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Research Article

Residential Street Block Disorder and Biological Markers of Aging in Older Adults: The National Health and Aging Trends Study

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Abstract

Background: Residential environments are associated with older adults' health, but underlying physiologic causal mechanisms are not well understood. As adults age, street blocks are likely more relevant to their health than the larger neighborhood environment. This study examined the effects of adverse street block conditions on aging biomarkers among older adults.

Methods: We included community-dwelling Medicare beneficiaries aged 67 and older with 2017 biomarker data from the nationally representative National Health and Aging Trends Study (n = 4357). Street block disorder in 2016 was measured using interviewer report of any trash/glass/litter, graffiti, or vacant buildings on participants' blocks. Propensity score models were used to create balanced groups with regard to multiple 2015 participant characteristics, including demographic, socioeconomic, residence, and early-life characteristics. Linear regressions modeled street block disorder as a predictor of 4 aging biomarkers, hemoglobin A1C, high-sensitivity C-reactive protein, interleukin-6, and cytomegalovirus antibodies, before and after applying propensity score weighting.

Results: Adjusting for participant sociodemographic characteristics and applying propensity score weights, living on a block with any disorder was associated with 2% higher mean hemoglobin A1C levels (95% confidence interval [CI]: 0.002–0.03), 13% higher C-reactive protein (95% CI: 0.03–0.23), 10% higher interleukin-6 (95% CI: 0.02–0.19), and 19% more cytomegalovirus antibodies (95% CI: 0.09–0.29) compared to living on a block with no disorder.

Conclusions: Street block disorder predicted subsequent aging biomarkers after applying a propensity score approach to account for confounding among a national sample of older adults. Targeting street-level residential contexts for intervention may reduce the risk for poor health in older adults.

Keywords: Biological markers, National Health and Aging Trends Study, Residential characteristics

Residential context is important to older adults' health. Numerous studies have linked adverse residential conditions, such as physical disorder, to poorer functional status, chronic health conditions, and cognitive decline (1–3). A growing literature investigating possible physiologic pathways between residential contexts and health has focused on biological markers (4–7). As indicators of normal biological processes, biomarkers may reflect aging-related health and functional changes and have been linked to morbidity and mortality (8,9). For example, inflammatory markers, such as C-reactive protein (CRP) and interleukin-6 (IL-6), are associated with physical function decline, cardiovascular disease, and mortality in older adults (10–13). Infection with cytomegalovirus (CMV), a pathogen in the herpesvirus family that is common but typically asymptomatic among US adults (14), is associated with frailty and mortality (15,16). Increases in the metabolic biomarker hemoglobin A1C, which is an indicator of long-term glucose levels, have been linked to increased diabetes, cardiovascular disease, and mortality risk (17,18). Importantly, these biomarkers may capture distinct, but related, physiologic aging pathways. Together, these studies suggest that both residential contexts and biomarkers of aging are associated with health declines in late life, but the pathways linking residential contexts to biomarkers are less understood.

Most of the research examining residential context and aging biomarkers has focused on neighborhood-level characteristics rather than street-level conditions. In cross-sectional studies, neighborhood disorder, typically capturing signs of deterioration such as litter, graffiti, or vacant buildings, has been associated with higher CRP among middle-aged and older adults (19,20). Conversely, other cross-sectional and longitudinal studies investigating disordered neighborhoods and hemoglobin A1C or IL-6 have not found associations (7,21–24). These prior studies may not have found associations because they focused on neighborhood-level characteristics. Smaller area units should be considered because older adults' life space can decrease with the onset of age-related health or functional limitations (25). Conditions of the residential environment proximate to the home, such as the street block on which the home is situated, may be more influential in older adults' everyday lives than the wider neighborhood context. One study in the St. Louis metropolitan area found no association between adverse street block conditions and CRP or soluble IL-6 receptors, but that study only included 49- to 65-year-old African American adults (26). These relationships have not been evaluated in older adults, who may be more sensitive to adverse residential exposures, particularly at the street block level.

Residential contexts are thought to influence health through both behavioral and stress response pathways, but the underlying biologic mechanisms remain understudied (27). Thus, examining the relationships between adverse street block conditions and biomarkers of aging would further our understanding of the physiological mechanisms through which residential context influences aging and health. The purpose of this study was to test associations between adverse street block conditions and biomarkers of aging among a nationally representative cohort of US adults aged 67 years and older. This article builds on previous findings by using propensity score methods to balance participant characteristics across levels of block disorder to strengthen causal inferences. The analysis also leveraged longitudinal data from the National Health and Aging Trends Study (NHATS) to account for the temporal ordering of the exposure and the outcome. We hypothesized that the presence of any street block disorder is associated with higher levels of 4 biomarkers of aging: hemoglobin A1C, high-sensitivity CRP, IL-6, and CMV antibodies.

Method

Sample

The NHATS is a nationally representative cohort study of Medicare beneficiaries 65 years and older. In 2011, participants were recruited using a stratified 3-stage sample design, with oversampling of Black individuals and older age groups (28); a replenishment sample was recruited in 2015. Trained interviewers conducted annual in-home interviews. All participants provided informed consent. NHATS was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

The dried blood spot substudy was conducted in 2017. All participants who completed the 2017 interview without a proxy were eligible for blood spot collection. Of 5265 eligible participants, 4903 (93.1%) consented to blood spot collection; of those who consented, 4691 persons (95.7%) were able to provide a blood specimen (29). This study included the 4593 community-dwelling older adults who provided blood specimens.

Biological Markers of Aging

Four biomarkers of aging were assayed based on their associations with the biologic risk of disability progression: hemoglobin A1C (HbA1c) in %, high-sensitivity CRP in mg/L, IL-6 in pg/mL, and CMV IgG antibodies in AU/mL. These biomarkers were chosen as indicators of heightened inflammation, metabolic dysregulation, and immune function (29). Detailed assay procedures are described elsewhere (29). Briefly, dried blood spots were collected on a card, frozen, and shipped to the University of Washington School of Medicine for processing. CRP, IL-6, and CMV were measured with sandwich ELISA assays and HbA1c was measured with a Variant II Hemoglobin Testing System (Bio-Rad Laboratories, Hercules, CA). Assay results were available as direct analyte concentrations or plasma-equivalent concentrations. We used the plasma-equivalent values to aid in clinical interpretability and to allow comparability to other published metrics. An additional 139 individuals with CRP levels exceeding 3 standard deviations above the mean were excluded from CRP and IL-6 analyses due to a high likelihood of active infection (30).

Block Disorder

We used street block disorder measured in 2016 as our exposure of interest to assess exposure prior to outcome. Standing in front of participants' homes or buildings, NHATS interviewers rated the presence of 3 items: litter, broken glass, or trash on sidewalks and streets, graffiti on buildings and walls, and vacant or deserted houses or storefronts. Item ratings included (1) *none*, (2) *a little*, (3) *some*, and (4) *a lot*. As in prior work (31), street block disorder was dichotomized into (0) no disorder or (1) any disorder.

Covariates

Sociodemographic characteristics included sex (male [reference], female) and race/ethnicity (White [ref.], Black, Hispanic, and other race). Age was categorized as 65–69 (ref.), 70–74, 75–79, 80–84, 85–89, and 90 and older. Educational attainment was ordinal (<high school [ref.], high school, some college, and ≥bachelor's degree). Income to poverty ratio was calculated as the ratio of 2017 household income to the relevant 2017 US Census Bureau poverty threshold for individuals aged 65 and older based on household size. Diabetes diagnosis was a binary indicator of a self-reported doctor diagnosis of diabetes by 2017.

Propensity score analyses additionally included covariates measured in 2015, including income to poverty ratio, financial strain (any lack of money for the rent/mortgage, utility bills, or medical/prescription bills in the past year or any skipping meals because there was not enough money to buy food in the past month), home ownership (rent [ref.], own with mortgage, own without payments), marital status (married [ref.], separated/divorced, widowed, never married), household size, residence within a metropolitan area, type of home (single family [ref.] vs other), childhood financial status (well off [ref.], above average, average, below average, poor), and nativity status (born in the United States).

Statistical Analysis

Residential selection is a nonrandom process guided by individual and neighborhood characteristics, preferences, and constraints

(32–34). As a result, observational studies investigating contextual effects on health may be biased due to differences in individual characteristics related to both the contextual exposure and the health outcome or to a lack of equivalent comparison groups (35). To mimic an experimental design, we used propensity score methods to account for the differential probability of exposure to block disorder among older adults. We first generated a propensity score model to estimate the probability of residing on a street block with disorder based on covariates. Covariates chosen for the propensity score model were variables that predicted both 2016 block disorder and 2017 biomarkers, but were themselves not outcomes of block disorder (35,36). The propensity score logistic regression predicting 2016 block disorder included 2015 values for sex, race/ethnicity, age, education, income to poverty ratio, financial strain, home ownership, marital status, household size, residence within a metropolitan area, type of home, childhood financial status, and nativity status. The model also included statistically significant interaction terms for race × education, race × financial strain, and race × nativity to account for differential experiences of Black individuals across the life course. Covariate balance was assessed using standardized differences. Sufficient balance was achieved if the standardized mean difference between groups was less than 0.1 for each variable and overall across all variables (37).

Propensity scores were used to calculate the inverse probability of treatment weights, defined as (1/propensity score) for participants living on a street block with any disorder and 1/(1 − propensity score) for participants living on a street block with no disorder. Inverse probabilities of treatment weights were truncated at the 95th percentile to account for extreme values (38). Final analytic weights were created by multiplying the inverse probability of treatment weights by NHATS survey weights, which accounted for study design, attrition, and nonresponse to the dried blood spot study. This allowed our results to be generalized to the US population of community-dwelling adults older than age 67 years in 2017.

Values for all 4 biomarkers were skewed and therefore ln-transformed for analysis. Linear regressions modeled the 4 biomarker outcomes in 2017 as a function of block disorder in 2016. Model 1 tested unadjusted associations weighted with the NHATS survey weights; the HbA1c model accounted for 2017 diabetes diagnosis. Model 2 additionally adjusted for age, sex, race/ethnicity, education, and the 2017 income to poverty ratio. Model 3 applied the final analytic weights incorporating the propensity score-based inverse probability of treatment weights. These results can be interpreted as the average treatment effect (36), which is the difference in expected mean biomarker levels of living on a block with any disorder and living on a block with no disorder. We conducted 2 sensitivity analyses. First, we tested alternative weight truncation at the 90th and 99th percentiles. Second, participants with propensity scores greater than 0.5 were excluded to evaluate influential observations. Analyses were conducted using SAS 9.4 software.

Results

The final analytic sample included 4357 community-dwelling participants aged 67 and older. In analyses applying sampling weights but not propensity score-based weights, 8.4% of participants lived on a street block with any disorder in 2016 (Table 1), which translates to 2 382 092 US older adults. Participants living on disordered blocks were more likely to be Black or Hispanic than White, have a high school education or less, and have a lower average income to poverty ratio compared to participants living on blocks with no disorder. These participants were also more likely to experience financial strain, be unmarried, rent their home, have a larger mean household size, live in a non-single-family type home, have had less than average family wealth growing up, and have been born outside the United States.

Before propensity score weighting, absolute standardized mean differences between the group residing on a street block with any disorder and the group residing on a street block without disorder for all covariates ranged from 0.004 to 0.410 (Table 1). After applying weights, all covariates had a standardized difference of less than 10% (range: 0.003–0.058). This indicated our propensity score model achieved covariate balance. There were no statistically significant differences across groups for any covariate in the propensity score-weighted sample (Table 1).

In unadjusted linear regressions that applied sampling weights but not propensity score weights, street block disorder was associated with 20% higher CRP levels (95% CI: 0.08–0.32), 21% higher IL-6 levels (95% CI: 0.12–0.30), and 35% more CMV antibodies (95% CI: 0.22–0.48); accounting for diabetes diagnosis, HbA1c was 4% higher in participants living on blocks with any disorder (95% CI: 0.02–0.06) (Table 2, Model 1). Adjusting for sociodemographic characteristics (Table 2, Model 2), estimates decreased across all biomarkers compared to unadjusted models, but remained statistically significant for CRP (b = 0.15, 95% CI: 0.03–0.27), IL-6 (b = 0.13, 95% CI: 0.05–0.22), and CMV (b = 0.13, 95% CI: 0.02–0.24). In the propensity score weighted and adjusted model (Table 2, Model 3), street block disorder was associated with all 4 biomarkers. Older adults living on a block with any disorder had 2% higher HbA1c (95% CI: 0.002–0.03), 13% higher CRP (95% CI: 0.03–0.23), 10% higher IL-6 (95% CI: 0.02–0.19), and 19% more CMV antibodies (95% CI: 0.09–0.29). Inferences remained unchanged in sensitivity analyses described in the Method section (results not shown).

Discussion

This study found that living on a street block with any disorder predicted higher subsequent levels of aging biomarkers, including HbA1c, CRP, IL-6, and CMV antibodies, among a nationally representative sample of US older adults. These associations remained statistically significant after accounting for participant and residence characteristics that could affect exposure to block disorder and biomarker levels. This study contributes to the literature in 2 key ways. First, this study identified novel relationships between several aging biomarkers and street block disorder, an understudied, but potentially more relevant, geographic context in relation to older adult health than broader neighborhood contexts. Second, this study applied a quasi-experimental approach to more rigorously account for potentially confounding characteristics than has been done in prior studies examining residential context. Although our results contradict those from other studies showing no relationship between block or neighborhood disorder and aging biomarkers, we believe our results show less biased estimates of the effect of street block disorder on biomarkers of aging and suggest a causal relationship between them. These results are noteworthy because the aging biomarkers are relevant to physiological aging mechanisms that may explain the linkages between residential context and older adult health found in other studies reviewed earlier.

Although one prior study found no association between street block disorder and CRP or soluble IL-6 receptors (26), this study

Table 1. 2015 Characteristics of 4357 National Health and Aging Trends Study Participants by Street Block Disorder Category, Before and After Propensity Score Weighting

	Unweighted			Propensity Score Weighted		
	Block Disorder Categories		Standardized Difference	Block Disorder Categories		Standardized Difference
Characteristic	No disorder *n* = 3904, 92%	Any disorder *n* = 453, 8%	No vs Any Disorder	No disorder *n* = 3904, 67%	Any disorder *n* = 450, 33%	No vs Any Disorder
Age (%)						
65–69 (ref)	32.7	33.5	−0.004	32.8	33.0	−0.058
70–74	29.4	28.7		29.2	34.5	
75–79	19.3	19.0		19.4	16.4	
80–84	11.2	10.9		11.1	9.0	
85–89	5.5	5.5		5.6	5.0	
90+	1.9	2.3		1.8	2.1	
Sex (%)						
Male (ref)	44.7	46.7	−0.036	47.7	44.4	0.004
Female	55.3	53.3		52.3	55.6	
Race/ethnicity (%)						
White (ref)	84.1	52.0**		81.7	83.6	
Black	6.8	21.3	0.370	8.1	8.3	0.007
Hispanic	6.1	22.7	0.240	7.2	5.8	−0.030
Other	3.0	4.0	0.037	3.0	2.3	−0.036
Income–poverty ratio (mean, *SE*)	4.6 (0.2)	2.2 (0.2)**	−0.250	4.4 (0.2)	4.1 (0.7)	−0.026
Education (%)						
<High school (ref)	12.9	38.6**	−0.410	15.1	13.2	0.048
High school	25.0	26.2		25.1	24.9	
Some college	30.0	22.9		29.3	24.5	
≥Bachelor's degree	32.1	12.4		30.4	37.5	
Financial strain (%)						
No (ref)	93.1	84.8**	0.240	92.6	92.9	−0.010
Yes	6.9	15.2		7.4	7.1	
Home ownership (%)						
Rent (ref)	18.9	36.0**	−0.280	20.4	22.9	−0.040
Own with mortgage	30.6	27.5		30.4	31.6	
Own without payments	50.4	36.5		49.2	45.5	
Marital status (%)						
Married (ref)	61.8	39.7**	0.370	59.7	57.7	0.022
Separated/divorced	13.4	26.6		14.6	16.3	
Widowed	21.7	27.6		22.3	22.3	
Never married	3.1	6.2		3.4	3.7	
Household size (mean, *SE*)	2.0 (0.02)	2.1 (0.1)**	0.280	2.0 (0.02)	2.1 (0.1)	0.051
Geographic residence (%)						
Non-metropolitan (ref)	18.7	20.6	−0.010	18.9	14.1	0.026
Metropolitan area	81.3	79.4		81.1	85.9	
Type of home (%)						
Single family (ref)	87.2	73.3**	0.260	86.1	82.3	0.054
Other	12.8	26.7		13.9	17.7	
Childhood financial status (%)						
Well off (ref)	3.0	7.2**	0.100	3.4	5.7	−0.007
Above average	12.1	7.9		11.7	11.4	
Average	50.9	43.9		50.3	47.2	
Below average	20.6	21.6		20.8	21.9	
Poor	13.4	19.4		13.8	13.8	
Nativity status (%)						
Born in the United States (ref)	90.1	80.5**	−0.150	89.5	92.6	0.053
Born outside the United States	9.9	19.5		10.5	7.4	

Note: Sampling weights were applied to all analyses so that inferences can be drawn to the community-dwelling 2017 population of US adults aged 67 and older. **p* < .05, ***p* < .01.

provides evidence that block disorder is associated with higher CRP and IL-6. There are a few potential reasons for this difference. First, the previous analysis adjusted for health conditions and behaviors, including body mass index, chronic conditions, alcohol use, and smoking, that could act as mediators between street block disorder and inflammatory cytokines. This adjustment may have

Table 2. Associations Between 2016 Street Block Disorder and ln-Transformed 2017 Biomarkers of Aging Among Community-Dwelling National Health and Aging Trends Study Participants

	b Coefficient (95% CI)			
	HbA1c (%) *n* = 4125	CRP (mg/L) *n* = 3934	IL-6 (pg/mL) *n* = 3782	CMV (AU/mL) *n* = 4142
Model 1*	0.04 (0.02–0.06)***	0.20 (0.08–0.32)***	0.21 (0.12–0.30)***	0.35 (0.22–0.48)***
Model 2†	0.02 (−0.001 to 0.03)	0.15 (0.03–0.27)*	0.13 (0.05–0.22)*	0.13 (0.02–0.24)*
Model 3‡	0.02 (0.002–0.03)*	0.13 (0.03–0.23)*	0.10 (0.02–0.19)*	0.19 (0.09–0.29)**

Note: CMV = cytomegalovirus; CRP = C-reactive protein; HbA1c= hemoglobin A1C; IL-6 = interleukin-6. All linear regression models applied survey weights to allow inferences to be drawn to US older adult Medicare beneficiaries.

*Adjusted for 2017 diabetes diagnosis in the HbA1c model.

†Additionally adjusted for age, gender, race/ethnicity, education, and 2017 income to poverty ratio.

‡Additionally applied inverse probability weights to account for differential probability of exposure to street block disorder in 2016 based on estimates from the propensity score model.

*$p < .05$, **$p < .01$, ***$p < .0001$.

biased associations toward the null. The previous study was also conducted using an exclusively African American sample within one metropolitan area. While this potentially accounted for confounding related to race itself, it was not designed to account for the fact that African Americans are more likely to experience street disorder due to longstanding racial residential segregation (39) and therefore did not account for confounding through other unmeasured pathways related to Black race status. Our study's inclusion of race in its statistical adjustment allowed us to account for race as a common cause to other "backdoor" pathways. Furthermore, Black race was a strong predictor of street block disorder and had several statistically significant interactions with other life course variables (eg, nativity, education, and current financial strain) in our propensity score model, suggesting these confounders may be more impactful among Black individuals. With race included in our models, the current study's analysis may have better estimated the true total effect of these exposures among Black individuals. Finally, the current study was focused on older adults whereas the previous study was conducted in a sample of middle-aged adults. Our results may differ because of aging-related changes in biology between middle-aged and older adults. Natural alterations in bodily systems, such as the immune system, could result in older adults being more sensitive to environmental conditions in and around their homes, which then further exacerbates these aging processes. Additional research is needed to elucidate causal links between street block disorder with biomarkers of aging among population-based samples of young and middle-aged adults.

Our finding that street block disorder predicts subsequent CMV antibodies and HbA1c levels is a novel contribution to the literature. Studies that investigated the relationship between HbA1c and perceived neighborhood disorder in adults with diabetes did not find evidence of an association (21–24). Differences in HbA1c results comparing this study to the neighborhood disorder studies may be due to differences in age of the sample, the areal unit (street block vs neighborhood), or measurement differences in relying on standardized observers rather than participant perception. Alternatively, the nonsignificant estimates in the previous studies may be biased. In this study, the models using regression adjustment similar to that in prior studies (Model 2) also found no relationship between block disorder and HbA1c, but propensity score models producing doubly robust estimates by accounting for the differential probability of block disorder did find a relationship between block disorder and subsequent HbA1c (Model 3). Regardless of the reason for the differences, the HbA1c results from this study contribute to the literature by showing that street block disorder, which is a modifiable social determinant of health, is relevant to HbA1c for older adults.

That block disorder was associated with higher HbA1c, CRP, IL-6, and CMV antibodies in this study suggests that multiple physiological processes may be affected by poor residential environments right outside older adults' homes. For example, heightened levels of these biomarkers can reflect increased inflammation (40), poor metabolic control (18), and potential decline in immune response (41). There are several pathways through which street block disorder could influence these physiological processes. First, block disorder could invoke a stress response that stimulates inflammatory processes, including the production of cytokines (IL-6) and acute phase reactants (CRP) (40). Stress is also implicated in the reactivation of CMV infection, which contributes to inflammation and to increased immunosenescence (41,42). This pro-inflammatory state may impair insulin metabolism (42) that can lead to increased HbA1c levels. Block disorder may also discourage exercise or activity outside the home, which might increase sedentary behavior. Low physical activity and greater sedentary behavior are both associated with increased CRP, IL-6, and HbA1c (43–46). Finally, street block disorder has been associated with less social engagement among NHATS participants (31), which may be another potential pathway between street block disorder and biomarkers of aging found in this study. Altogether, these processes provide plausible physiological links between residential environments and aging-related physical and cognitive health outcomes. Although immune and metabolic dysregulation is associated with aging (42), this study suggests older adults living on disordered street blocks may be at a disadvantage as a result of accelerated aging processes. Based on this important finding, and considering exposure to street block disorder is ultimately a nonrandom occurrence influenced by individual characteristics like socioeconomic status, future research should investigate possible interactions between individual characteristics and street block disorder on health and aging processes.

This research has important policy and health care implications. Disorder indicators in this study are modifiable and could be addressed through targeted policy or community-based interventions. Implementation or investment in revitalization programs, land banking (the aggregation and repurposing of vacant or abandoned properties), and code enforcement may be valuable in reducing the number of vacant properties (47). Efforts to address littering and graffiti may be easier to implement at the community level, such as regularly scheduled, organized clean-ups with neighborhood residents, or receiving targeted city services to aid in litter or graffiti removal. However, moving beyond simply eliminating disorder to supporting beautification of residential contexts could provide a more sustainable solution by providing positive visual cues that discourage unwanted behaviors, like littering, from occurring in the first place (48). Using a "health in all policies" approach, decisions about public spending on greenspace and revitalization should take into account block-level need, as well as historical segregation and disinvestment to ensure that beautification efforts are equitably implemented (49). Additionally, as health care systems increasingly seek to address social determinants of health, practitioners can play an important collaborative role in promoting healthier residential environments. Possible actions include engaging in impact assessments to understand how land use and community design interventions may influence health, and partnering with policymakers and residents to guide community design decisions and environmental health policies (50). At the individual level, practitioners should consider screening patients for stressors related to social determinants of health during routine office visits. Although practitioners may not be in a position to directly address stressors such as street block disorder, they can help their patients connect to resources that can help address the effects of living in disordered residential contexts, such as access to mental health services, social opportunities, and physical activity resources. Attending to both indicators of disorder and its underlying causes will become more important as health systems become financially accountable for the population health of their communities.

This study has limitations. First, the 3-item NHATS measure is not an in-depth measure of physical or social block disorder. While this measure was significantly associated with all 4 aging biomarkers, future research could consider additional indicators for both the physical environment and the social environment, like noise or loitering, which co-occur within these residential contexts and may uncover additional physiological pathways. Similarly, there may be aspects of the residential environment that were unmeasured in NHATS and may influence results, such as area socioeconomic status, community resources, and safety. Additional studies are needed to elucidate the interrelationships between residential contextual factors as they relate to biomarkers of aging. Finally, this study did not exclude participants who moved between interviews, which could affect model estimates if older adults' exposure to block disorder changed over time. However, fewer than 4% of participants moved between 2016 (block disorder exposure) and 2017 (biomarker outcomes).

This study also has notable strengths. The study was conducted among a nationally representative sample of older adults, increasing the generalizability of the results. Additionally, we leveraged the longitudinal design of the NHATS data set to select variables across rounds to ensure proper temporal ordering of the exposure–outcome relationship. We also strengthened the study's causal inference by incorporating propensity score methods to mimic an experimental design and balance participant characteristics across street block disorder groups, reducing potential confounding of the biomarker estimates. Lastly, objective rather than perceived measurement of block disorder may have reduced bias resulting from participant self-report, such as imperfect recall or social acceptability bias, in which participants could underreport disorder to present their block in a better light to interviewers.

Conclusions

Our study found that older adults residing on street blocks with any disorder had higher mean levels of 4 aging biomarkers compared to older adults on street blocks with no disorder in models using doubly robust adjustment for individual and residential characteristics. These results reinforce the important role residential contexts, especially those close to home, may play in accelerating the physiologic aging processes that have been associated with poor outcomes among older adults. Disordered street blocks may lead to, or exacerbate, complex health circumstances, such as multimorbidity, that older adults may face with aging. Developing policies or interventions to improve street block conditions and screening for social determinants during health care visits for older adults have the potential to address the negative physiological consequences stemming from living in disordered residential environments.

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Conflict of Interest

None declared.

Author Contributions

L.C.R.L. and L.J.S. conceptualized the research question with input from M.H., S.E.L., and S.L.S.; J.T. led analyses in consultation with L.C.R.L. and L.J.S.; all authors contributed to writing this manuscript.

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