–30.6)	25.0 (19.0–31.0)	24.8 (20.9–28.7)
30,000 or more	62.1 (58.3–65.9)	46.4 (43.4–49.3)	50.2 (46.7–53.7)	28.3 (25.8–30.7)	47.5 (40.6–54.4)	25.8 (21.9–29.8)
Marital status						
Married	78.4 (75.2–81.6)	51.1 (48.2–53.9)	77.2 (74.3–80.1)	40.6 (37.9–43.2)	62.9 (56.4–69.5)	24.3 (20.5–27.9)
Separated	5.7 (3.9–7.5)	4.8 (3.6–6.1)	4.2 (2.8–5.6)	3.6 (2.6–4.6)	2.4 (0.3–4.5)	6.9 (4.7–9.1)
Divorced	8.5 (6.3–10.7)	16.5 (14.3–18.7)	5.5 (3.9–7.1)	13.6 (11.8–15.5)	2.9 (0.6–5.2)	6.9 (4.7–9.1)
Widowed	7.4 (5.4–9.4)	27.6 (25.0–30.2)	13.1 (10.8–15.4)	42.2 (39.6–44.9)	31.7 (25.4–38.1)	61.9 (57.7–66.2)
Health status						
Excellent	24.9 (21.5–28.2)	21.3 (18.9–23.7)	17.2 (14.6–19.8)	17.5 (15.4–19.5)	12.5 (8.0–16.9)	21.1 (17.5–24.6)
Good	50.4 (46.5–54.3)	54.0 (51.1–56.9)	50.6 (47.2–54.1)	49.5 (46.8–52.2)	48.1 (41.3–54.9)	45.7 (41.3–50.0)
Fair/poor	24.7 (21.4–28.1)	24.7 (22.2–27.2)	32.2 (28.9–35.4)	33.1 (30.5–35.6)	39.4 (32.8–46.1)	33.3 (29.2–37.4)
Cognitive function (MMSE score)						
27–30	73.7 (70.3–77.2)	81.4 (79.1–83.6)	58.9 (55.4–62.4)	65.1 (62.5–67.7)	43.8 (36.7–50.8)	49.1 (44.6–53.5)
21–26	21.7 (18.5–24.9)	15.9 (13.8–18.1)	29.8 (25.6–32.9)	27.3 (24.9–29.7)	36.5 (29.7–43.3)	27.9 (23.9–31.9)
20 or more	4.5 (2.9–6.1)	2.7 (1.7–3.6)	11.3 (9.1–13.6)	7.6 (6.2–9.1)	19.8 (14.2–25.4)	23.0 (19.3–26.7)
Depressive symptoms: CESD						
0	51.9 (48.0–55.8)	44.1 (41.2–47.0)	44.6 (41.1–48.0)	38.9 (36.3–41.6)	40.9 (34.2–47.7)	32.4 (28.3–36.5)
1–2	39.0 (35.6–43.2)	40.9 (38.0–43.7)	38.1 (34.8–41.5)	43.5 (40.8–46.1)	48.9 (44.6–53.4)	42.4 (35.7–49.2)
>3	8.70 (6.50–10.9)	15.0 (12.9–17.1)	27.0 (14.7–19.9)	17.6 (15.7–19.7)	16.6 (11.5–21.7)	18.6 (15.2–22.1)

The CI is based on inversion of the Wald test constructed with the use of standard errors.

factors, this study constructed categorical variables to examine the levels of education and income and risk for elder self-neglect and its specific phenotypes. Socioeconomic variables were considered both as continuous variables as well as categorical variables (education: college, high school or less than high school; income categories: ≥ 7 , 4–6, or ≤ 3). Results are presented as odds ratios with 95% confidence intervals (CI). All analyses used 2-sided alternatives with p values of <0.05 . All analyses were done using SAS® [13].

Results

Baseline Characteristics

In the total cohort, there were 4,627 older adults (1,645 men and 2,982 women). Table 1 summarizes the demographic, socioeconomic status, health status, cognitive function and depressive symptoms of the participants. In

general, older age groups had relatively lower education, and income. This trend was similar for both men and women across these age groups.

Across race/ethnicity, the prevalence of overall self-neglect for black men was 13.2% (95% CI 11.2–15.3) and for black women 10.9% (95% CI 9.5–12.3; table 2). For white older adults, the prevalence of overall self-neglect for men was 2.4% (95% CI 1.2–3.6) and for women 2.6% (95% CI 1.7–3.6). For the specific hazards of poor hygiene, house in need of repair, unsanitary conditions and inadequate utilities, prevalence remained persistently higher for black than white older adults. Among men, the prevalence of self-neglect was more than 6-fold higher for black than white older adults (OR 6.21, 95% CI 3.55–10.86). Among women, the prevalence of self-neglect was more than 4-fold higher for black than white older adults (OR 4.52, 95% CI 3.01–6.80). Similar trends

Table 2. Prevalence of hoarding, poor hygiene and environmental hazards by race/ethnicity

	Sex	Number	White % (95% CI)	Black % (95% CI)	Black vs. white odds ratio (CI)
Overall self-neglect	M	1,642	2.4 (1.2–3.6)	13.2 (11.2–15.3)	6.21 (3.55–10.86)*
	F	2,969	2.6 (1.7–3.6)	10.9 (9.5–12.3)	4.52 (3.01–6.80)*
Hoarding	M	1,562	0.9 (0.1–1.6)	6.9 (5.4–8.6)	8.56 (3.44–21.35)*
	F	2,837	0.9 (0.4–1.6)	5.4 (4.4–6.5)	5.74 (2.98–11.05)*
Personal hygiene	M	1,531	0.2 (0.0–0.5)	4.4 (3.1–5.7)	26.08 (3.58–189.99)*
	F	2,781	0.0 (0.0–0.0)	2.9 (2.2–3.8)	xxx
House needing repair	M	1,582	1.0 (0.2–1.9)	8.8 (7.0–10.5)	9.11 (3.96–20.96)*
	F	2,863	0.8 (0.3–1.3)	6.9 (5.7–8.0)	9.20 (4.49–18.88)*
Unsanitary conditions	M	1,549	1.0 (0.2–1.9)	5.7 (4.2–7.1)	5.69 (2.44–13.30)*
	F	2,810	0.9 (0.4–1.6)	4.0 (3.1–4.9)	4.17 (2.14–8.12)*
Inadequate utilities	M	1,498	0.0 (0.0–0.0)	1.1 (0.4–1.7)	xxx
	F	2,748	0.3 (0.0–0.6)	0.9 (0.5–1.4)	3.28 (0.96–11.24)

CI was based on inversion of the Wald test constructed with the use of standard errors. Odds ratios were based on logistic regression estimated separately for men and women.

xxx = Odds ratios could not be calculated based on the 0 prevalence of the indicators in any of the categorical definition of variables.

* $p < 0.005$.

for race/ethnicity were found for hoarding, poor hygiene, house in need of repair, unsanitary conditions and inadequate utilities for both men and women (Appendix 1).

For the levels of education, the prevalence of self-neglect for men was 6.0% (95% CI, 4.3–7.7) for those with \geq college education, 9.7% (95% CI 6.9–12.4) for those with high school education, and 14.7% (95% CI 11.5–18.1) for those with less than high school education (table 3). For women, the prevalence of self-neglect was 7.1% (95% CI 5.7–8.4) for those with \geq college education, 7.5% (95% CI 5.9–9.2) for those with high school education, and 10.9% (95% CI 8.5–13.3) for those with less than high school education. The prevalence of self-neglect increased significantly with each lower level of education (men: OR 1.14, 95% CI 1.09–1.19; women: OR 1.09, 95% CI 1.05–1.14). Similar trends for education levels were found for hoarding, poor hygiene, house in need of repair, unsanitary conditions and inadequate utilities for both men and women (Appendix 2). Figure 1a demonstrates the odds ratio and 95% CI for the risk of specific personal and environmental hazards associated with lower levels of education.

For levels of income (table 4), the prevalence of self-neglect for men was 5.3% (95% CI 3.8–6.7) for those with annual income of more than USD 30,000, 12.2% (95% CI 9.6–14.9) for those with annual income between USD

15,000 and 30,000, and 21.7% (95% CI 15.4–28.1) for those with annual income of less than USD 15,000. For women, the prevalence of self-neglect was 3.3% (95% CI 2.2–4.5) for those with annual income of more than USD 30,000, 8.0% (95% CI 6.4–9.6) for those with annual income between USD 15,000 and 30,000, and 15.3% (95% CI 12.7–17.9) for those with annual income of less than USD 15,000. The prevalence of the self-neglect increased significantly with lower levels of income (men: OR 1.34, 95% CI 1.24–1.44; women: OR 1.22, 95% CI 1.25–1.42). Similar trends for income levels were found for hoarding, hygiene and other environmental hazards for both men and women (Appendix 3). Figure 1b demonstrates the odds ratio and 95% CI for the risk for specific personal and environmental hazards associated with lower levels of income.

Discussion

Our study suggests that the prevalence of self-neglect and specific personal and environmental hazards was higher in black older adults and white older adults in a geographically defined urban community-dwelling aging population. In addition, the prevalence of self-neglect and specific personal and environmental hazards was higher among those with lower levels of education and income.

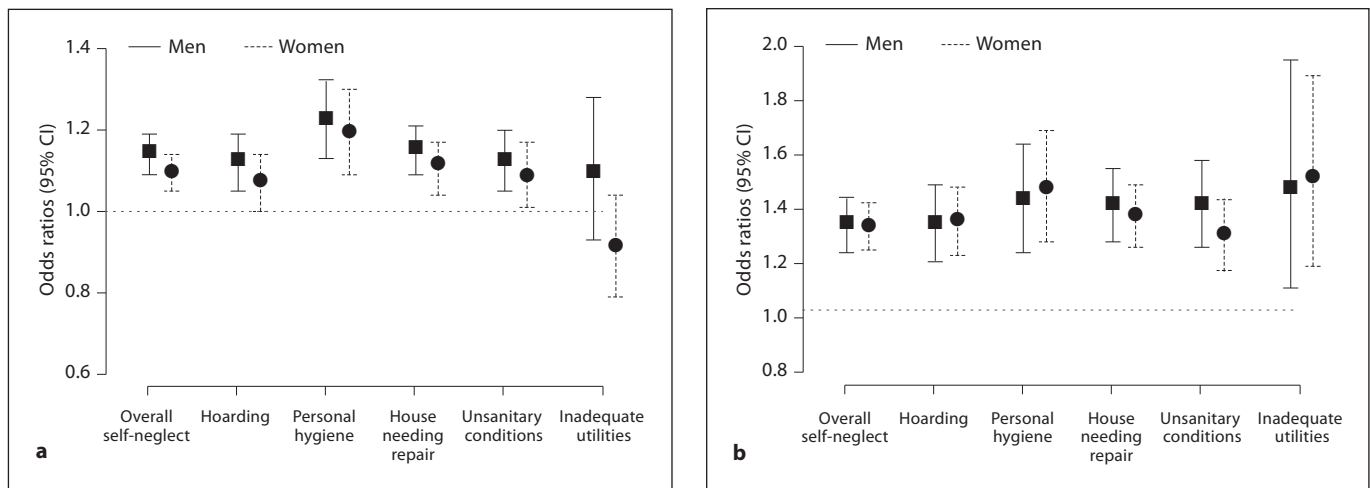


Fig. 1. Odds ratio for yearly decreases in education (a) and income levels (b) as well as risk for overall self-neglect and specific behaviors of hoarding, personal hygiene, house repair, unsanitary conditions and inadequate utilities.

Table 3. Prevalence of hoarding, poor hygiene and environmental hazards by levels of education

	Sex	Number	College % (95% CI)	High school % (95% CI)	<High school % (95% CI)	High school vs. college odds ratio (CI)	<High school vs. college odds ratio (CI)
Overall self-neglect	M	1,642	6.0 (4.3–7.7)	9.7 (6.9–12.4)	14.7 (11.5–18.1)	1.67 (1.08–2.58) ⁺	2.73 (1.83–4.06) [*]
	F	2,976	7.1 (5.7–8.4)	7.5 (5.9–9.2)	10.9 (8.5–13.3)	1.07 (0.78–1.47)	1.66 (1.20–2.29) [*]
Hoarding	M	1,562	3.3 (2.0–4.6)	4.9 (2.9–7.0)	7.1 (4.6–9.5)	1.53 (0.84–2.78)	2.29 (1.32–3.98) [*]
	F	2,843	3.5 (2.5–4.5)	3.9 (2.7–5.2)	4.6 (2.9–6.3)	1.13 (0.73–1.76)	1.38 (0.85–2.23)
Personal hygiene	M	1,530	1.1 (0.4–1.9)	1.9 (0.6–3.3)	6.6 (4.2–9.0)	1.75 (0.65–4.69)	6.19 (2.78–13.75) [*]
	F	2,786	1.5 (0.8–2.1)	1.5 (0.7–2.2)	3.6 (2.1–5.1)	0.99 (0.49–2.01)	2.51 (1.34–4.69) [*]
House needing repair	M	1,582	3.7 (2.3–5.1)	6.5 (4.2–8.8)	9.3 (6.5–12.0)	1.81 (1.05–3.12) ⁺	2.72 (1.64–4.49) [*]
	F	2,870	3.9 (2.9–4.9)	4.3 (3.0–5.7)	7.1 (5.1–9.1)	1.11 (0.73–1.69)	1.96 (1.30–2.96) [*]
Unsanitary conditions	M	1,549	2.9 (1.7–4.1)	3.6 (1.8–5.4)	6.1 (3.8–8.5)	1.25 (0.64–2.45)	2.27 (1.26–4.09) ⁺
	F	2,816	2.9 (1.9–3.8)	2.1 (1.2–3.0)	4.3 (2.6–5.9)	0.72 (0.41–1.26)	1.55 (0.93–2.58)
Inadequate utilities	M	1,497	0.4 (0.0–0.9)	1.2 (0.2–2.3)	0.5 (0.0–1.2)	2.91 (0.69–12.25)	1.22 (0.20–7.34)
	F	2,753	0.9 (0.4–1.4)	0.5 (0.1–0.9)	0.9 (0.1–1.7)	0.53 (0.17–1.66)	1.03 (0.36–2.98)

CI was based on inversion of the Wald test constructed with the use of standard errors. Odds ratios were based on a logistic regression estimated separately for men and women.

⁺ $p < 0.05$; ^{*} $p < 0.005$.

Reports from the National Adult Protective Services Agency suggests these reported cases are on the rise [2]. In addition, the National Center on Elder Abuse reports that elder self-neglect is more common than all other forms of elder abuse, neglect and exploitations combined [1]. Prior studies suggest that hoarding is common among minority populations and the extreme clutter interferes with basic hygiene and poses dangerous circumstances for health and safety not only for older adults but also those surrounding them [14, 15]. However, only a fraction of these older adults accept social and supportive services

from social service agencies, healthcare professionals, and other relevant aging disciplines.

Halliday et al. [16] conducted an environmental observational study of 91 clients requiring special cleaning services in an inner London borough, and found that physical disorders were common among higher levels of domestic squalor. Recent studies suggest that minority older adults and lower levels of socioeconomic status were common factors for older adults to be reported to Adult Protective Services. Although great paucity remains in our current understanding of the factors associated with

Table 4. Prevalence of hoarding, poor hygiene and environmental hazards by levels of annual income

	Sex	Number	USD >30,000 % (95% CI)	USD 15,000– 30,000 % (95% CI)	USD <15,000 % (95% CI)	USD 15,000–30,000 vs. >30,000 odds ratio (CI)	USD <15,000 vs. >30,000 odds ratio (CI)
Overall self-neglect	M	1,613	5.3 (3.8–6.7)	12.2 (9.6–14.9)	21.7 (15.4–28.1)	2.55 (1.73–3.76)*	5.02 (3.12–8.10)*
	F	2,863	3.3 (2.2–4.5)	8.0 (6.4–9.6)	15.3 (12.7–17.9)	2.47 (1.65–3.70)*	5.11 (3.43–7.60)*
Hoarding	M	1,535	2.8 (1.7–3.9)	5.9 (3.9–8.0)	11.9 (6.6–17.2)	2.27 (1.33–3.89)*	4.68 (2.44–8.95)*
	F	2,731	1.3 (0.6–2.1)	4.3 (3.1–5.5)	7.1 (5.2–9.1)	3.37 (1.82–6.26)*	5.67 (3.04–10.57)*
Personal hygiene	M	1,504	1.2 (0.5–1.9)	4.0 (2.3–5.7)	8.7 (3.9–13.4)	3.47 (1.62–7.44)*	7.93 (3.35–18.73)*
	F	2,676	0.2 (0.0–0.5)	2.3 (1.4–3.1)	4.2 (2.7–5.8)	10.96 (2.58–46.49)*	21.18 (5.02–89.36)*
House needing repair	M	1,553	2.9 (1.8–4.1)	7.6 (5.3–9.8)	16.6 (10.6–22.5)	2.78 (1.67–4.62)*	6.60 (3.68–11.86)*
	F	2,759	1.9 (1.0–2.7)	4.1 (2.9–5.3)	10.4 (8.1–12.7)	2.21 (1.29–3.80)*	5.86 (3.49–9.82)*
Unsanitary conditions	M	1,522	2.0 (1.1–2.9)	4.7 (2.9–6.6)	12.5 (7.1–17.9)	2.53 (1.36–4.71)*	6.99 (3.51–13.92)*
	F	2,706	1.4 (0.7–2.2)	2.9 (1.9–3.9)	5.6 (3.8–7.3)	2.15 (1.15–4.05) ⁺	4.03 (2.16–7.54)*
Inadequate utilities	M	1,471	0.4 (0.0–0.8)	0.6 (0.0–1.3)	3.1 (0.1–6.1)	1.65 (0.33–8.23)*	8.80 (1.95–39.80)*
	F	2,643	0.3 (0.0–0.7)	0.6 (0.1–1.0)	1.8 (0.7–2.8)	1.83 (0.46–7.33)	5.75 (1.59–20.70)*

CI was based on inversion of the Wald test constructed with the use of standard errors. Odds ratios were based on a logistic regression estimated separately for men and women.

⁺ $p < 0.05$; * $p < 0.005$.

self-neglect, existing evidence suggests that older adults who have encounters with Adult Protective Services may have significant nutritional deficiencies, untreated medical conditions, unmanaged pain, as well as premature morbidity and mortality [6, 8, 17–19].

Our study extends the existing literature. This is the first population-based study to systematically examine the issues of self-neglect and specific personal and environmental hazards in a diverse community, expanding the generalizability of the study findings. Our findings contrast prior studies based on case reports from the Adult Protective Services and further highlight the scope of the self-neglecting behaviors in a representative community population. In addition, our study provides a detailed estimate of the specific behaviors of hoarding, poor personal hygiene, house in need of repair, unsanitary conditions and inadequate utilities. Improved understanding of the scope of these specific personal and environmental hazards within the subgroups could inform practice and policy to safeguard these older adults.

Moreover, this study is the first to demonstrate the gradient relations between socioeconomic status and risk for these personal and environmental hazards. Healthcare professionals, social service agencies and other relevant disciplines that have frequent encounters with these older adults should pay particular attention to the personal and environmental hazards, which could negatively contribute to health and safety of an already vulnerable population.

The prevalence differences of self-neglecting behaviors among different sociodemographic and socioeco-

omic subgroups require further investigation. It is possible that there are significant differences in health-related factors that might contribute to the syndrome of self-neglect. There could also be differences in the onset of medical conditions, types of medical conditions, higher rate of medical comorbidities, and greater changes in the severity of medical conditions which could contribute toward the differences in prevalence findings [20–23].

The causal mechanism of the study findings requires further investigation. Even though our study findings demonstrate strength in the degree of association between race, education and income, there are likely other confounders or mediators not considered in our analyses. We did not have data on the severity of medical comorbidities (degree of congestive heart failure or diabetes control, severity of obstructive lung disease, etc.) that could have likely exacerbated the degree of self-neglecting behaviors. In addition, metabolic abnormalities, nutritional deficiencies, infections, injuries or trauma may be other factors that account for the observed association with self-neglect.

Moreover, there could be black and white health disparity that could have significantly mediated the potential casual mechanisms, such as access to health and healthcare professionals as well as racial trust in physicians and cultural competency in their communication with healthcare professionals. Furthermore, causal mechanisms for our observed findings could be mediated through the theory of cumulative disadvantage [24]. This theory suggests that individuals with higher education have more health resources including improved ability to

avoid stressors and unhealthy lifestyles and thus have beneficial, cumulative effects on health with increasing age. These issues rooted in health disparities are important and should be subject to further investigation.

Our study has limitations. First, we do not have information on the length of time to which these personal and environmental hazards have been in the household as well as any harm that could have resulted from these conditions. Future studies are needed to elucidate the consequences of these behaviors. Second, we did not have detailed information on the participant's perception of these personal and environmental hazards. Additional qualitative information could provide improved understanding of the setting and context of these behaviors. Third, there are likely other threats to validity that are not considered in this study. Future studies are needed to improve the internal validities of our study findings to elucidate the causal mechanism for elder self-neglect.

Fourth, we did not have information on the onset of medical conditions, severity of medical conditions, trajectory of decline in medical conditions, recent infections, metabolic abnormalities, illicit drug use and psychiatric diagnosis, which could be potential factors contributing to the behaviors of self-neglect. Fifth, the study did not have any information on the social service agencies' or healthcare professionals' interventions as the result of self-neglect or the effectiveness of these interventions in modifying these hazards and if the participants were willing to accept these interventions.

Sixth, we did not have comprehensive measures of socioeconomic status (i.e. occupation prestige, savings, quality of education, etc.) which could have operated differently by race/ethnicity and contributed toward the black and white differences in overall self-neglect and

specific personal and environmental hazards. Future longitudinal studies are needed to quantify the temporal relations of socioeconomic status and self-neglect in representative populations.

Conclusion

In sum, self-neglect is a common but under-recognized and poorly understood problem in community older adults, especially among black older adults and among those with lower levels of education and income. Like other geriatric syndromes that are the result of the complex interaction between a variety of medical, psychological and social factors, these personal and environmental hazards are likely to develop and progress slowly over time [25]. Our findings inform the healthcare professionals, social service agencies and other relevant aging disciplines on the scope and nature of a pervasive public health issue. Future studies are needed to quantify the risk/protective factors and consequences of self-neglect phenotypes in order to better inform practice and policy on the screening, treatment and prevention strategies.

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Appendix 1

Prevalence of hoarding, poor hygiene and environmental hazards by race/ethnicity

	Sex	Number	White % (95% CI)	Black % (95% CI)	Black vs. white odds ratio
<i>Hoarding</i>					
Newspaper/magazines	M	1,561	0.9 (0.1–1.6)	6.9 (5.3–8.5)	8.43 (3.38–21.05)
	F	2,834	0.9 (0.4–1.6)	5.3 (4.2–6.3)	5.56 (2.89–10.72)*
Boxes, bags, or bottles	M	1,559	0.7 (0.0–1.4)	6.8 (5.3–8.4)	10.40 (3.77–28.68)*
	F	2,829	0.9 (0.3–1.5)	5.1 (4.1–6.1)	5.93 (2.98–11.79)*
Trash	M	1,538	0.0 (0.0–0.0)	5.2 (3.8–6.6)	xxx
	F	2,794	0.1 (0.0–0.3)	3.6 (2.8–4.5)	37.67 (5.22–271.90)*
Pets	M	1,506	0.0 (0.0–0.0)	1.9 (1.0–2.8)	xxx
	F	2,756	0.2 (0.0–0.5)	1.5 (0.9–2.1)	7.53 (1.78–31.79) ⁺

Appendix 1 (continued)

	Sex	Number	White % (95% CI)	Black % (95% CI)	Black vs. white odds ratio
<i>Personal hygiene</i>					
Skin or Nails	M	1,530	0.2 (0.0–0.5)	4.2 (2.9–5.6)	25.46 (3.49–185.58)*
	F	2,779	0.0 (0.0–0.0)	2.9 (2.1–3.6)	xxx
Hair dirty/ungroomed	M	1,530	0.2 (0.0–0.5)	4.3 (2.9–5.6)	25.46 (3.49–185.58)*
	F	2,775	0.0 (0.0–0.0)	2.7 (1.9–3.4)	xxx
Clothes dirty	M	1,530	0.2 (0.0–0.5)	4.3 (2.9–5.6)	25.46 (3.49–185.579)*
	F	2,776	0.0 (0.0–0.0)	2.7 (1.9–3.5)	xxx
Fecal or urine smell	M	1,525	0.2 (0.0–0.5)	3.8 (2.6–4.9)	22.34 (3.06–163.25)*
	F	2,776	0.0 (0.0–0.0)	2.7 (1.9–3.5)	xxx
<i>House in need of repair</i>					
Interior walls	M	1,578	0.5 (0.0–1.1)	8.7 (6.9–10.4)	18.0 (5.67–57.18)*
	F	2,857	0.7 (0.2–1.2)	6.6 (5.5–7.7)	10.10 (4.69–21.73)*
Stairs, flooring or carpet	M	1,574	0.5 (0.0–1.1)	8.3 (6.6–10.0)	17.2 (5.40–54.60)*
	F	2,850	0.6 (0.1–1.1)	6.3 (5.2–7.4)	11.21 (4.92–25.55)*
Bath/kitchen	M	1,558	0.7 (0.0–1.4)	6.7 (5.1–8.3)	10.25 (3.71–28.26)*
	F	2,819	0.6 (0.1–1.1)	4.7 (3.7–5.7)	8.21 (3.57–18.84)*
Appliance/lighting	M	1,559	0.7 (0.0–1.4)	6.8 (5.2–8.4)	10.40 (3.77–28.68)*
	F	2,821	0.5 (0.1–0.9)	4.9 (3.9–5.8)	10.20 (4.13–25.20)*
House exterior	M	1,575	0.9 (0.1–1.6)	8.2 (6.5–9.9)	10.18 (4.10–25.27)*
	F	2,849	0.8 (0.3–1.3)	6.1 (5.0–7.2)	8.18 (3.98–16.83)*
<i>Unsanitary conditions</i>					
Extremely dirty or cluttered	M	1,545	0.5 (0.0–1.1)	5.6 (4.1–7.0)	11.18 (3.48–35.91)*
	F	2,807	0.8 (0.3–1.3)	3.9 (3.1–4.9)	5.14 (2.47–10.73)*
Spoiled or rotten food	M	1,524	0.4 (0.0–0.8)	3.6 (2.4–4.8)	10.56 (2.53–44.10)*
	F	2,763	0.3 (0.0–0.6)	1.8 (1.2–2.4)	6.18 (1.89–20.24)*
Many dirty dishes	M	1,529	0.2 (0.0–0.5)	4.2 (2.9–5.4)	24.81 (3.41–180.71)*
	F	2,773	0.2 (0.0–0.5)	2.4 (1.7–3.2)	12.46 (3.01–51.55)*
Insect/rodent infestation	M	1,518	0.0 (0.0–0.0)	3.2 (2.1–4.3)	xxx
	F	2,756	0.1 (0.0–0.3)	1.5 (0.9–2.1)	15.65 (2.12–115.32) ⁺
Foul odor	M	1,539	0.9 (0.1–1.6)	4.8 (3.4–6.1)	5.71 (2.26–14.46)*
	F	2,789	0.6 (0.1–1.1)	3.1 (2.3–3.9)	5.31 (2.28–12.38)*
<i>Inadequate utility</i>					
Heating or air conditioning	M	1,494	0.0 (0.0–0.0)	0.7 (0.1–1.2)	xxx
	F	2,744	0.2 (0.0–0.5)	0.8 (0.4–1.2)	4.06 (0.92–17.89)
Water	M	1,491	0.0 (0.0–0.0)	0.3 (0.0–0.7)	xxx
	F	2,734	0.0 (0.0–0.0)	0.4 (0.1–0.6)	xxx
Electricity	M	1,494	0.0 (0.0–0.0)	0.7 (0.1–1.2)	xxx
	F	2,741	0.3 (0.0–0.6)	0.6 (0.2–0.9)	1.93 (0.53–7.04)

CI is based on the inversion of the Wald test constructed with the use of standard errors. Adjusted odds ratios are based on a logistic regression, estimated separately for men and women. xxx = Odds ratio could not be calculated based on the 0 prevalence of the indicators in any of the categorical definition of variables; ⁺ p < 0.05; * p < 0.005.

Appendix 2

Prevalence of hoarding, poor hygiene and environmental hazards by levels of education

	Sex	Number	College % (95% CI)	High school % (95% CI)	<High school % (95% CI)	High school vs. college odds ratio	<High school vs. college odds ratio
<i>Hoarding</i>							
Newspaper/ magazines	M	1,561	3.2 (1.9–4.5)	4.9 (2.9–7.0)	7.1 (4.6–9.5)	1.59 (0.87–2.92)	2.39 (1.37–4.17)*
	F	2,740	3.4 (2.4–4.4)	3.8 (2.6–5.1)	4.4 (2.8–6.1)	1.12 (0.72–1.76)	1.36 (0.84–2.22)
Boxes, bags, or bottles	M	1,559	3.0 (1.8–4.3)	4.9 (2.9–7.0)	6.8 (4.4–9.3)	1.67 (0.91–3.07)	2.42 (1.37–4.26)*
	F	2,835	3.3 (2.4–4.3)	3.7 (2.5–4.9)	3.9 (2.4–5.5)	1.12 (0.71–1.76)	1.24 (0.75–2.05)
Trash	M	1,538	1.9 (0.9–2.9)	3.1 (1.5–4.8)	5.7 (3.4–7.9)	1.62 (0.76–3.48)	3.14 (1.61–6.15)*
	F	2,800	2.5 (1.7–3.4)	2.1 (1.2–3.0)	2.4 (1.2–3.7)	0.83 (0.47–1.47)	1.03 (0.56–1.91)
Pets	M	1,505	0.9 (0.3–1.7)	0.9 (0.0–1.9)	1.8 (0.5–3.1)	0.99 (0.29–3.43)	1.83 (0.64–5.26)
	F	2,762	0.9 (0.4–1.5)	0.9 (0.3–1.5)	1.4 (0.4–2.4)	0.96 (0.39–2.37)	1.70 (0.71–4.06)
<i>Personal hygiene</i>							
Skin or nails	M	1,529	1.1 (0.4–1.9)	1.9 (0.6–3.3)	6.4 (4.0–8.7)	1.75 (0.65–4.69)	5.96 (2.67–13.29)*
	F	2,784	1.4 (0.8–2.0)	1.5 (0.7–2.2)	3.4 (1.9–4.9)	1.04 (0.51–2.14)	2.52 (1.32–4.80)*
Hair dirty/ ungroomed	M	1,529	1.1 (0.4–1.9)	1.9 (0.6–3.3)	6.4 (4.0–8.7)	1.75 (0.65–4.69)	5.96 (2.67–13.29)*
	F	2,780	1.2 (0.6–1.8)	1.3 (0.6–2.1)	3.3 (1.8–4.7)	1.08 (0.51–2.30)	2.69 (1.37–5.27)*
Clothes dirty	M	1,529	1.1 (0.4–1.9)	1.9 (0.6–3.3)	6.4 (4.0–8.7)	1.75 (0.65–4.69)	5.96 (2.67–13.29)*
	F	2,781	1.2 (0.6–1.8)	1.3 (0.6–2.1)	3.4 (1.9–4.9)	1.08 (0.51–2.30)	2.83 (1.46–5.51)*
Fecal or urine smell	M	1,524	0.9 (0.3–1.7)	1.7 (0.5–2.9)	5.7 (3.4–7.9)	1.75 (0.61–5.01)	6.02 (2.56–14.16)*
	F	2,781	1.4 (0.8–2.0)	1.3 (0.6–2.1)	3.1 (1.7–4.5)	0.96 (0.46–2.01)	2.27 (1.17–4.39) ⁺
<i>House in need of repair</i>							
Interior walls	M	1,578	3.3 (2.0–4.6)	6.5 (4.2–8.8)	9.1 (6.3–11.8)	2.04 (1.17–3.56) ⁺	2.98 (1.77–5.03)*
	F	2,864	3.7 (2.7–4.7)	4.2 (2.9–5.5)	6.8 (4.8–8.8)	1.15 (0.75–1.77)	1.99 (1.31–3.03)*
Stairs, flooring or carpet	M	1,574	3.2 (1.9–4.5)	6.3 (4.0–8.6)	8.6 (5.9–11.3)	2.05 (1.16–3.62) ⁺	2.95 (1.73–5.04)*
	F	2,857	3.6 (2.6–4.6)	3.9 (2.7–5.2)	6.5 (4.5–8.4)	1.11 (0.71–1.72)	1.98 (1.29–3.04)*
Bath/kitchen	M	1,558	2.5 (1.4–3.7)	4.9 (2.9–7.0)	7.5 (4.9–10.5)	2.04 (1.07–3.87) ⁺	3.26 (1.81–5.88)*
	F	2,825	2.7 (1.8–3.5)	2.9 (1.8–3.9)	5.1 (3.3–6.8)	1.07 (0.64–1.79)	2.01 (1.23–3.29) ⁺
Appliance/ lighting	M	1,559	2.9 (1.7–4.1)	4.7 (2.7–6.8)	7.3 (4.8–9.8)	1.66 (0.89–3.11)	2.71 (1.53–4.77)*
	F	2,828	2.8 (1.9–3.7)	3.2 (2.0–4.3)	4.6 (2.9–6.3)	1.13 (0.69–1.85)	1.78 (1.08–2.92) ⁺
House exterior	M	1,575	3.4 (2.1–4.8)	6.1 (3.8–8.3)	8.6 (5.9–11.3)	1.82 (1.04–3.19) ⁺	2.71 (1.61–4.57)*
	F	2,856	3.5 (2.5–4.5)	4.0 (2.8–5.3)	6.3 (4.4–8.3)	1.16 (0.75–1.81)	1.97 (1.28–3.05)*
<i>Unsanitary conditions</i>							
Extremely dirty or cluttered	M	1,545	2.5 (1.4–3.7)	3.6 (1.8–5.4)	5.9 (3.6–8.2)	1.46 (0.73–2.92)	2.55 (1.37–4.73)*
	F	2,813	2.7 (1.9–3.6)	2.0 (1.1–2.9)	4.3 (2.6–5.9)	0.72 (0.41–1.28)	1.64 (0.98–2.74)
Spoiled or rotten food	M	1,524	1.9 (0.9–2.9)	1.9 (0.6–3.3)	3.5 (1.7–5.4)	0.99 (0.42–2.39)	1.96 (0.94–4.11)
	F	2,769	1.5 (0.8–2.1)	0.7 (0.1–1.2)	1.8 (0.7–2.8)	0.46 (0.18–1.15)	1.31 (0.62–2.78)
Many dirty dishes	M	1,529	1.9 (0.9–2.9)	2.2 (0.8–3.6)	4.5 (2.5–6.5)	1.12 (0.48–2.62)	2.49 (1.23–5.02) ⁺
	F	2,779	1.7 (0.9–2.4)	1.1 (0.4–1.8)	2.3 (1.0–3.5)	0.66 (0.31–1.39)	1.44 (0.73–2.84)
Insect/rodent infestation	M	1,518	1.4 (0.5–2.3)	1.7 (0.5–2.9)	3.3 (1.5–5.1)	1.22 (0.46–3.24)	2.57 (1.13–5.83) ⁺
	F	2,762	0.9 (0.4–1.5)	0.9 (0.3–1.5)	1.4 (0.4–2.4)	0.96 (0.39–2.37)	1.70 (0.71–4.06)
Foul odor	M	1,539	2.5 (1.4–3.7)	3.1 (1.5–4.8)	4.9 (2.9–7.1)	1.26 (0.61–2.60)	2.14 (1.13–4.06) ⁺
	F	2,795	2.2 (1.4–3.0)	1.7 (0.8–2.5)	2.9 (1.6–4.3)	0.75 (0.39–1.40)	1.41 (0.78–2.56)
<i>Inadequate utilities</i>							
Heating/air conditioning	M	1,493	0.4 (0.0–0.9)	0.7 (0.0–1.6)	0.0 (0.0–0.0)	1.75 (0.35–8.69)	xxx
	F	2,749	0.8 (0.3–1.3)	0.5 (0.0–0.9)	0.4 (0.0–0.8)	0.58 (0.18–1.85)	0.45 (0.09–2.08)
Water	M	1,490	0.1 (0.0–0.4)	0.5 (0.0–1.2)	0.0 (0.0–0.0)	3.49 (0.32–38.64)	xxx
	F	2,739	0.3 (0.0–0.6)	0.1 (0.0–0.3)	0.2 (0.0–0.5)	0.36 (0.04–3.24)	0.57 (0.06–5.08)
Electricity	M	1,493	0.1 (0.0–0.4)	0.7 (0.0–1.6)	0.5 (0.0–1.2)	5.23 (0.54–50.53)	3.67 (0.33–40.56)
	F	2,746	0.6 (0.2–1.1)	0.3 (0.0–0.7)	0.4 (0.0–0.8)	0.54 (0.14–2.05)	0.57 (0.12–2.68)

CI is based on inversion of the Wald test constructed with the use of standard errors. Adjusted odds ratios are based on a logistic regression, estimated separately for men and women. xxx = Odds ratio could not be calculated based on the 0 prevalence of the indicators in any of the categorical definitions of variables; ⁺ p < 0.05; * p < 0.005.

Appendix 3

Prevalence of hoarding, poor hygiene and environmental hazards by levels of annual income

	Sex	Number	USD >30,000 % (95% CI)	USD 15,000–30,000 % (95% CI)	USD <15,000 % (95% CI)	USD 15,000–30,000 vs. >30,000, odds ratio	<15,000 vs. >30,000 odds ratio
<i>Hoarding</i>							
Newspaper/ magazines	M	1,534	2.7 (1.6–3.8)	5.9 (3.9–8.0)	11.9 (6.6–17.2)	2.37 (1.38–4.09)*	4.88 (2.54–9.39)*
	F	2,728	1.1 (0.5–1.8)	4.3 (3.1–5.5)	7.0 (5.1–8.9)	3.98 (2.06–7.72)*	6.56 (3.37–12.76)*
Boxes, bags, or bottles	M	1,532	2.6 (1.5–3.6)	5.8 (3.8–7.8)	11.9 (6.6–17.2)	2.41 (1.38–4.19)*	5.11 (2.64–9.87)*
	F	2,723	1.1 (0.5–1.8)	4.1 (2.9–5.3)	6.6 (4.7–8.5)	3.82 (1.97–7.42)*	6.13 (3.14–11.98)*
Trash	M	1,511	1.7 (0.8–2.5)	3.8 (2.2–5.5)	10.6 (5.6–15.7)	2.48 (1.25–4.92) ⁺	7.08 (3.34–15.01)*
	F	2,689	0.8 (0.3–1.4)	2.8 (1.8–3.8)	4.2 (2.7–5.8)	3.54 (1.62–7.74)*	5.29 (2.39–11.73)*
Pets	M	1,478	0.7 (0.2–1.3)	1.2 (0.2–2.1)	3.8 (0.5–7.1)	1.65 (0.53–5.16)	5.51 (1.66–18.30) ⁺
	F	2,652	0.3 (0.0–0.7)	1.2 (0.6–1.9)	1.9 (0.9–3.0)	4.26 (1.22–14.88) ⁺	6.27 (1.76–22.32)*
<i>Personal hygiene</i>							
Skin or nails	M	1,503	1.2 (0.5–1.9)	3.8 (2.2–5.5)	8.7 (3.9–13.4)	3.31 (1.54–7.12)*	7.93 (3.36–18.73)*
	F	2,674	0.2 (0.0–0.5)	2.3 (1.4–3.1)	3.9 (2.4–5.4)	10.96 (2.58–46.49)*	19.61 (4.63–83.07)*
Hair dirty/ ungroomed	M	1,503	1.2 (0.5–1.9)	3.8 (2.2–5.5)	8.7 (3.9–13.4)	3.31 (1.54–7.12)*	7.93 (3.36–18.73)*
	F	2,670	0.2 (0.0–0.5)	2.1 (1.2–2.9)	3.6 (2.2–5.1)	10.05 (2.36–42.84)*	18.04 (4.24–76.78)*
Clothes dirty	M	1,503	1.2 (0.5–1.9)	3.8 (2.2–5.5)	8.7 (3.9–13.4)	3.31 (1.54–7.12)*	7.93 (3.36–18.73)*
	F	2,671	0.2 (0.0–0.5)	1.9 (1.1–2.8)	3.9 (2.4–5.4)	9.59 (2.24–41.01)*	19.61 (4.63–83.07)*
Fecal or urine smell	M	1,498	1.2 (0.5–1.9)	3.3 (1.7–4.8)	7.4 (2.9–11.7)	2.81 (1.28–6.19) ⁺	6.60 (2.69–16.18)*
	F	2,671	0.2 (0.0–0.5)	1.9 (1.1–2.8)	3.9 (2.4–5.4)	9.59 (2.24–41.01)*	19.61 (4.62–83.07)*
<i>House in need of repair</i>							
Interior walls	M	1,549	2.5 (1.4–3.5)	7.6 (5.3–9.8)	16.6 (10.6–22.5)	3.31 (1.94–5.65)*	7.86 (4.27–14.46)*
	F	2,753	1.6 (0.9–2.4)	4.1 (2.9–5.3)	9.9 (7.6–12.1)	2.47 (1.41–4.34)*	6.18 (3.59–10.63)*
Stairs, flooring or carpet	M	1,545	2.4 (1.3–3.4)	7.2 (5.0–9.4)	16.0 (10.1–21.9)	3.31 (1.91–5.72)*	7.92 (4.25–14.76)*
	F	2,746	1.6 (0.9–2.4)	3.9 (2.8–5.1)	9.2 (7.0–11.4)	2.36 (1.34–4.17)*	5.72 (3.31–9.88)*
Bath/kitchen	M	1,531	1.8 (0.9–2.7)	5.8 (3.8–7.8)	15.4 (9.6–21.2)	3.53 (1.89–6.58)*	10.13 (5.15–19.93)*
	F	2,714	1.2 (0.5–1.9)	2.8 (1.8–3.8)	7.3 (5.3–9.3)	2.36 (1.21–4.62) ⁺	6.28 (3.31–11.91)*
Appliance/ lighting	M	1,531	2.0 (1.1–2.9)	5.6 (3.7–7.6)	14.9 (9.1–20.6)	3.02 (1.65–5.51)*	8.55 (4.42–16.54)*
	F	2,717	1.1 (0.5–1.8)	3.2 (2.2–4.3)	7.0 (5.1–8.9)	2.74 (1.42–5.29)*	6.01 (3.16–11.44)*
House exterior	M	1,546	2.6 (1.5–3.6)	7.0 (4.9–9.2)	16.0 (10.1–21.9)	2.93 (1.72–5.00)*	7.20 (3.92–13.23)*
	F	2,745	1.6 (0.9–2.4)	3.8 (2.6–4.9)	9.4 (7.2–11.5)	2.26 (1.28–3.99)*	5.83 (3.37–10.03)*
<i>Unsanitary conditions</i>							
Extremely dirty or cluttered	M	1,518	1.7 (0.8–2.5)	4.7 (2.9–6.6)	11.9 (6.6–17.2)	3.07 (1.59–5.94)*	8.02 (3.86–16.67)*
	F	2,703	1.3 (0.6–2.1)	2.9 (1.9–3.9)	5.4 (3.7–7.2)	2.25 (1.17–4.31) ⁺	4.22 (2.22–8.04)*
Spoiled or rotten food	M	1,497	1.3 (0.5–2.1)	2.3 (1.0–3.6)	8.7 (3.9–13.4)	1.96 (0.87–4.39)	7.20 (3.11–16.67)*
	F	2,659	0.4 (0.0–0.8)	1.4 (0.7–2.1)	2.6 (1.3–3.8)	3.65 (1.22–10.97) ⁺	6.27 (2.09–18.86)*
Many dirty dishes	M	1,502	1.3 (0.5–2.1)	2.7 (1.3–4.1)	10.6 (5.6–15.7)	2.26 (1.03–4.95)*	9.00 (4.05–20.04)*
	F	2,669	0.5 (0.1–0.9)	1.7 (0.9–2.5)	3.5 (2.1–4.9)	3.47 (1.29–9.33) ⁺	6.90 (2.60–18.32)*
Insect/rodent infestation	M	1,491	1.1 (0.4–1.8)	1.8 (0.6–2.9)	8.0 (3.5–12.6)	1.84 (0.74–4.55)	8.07 (3.28–19.86)*
	F	2,652	0.2 (0.0–0.5)	1.1 (0.5–1.8)	2.2 (1.1–3.4)	5.93 (1.34–26.35) ⁺	10.97 (2.49–48.43)*
Foul odor	M	1,512	1.7 (0.8–2.5)	3.7 (2.0–5.3)	11.9 (6.6–17.2)	2.36 (1.18–4.72) ⁺	8.02 (3.86–16.67)*
	F	2,685	0.6 (0.1–1.1)	2.6 (1.7–3.6)	4.2 (2.7–5.8)	4.42 (1.83–10.68)*	7.06 (2.89–17.19)*
<i>Inadequate utilities</i>							
Heating/air conditioning	M	1,467	0.1 (0.0–0.4)	0.6 (0.0–1.3)	1.6 (0.0–3.7)	4.96 (0.52–47.83)	13.21 (1.19–146.71) ⁺
	F	2,639	0.3 (0.0–0.7)	0.4 (0.0–0.8)	1.5 (0.5–2.4)	1.22 (0.27–5.46)	4.71 (1.27–17.45) ⁺
Water	M	1,464	0.1 (0.0–0.4)	0.2 (0.0–0.6)	0.8 (0.0–2.3)	1.65 (0.10–26.50)	6.60 (0.41–106.24)
	F	2,629	0.0 (0.0–0.0)	0.3 (0.0–0.6)	0.5 (0.0–1.0)	xxx	xxx
Electricity	M	1,467	0.2 (0.0–0.6)	0.2 (0.0–0.6)	2.3 (0.0–4.9)	0.83 (0.08–9.14)	9.91 (1.64–59.86) ⁺
	F	2,636	0.1 (0.0–0.3)	0.4 (0.0–0.8)	1.3 (0.4–2.2)	3.65 (0.41–32.73)	12.55 (1.57–100.53) ⁺

CI is based on inversion of the Wald test constructed with the use of standard errors. Adjusted odds ratios are based on a logistic regression, estimated separately for men and women.; xxx = Odds ratio could not be calculated based on the 0 prevalence of the indicators in any of the categorical definitions of variables; ⁺ p < 0.05; * p < 0.005.

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