



**HAL**  
open science

# Neighborhood Stigma and Sleep: Findings from a Pilot Study of Low-Income Housing Residents in New York City

Ryan Richard Ruff, Jeannie Ng, Girardin Jean-Louis, Brian Elbel, Basile Chaix, Dustin T. Duncan

► **To cite this version:**

Ryan Richard Ruff, Jeannie Ng, Girardin Jean-Louis, Brian Elbel, Basile Chaix, et al.. Neighborhood Stigma and Sleep: Findings from a Pilot Study of Low-Income Housing Residents in New York City. Behavioral Medicine, 2018, 44 (1), pp.48–53. 10.1080/08964289.2016.1203754 . hal-03889756

**HAL Id: hal-03889756**

**<https://hal.sorbonne-universite.fr/hal-03889756>**

Submitted on 9 Mar 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**Neighborhood stigma and sleep: Findings from a pilot study of low-income housing residents in New York City**

Ryan Richard Ruff, PhD <sup>1,2</sup>  
Jeannie Ng, MPH <sup>2</sup>  
Girardin Jean-Louis, PhD <sup>3</sup>  
Brian Elbel, PhD, MPH <sup>3,4</sup>  
Basile Chaix, PhD <sup>6,7</sup>  
Dustin T. Duncan, ScD <sup>2,3,5,8</sup>

<sup>1</sup> *Department of Epidemiology and Health Promotion, New York University College of Dentistry, New York, NY USA*

<sup>2</sup> *College of Global Public Health, New York University, New York, NY, USA*

<sup>3</sup> *Department of Population Health, New York University School of Medicine, New York, NY USA*

<sup>4</sup> *Wagner Graduate School of Public Service, New York University, New York, NY USA*

<sup>5</sup> *Population Center, New York University, New York, NY, USA*

<sup>6</sup> *Sorbonne Universités, UPMC Univ Paris 06, UMR\_S 1136, Pierre Louis Institute of Epidemiology and Public Health, Paris, France*

<sup>7</sup> *Inserm, UMR\_S 1136, Pierre Louis Institute of Epidemiology and Public Health, Paris, France*

<sup>8</sup> *Center for Data Science, New York University, New York, NY, USA*

**Correspondence:** Ryan Richard Ruff, PhD, New York University College of Dentistry, Department of Epidemiology and Health Promotion, 433 1<sup>st</sup> Avenue, Room 730, New York, New York, 10010. Phone: 212-998-9663. Email: [ryan.ruff@nyu.edu](mailto:ryan.ruff@nyu.edu)

## **Abstract**

The primary objective of this study was to investigate the relationship between neighborhood stigma and sleep in a sample of low-income housing residents in New York City. Data were derived from the NYC Low-Income Housing, Neighborhoods, and Health Study ( $n=120$ ). Adults living in low-income housing completed a survey consisting of measures of neighborhood stigma, sleep quality and sleep duration. Neighborhood stigma and sleep were self-reported. Associations between neighborhood stigma and sleep health were analyzed using generalized linear models with cluster variance estimation. Multivariable models adjusted for age, gender, race/ethnicity, income, education, employment status, obesity, the census block percentage of non-Hispanic black residents, and the census block percentage median household income. Results indicate that a reported negative media perception of the neighborhood was negatively associated with sleep quality and duration ( $p<0.01$ ). However, additional research is needed to explore neighborhood stigma as it relates to sleep.

**Keywords:** neighborhood stigma; low-income housing; sleep health

## **Introduction**

Sleep health is related to obesity and other noncommunicable diseases, such as type-2 diabetes, hypertension, and cardiovascular disease<sup>1-5</sup>. For example, evidence from large epidemiologic studies and meta-analyses indicates that poor sleep outcomes are associated with increased obesity risk across multiple populations<sup>3,4,6-16</sup>. While sleep health among those living in low-income housing residences remains understudied, existing research shows that low-SES individuals have poor sleep health<sup>17-19</sup>.

As a social determinant of multiple health outcomes, neighborhoods and the local environment play a substantial role in health behavior, including among low-income individuals<sup>20,21</sup>. A growing body of literature suggests that facets of the neighborhood environment may be related to sleep health. For example, an analysis of residents in three German cities indicates that neighborhood unemployment is significantly related to insomnia among low-income and socially isolated adults aged 45-75 years<sup>22</sup>, and data from the National Health Interview Study show that living in an inner city has greater risks of short sleep compared to living in non-urban areas among adults aged 18 years or older<sup>23</sup>. Additionally, perceptions of low neighborhood quality (e.g., noisy, unclean, and unsafe) and neighborhood disorder are associated with poor self-rated sleep health and reduced sleep quality among adults in Texas and Wisconsin<sup>24-26</sup>, and data from six countries indicate that negative perceptions of neighborhood safety are related to poor sleep quality, symptoms of insomnia, sleepiness, lethargy, and inconsistent sleep duration<sup>27</sup>. These sleep studies are informative, but have yet to fully explore the range of neighborhood factors that may relate to sleep.

Neighborhood stigma, or the “negative representation of place” attached to neighborhoods, may have adverse effects on sleep<sup>28</sup>. Stigmatized neighborhoods and residents of those neighborhoods may be viewed poorly by the media, individuals living outside the neighborhood, or residents themselves. As a result, stigmatized neighborhoods or other marginalized places can carry negative symbolic meanings that may affect the health and wellbeing of residents, including causing stress<sup>29</sup>. However, at present, the relationship between neighborhood stigma and sleep remains largely unexplored. Neighborhood stigma might be especially salient to low-income populations. For example, residents of low-income housing populations may have less means to overcome employment discrimination in the face of neighborhood stigma, and public housing residents have been historically stigmatized due to perceptions of self-destructive behavior, crime within public housing developments, and welfare status<sup>30-33</sup>. While we have previously shown an association between neighborhood stigma and obesity and hypertension among low-income housing residents<sup>34</sup>, no research has examined the specific relationship between neighborhood stigma and sleep in this population.

The primary objective of this study was to explore the relationship between neighborhood stigma and sleep in a sample of low-income housing residents in New York City. We hypothesized that neighborhood stigma was negatively associated with sleep duration and quality.

## **Methods**

### *Study*

Data were derived from survey responses from the NYC Low-Income Housing, Neighborhoods, and Health Study ( $n=120$ )<sup>35,36</sup>, a study designed to collect Global Positioning Systems (GPS),

health behavior, and health status data from low-income housing residents. Any adult that reported living in low-income housing in New York City, was 18 years of age or older, could speak and read English, was not pregnant, had no difficulty walking or climbing stairs, and was willing to wear a GPS device was eligible for the study. Recruitment was conducted through handing out flyers outside of public housing developments in four different New York City neighborhoods, as well as through flyers posted and circulated by community-based organizations that work with low-income individuals (especially public housing residents), flyers posted in community locations (e.g. local stores) and through word of mouth. Data were collected between June and July of 2014. Informed consent was obtained from all participants prior to data collection. The study was reviewed and approved by the New York University School of Medicine Institutional Review Board.

### *Measures*

Neighborhood stigma was assessed using a four-item survey informed by prior work on neighborhood stigma and health disparities<sup>28,37-41</sup> and were field tested among a diverse set of colleagues with expertise in neighborhood stigma. Overall stigma was measured by asking “Overall, what is the reputation of your neighborhood?”, followed by questions for media image (“Overall, is the image of your neighborhood in the media positive?”), external perceptions, (“According to you, are people who live in your neighborhood seen negatively outside the neighborhood?”), and feelings of judgment (“Do you feel that people judge you because you live in low-income or subsidized housing?”).

Sleep duration and quality measures were taken from The Pittsburgh Sleep Quality Index <sup>42</sup> . Sleep duration was measured by asking the item “During the past month, how many hours of actual sleep [on average] did you get at night?”. Participants were asked to not include the number of hours actually spent in bed but not sleeping, and responses were open ended. Sleep quality was assessed using the item “During the past month, how would you rate your sleep quality overall?”. For this study, sleep duration was considered as both a continuous variable and dichotomized into  $\geq 7$  hours of sleep and  $< 7$  hours of sleep per night, consistent with two large epidemiologic studies of US adults <sup>1,2</sup>. Sleep quality was dichotomized into good and poor quality.

Covariates included categorical age (18-24, 25-44, and 45+), gender, race/ethnicity (Black, Hispanic, Other), education (12<sup>th</sup> grade education, high school degree or GED, and some college or more, employment status (full-time, part-time, or not working), and household income (<\$25,000 and \$25,000+). Obesity was calculated following established guidelines from the World Health Organization <sup>43</sup>. Body Mass Index (BMI) under 18.5 was classified as underweight, 18.5-24.9 as normal weight, 25-29.9 as overweight, and  $\geq 30$  as obese. The neighborhood percent of non-Hispanic Black residents and neighborhood median household income at the census block group level were calculated using geographic information systems (GIS) software using data from the 2010 US Census and the 2009-2013 American Community Survey.

### *Statistical Analysis*

Descriptive statistics were obtained for socio-demographic variables for the full sample and for a subsample of participants with valid data for sleep and stigma items. For this pilot study, we used available case analysis in order to maximize the available power. There were no significant differences between the full sample and the sub-sample with overall stigma (Table 1) for included socio-demographic characteristics. Additional comparisons were made for subsamples for each stigma and sleep item, and there were no significant differences when compared to the overall sample (data not shown).

All neighborhood stigma responses of “Don’t know/Not sure” were set to missing, consistent with previous research<sup>34</sup>. Associations between neighborhood stigma and sleep were explored in a series of generalized linear models adjusted for age, gender, race/ethnicity, income, education, obesity, employment status, the census block group percentage of non-Hispanic black residents, and median household income. Sleep duration was analyzed using linear regression and sleep quality using GLM with a Poisson distribution and a log link to estimate relative risks (as opposed to odds ratios), given the high prevalence of the sleep outcomes<sup>44</sup>. Regression models used cluster variance estimation or robust variance estimation to adjust for cluster correlation. Statistical analysis was performed using Stata v13.0. Statistical significance was set at  $p < .05$ .

## **Results**

The full study sample (Table 1) consisted of 45% male and was mainly Black (67.8%) or Hispanic (23.7%). Approximately 69% of the sample received a high school education or less, and 71.6% of participants reported a household income of less than \$25,000 a year. The average participant BMI was 29.4, with 40% obese and 26.7% overweight. The average sleep duration



was 6.5 hours, with 53.7% of participants reporting insufficient sleep duration (less than seven hours per night). The proportion of participants reporting good sleep quality was 69.5% (30.5% reporting poor sleep quality). Over half (52%) of participants reported a moderate neighborhood reputation, and 20% reported a bad neighborhood reputation. Approximately 36% reported a negative media image of their neighborhood, 41% reported negative external perception, and 58% reported feeling judged due to living in low-income housing.

Overall neighborhood stigma was not associated with sleep quality or duration (Table 2). Media perception of the neighborhood was significantly related to sleep duration and quality. Those reporting a negative media image of their neighborhood had significantly less average sleep per night ( $\beta = -.96$ , 95% CI = -1.72, -.19) and were at increased risk of poor sleep quality (RR = 2.64, 95% CI = 1.32, 5.26) (Table 2). However, negative external perception and feelings of judgment from living in subsidized housing were also not related to sleep health.

## **Discussion**

To our knowledge, no study has investigated the relationship between neighborhood stigma and sleep in any population, including low-income housing residents. In this pilot study, the average sleep duration was less than the seven hours of nightly sleep currently recommended, and a majority of participants reported insufficient total sleep. Despite this insufficiency, a majority of study participants reported that their sleep quality was good.

Specific to neighborhood stigma, participants who reported feeling their neighborhood was negatively perceived in the media were more likely to report reduced sleep duration and poor

quality sleep. Though this was a pilot study, there are several potential pathways through which neighborhood stigma might be related to health and sleep. As previously described in the literature, neighborhood stigma can manifest as a psychosocial stressor that influences physical and mental health outcomes<sup>28,37,39,40</sup>. It is possible that neighborhood stigma is related to stress, which has been shown to influence sleep<sup>45</sup>. In particular, residents with negative perceptions of the neighborhood environment, feelings of judgment, or poor external perceptions of their residential area may have poorer sleep quality and reduced time spent sleeping each night due to these various potential neighborhood stressors. Negative perceptions of identity from neighborhood associations can also translate to individuals, and thus negatively affect behavior. For example, neighborhood stigma emerging from a negative collective identity can influence peoples' sense of self, resulting in inability to monitor health, and can also limit economic opportunities and restrict access to health promotion opportunities such as sleep management programs.

Importantly, poor sleep duration and quality are known to be strongly associated with both low socioeconomic status and race/ethnicity, with low-income, minority persons exhibiting high rates of sleep disturbances such as high sleep latency, difficulty falling asleep, and difficulty maintaining sleep<sup>46-51</sup>. Though sleep research in high-poverty residential areas is limited, the available evidence indicates that substandard housing can also negatively affect sleep quality<sup>52</sup>. It is possible that a poor residential environment characterized by excessive noise, crime, and a lack of personal satisfaction with one's home can impact sleep and other health outcomes as well<sup>53</sup>. Collectively, this suggests that policy interventions could be implemented at the housing and neighborhood-level for low-income populations in attempts to improve health. For example, with

respect to neighborhood stigma, interventions can be conducted to reduce potential employment discrimination based on residential address, which may in turn improve sleep health among low-income populations.

### *Study Limitations*

This study has several limitations. First, neighborhood stigma, sleep duration, and sleep quality were assessed using self-report questionnaires rather than objective measures. Thus, results may be subject to inaccurate reporting. Future studies can more comprehensively examine neighborhood stigma and sleep by including other sleep disorders, such as insomnia and obstructive sleep apnea, as well as using objective measures of sleep duration. Second, results are limited by potential residual confounders, such as residential history, that were not assessed in surveys and unable to be controlled for in analyses. We attempted to adjust for known or hypothesized observed confounders in multivariable models. Third, due to the low sample size the study had limited power, and was thus unsuitable for testing for effect modification by substantively important socio-demographic variables such as gender and race/ethnicity. However, this is the first study to examine the relationship between neighborhood stigma and sleep health. As this was a pilot study, main effects are important and any hypotheses of effect modification can be further explored in a larger, more detailed study. Finally, as an observational study using a non-probability sample of participants, reverse causation is possible and associations found in the current study cannot generalize to other populations, including non-urban geographies.

### **Conclusions**

In a pilot study of low-income housing residents in New York City, perception of a negative media image of the neighborhood was negatively associated with sleep duration and quality.

While results are intriguing, additional research is needed to explore neighborhood stigma as it relates to sleep.

## References

1. Buxton OM, Marcelli E. Short and long sleep are positively associated with obesity, diabetes, hypertension, and cardiovascular disease among adults in the United States. *Soc Sci Med*. 2010;71:1027-1036.
2. Xiao Q, Keadle SK, Hollenbeck AR, Matthews CE. Sleep duration and total and cause-specific mortality in a large US cohort: interrelationships with physical activity, sedentary behavior, and body mass index. *American journal of epidemiology*. 2014;180(10):997-1006.
3. Carrillo-Larco RM, Bernabe-Ortiz A, Miranda JJ, Rey de Castro J. Peruvians' sleep duration: analysis of a population-based survey on adolescents and adults. *PeerJ*. 2014;2:e345.
4. Chen HC, Su TP, Chou P. A nine-year follow-up study of sleep patterns and mortality in community-dwelling older adults in Taiwan. *Sleep*. 2013;36(8):1187-1198.
5. Zhang J, Jin X, Yan C, Jiang F, Shen X, Li S. Short sleep duration as a risk factor for childhood overweight/obesity: a large multicentric epidemiologic study in China. *Sleep Health*. 2015.
6. Knutson KL, Van Cauter E. Associations between sleep loss and increased risk of obesity and diabetes. *Ann N Y Acad Sci*. 2008;1129:289-304.
7. Pannain S, Miller A, Van Cauter E. Sleep loss, obesity and diabetes: prevalence, association and emerging evidence for causation. *Obes Metab-Milan*. 2008;4:28-41.
8. Patel SR, Hu FB. Short sleep duration and weight gain: a systematic review. *Obesity*. 2008;16:643-653.
9. Leproult R, Van Cauter E. Role of sleep and sleep loss in hormonal release and metabolism. *Endocr Dev*. 2010;17:11-21.
10. Buysse DJ, Browman KE, Monk TH, Reynolds CF, 3rd, Fasiczka AL, Kupfer DJ. Napping and 24-hour sleep/wake patterns in healthy elderly and young adults. *Journal of the American Geriatrics Society*. 1992;40(8):779-786.
11. Buysse DJ, Monk TH, Carrier J, Begley A. Circadian patterns of sleep, sleepiness, and performance in older and younger adults. *Sleep*. 2005;28(11):1365-1376.
12. Buysse DJ, Monk TH, Reynolds CF, 3rd, Mesiano D, Houck PR, Kupfer DJ. Patterns of sleep episodes in young and elderly adults during a 36-hour constant routine. *Sleep*. 1993;16(7):632-637.
13. Beccuti G, Pannain S. Sleep and obesity. *Curr Opin Clin Nutr Metab Care*. 2011;14(4):402-412.
14. Cappuccio F, Miller M, eds. *The epidemiology of sleep and cardiovascular risk and disease*. Oxford: Oxford University Press; 2010. Sleep, health, and society: from aetiology to public health.
15. Logue EE, Scott ED, Palmieri PA, Dudley P. Sleep duration, quality, or stability and obesity in an urban family medicine center. *J Clin Sleep Med*. 2014;10(2):177-182.
16. Jarrin DC, McGrath JJ, Drake CL. Beyond sleep duration: distinct sleep dimensions are associated with obesity in children and adolescents. *Int J Obes (Lond)*. 2013;37(4):552-558.
17. Okun ML, Tolge M, Hall M. Low socioeconomic status negatively affects sleep in pregnant women. *J Obstet Gynecol Neonatal Nurs*. 2014;43(2):160-167.

18. Stringhini S, Haba-Rubio J, Marques-Vidal P, et al. Association of socioeconomic status with sleep disturbances in the Swiss population-based CoLaus study. *Sleep Med.* 2015;16(4):469-476.
19. Felden EP, Leite CR, Rebelatto CF, Andrade RD, Beltrame TS. [Sleep in adolescents of different socioeconomic status: a systematic review]. *Rev Paul Pediatr.* 2015;33(4):467-473.
20. Cradock AL, Duncan DT. *The Role of the Built Environment in Supporting Health Behavior Change.* New York: Springer Publishing Company; 2014.
21. Kawachi I, Berkman LF. *Neighborhoods and Health.* New York: Oxford University Press; 2003.
22. Riedel N, Fuks K, Hoffmann B, et al. Insomnia and urban neighbourhood contexts--are associations modified by individual social characteristics and change of residence? Results from a population-based study using residential histories. *BMC Public Health.* 2012;12:810.
23. Hale L, Do DP. Racial differences in self-reports of sleep duration in a population-based study. *Sleep.* 2007;30(9):1096-1103.
24. Hale L, Hill TD, Friedman E, et al. Perceived neighborhood quality, sleep quality, and health status: evidence from the Survey of the Health of Wisconsin. *Social science & medicine.* 2013;79:16-22.
25. Hill TD, Burdette AM, Hale L. Neighborhood disorder, sleep quality, and psychological distress: testing a model of structural amplification. *Health Place.* 2009;15(4):1006-1013.
26. Hale L, Hill TD, Burdette AM. Does sleep quality mediate the association between neighborhood disorder and self-rated physical health? *Prev Med.* 2010;51(3-4):275-278.
27. Hill TD, Trinh HN, Wen M, Hale L. Perceived neighborhood safety and sleep quality: a global analysis of six countries. *Sleep Med.* 2014;18:56-60.
28. Keene DE, Padilla MB. Spatial stigma and health inequality. *Critical Public Health.* 2014:1-13.
29. Graham LF, Padilla MB, Lopez WD, Stern AM, Peterson J, Keene DE. Spatial stigma and health in postindustrial Detroit. *Int Q Community Health Educ.* 2016.
30. McCormick NJ, Joseph ML, Chaskin RJ. The New Stigma of Relocated Public Housing Residents: Challenges to Social Identity in Mixed-Income Developments. *City & Community.* 2012;11(3):285-308.
31. MacLeod J. *Ain't no makin' it: Aspirations and attainment in a low-income neighborhood.* Boulder, CO: Westview Press; 1995.
32. Wacquant L. *Urban outcasts: A comparative sociology of advanced marginality.* Cambridge, UK: Polity Press; 2008.
33. Wilson WJ. *The truly disadvantaged: The inner city, the underclass, and public policy.* Chicago, IL: The University of Chicago Press; 1987.
34. Duncan DT, Ruff RR, Chaix B, et al. Spatial Stigma, body mass index, and blood pressure among low-income housing residents in New York City. *In Press, Geospatial Health.* 2015.
35. Duncan D, Regan S, Shelley D, et al. Application of Global Positioning System Methods for the Study of Obesity and Hypertension Risk Among Low-Income

- Housing Residents in New York City: A Spatial Feasibility Study. *Geospatial Health*. 2014;9(1):57-70.
36. Duncan DT, Regan SD. Mapping multi-day GPS data: a cartographic study in NYC. *Journal of Maps*. 2015:1-3.
  37. Keene DE, Padilla MB. Race, class and the stigma of place: moving to "opportunity" in Eastern Iowa. *Health Place*. 2010;16(6):1216-1223.
  38. Sampson R, Raudenbush S. Seeing Disorder: Neighborhood Stigma and the Social Construction of "Broken Windows.". *Social Psychology Quarterly*. 2004;67(4):319-342.
  39. Tabuchi T, Fukuhara H, Iso H. Geographically-based discrimination is a social determinant of mental health in a deprived or stigmatized area in Japan: a cross-sectional study. *Social science & medicine*. 2012;75(6):1015-1021.
  40. Kelaher M, Warr DJ, Feldman P, Tacticos T. Living in 'Birdsville': exploring the impact of neighbourhood stigma on health. *Health Place*. 2010;16(2):381-388.
  41. Thompson L, Pearce J, Barnett J. Moralising geographies: stigma, smoking islands and responsible subjects. *Area*. 2007;39(4):508-517.
  42. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice *Psychiatric Research*. 1989;28(2):193-213.
  43. WHO Global Database on Body mass Index. [http://apps.who.int/bmi/index.jsp?introPage=intro\\_3.html](http://apps.who.int/bmi/index.jsp?introPage=intro_3.html). Accessed May 6, 2016.
  44. Lovasi GS, Underhill LJ, Jack D, Richards C, Weiss C, Rundle A. At odds: concerns raised by using odds ratios for continuous or common dichotomous outcomes in research on physical activity and obesity. *Open Epidemiology J*. 2012;5:13-17.
  45. Hall MH, Casement MD, Troxel WM, et al. Chronic stress is prospectively associated with sleep in midlife women: the SWAN sleep study. *Sleep Breath*. 2015.
  46. Patel NP, Grandner MA, Xie D, Branas CC, Gooneratne N. "Sleep disparity" in the population: poor sleep quality is strongly associated with poverty and ethnicity. *BMC Public Health*. 2010;10:475.
  47. Grandner MA, Petrov ME, Rattanaumpawan P, Jackson N, Platt A, Patel NP. Sleep symptoms, race/ethnicity, and socioeconomic position. *J Clin Sleep Med*. 2013;9(9):897-905; 905A-905D.
  48. Jackson CL, Redline S, Kawachi I, Williams MA, Hu FB. Racial disparities in short sleep duration by occupation and industry. *Am J Epidemiol*. 2013;178(9):1442-1451.
  49. Chen X, Wang R, Zee P, et al. Racial/Ethnic Differences in Sleep Disturbances: The Multi-Ethnic Study of Atherosclerosis (MESA). *Sleep*. 2015;38(6):877-888.
  50. Suarez E, Fang SC, Bliwise D, Yaggi HK, Araujo A. Disentangling racial/ethnic and socioeconomic differences in self-reported sleep measures: the Boston Area Community Health Survey. *Sleep Health*. 2015;1(2):90-97.
  51. Keyes KM, Maslowsky J, Hamilton A, Schulenberg J. The great sleep recession: changes in sleep duration among US adolescents, 1991-2012. *Pediatrics*. 2015;135(3):460-468.
  52. Simonelli G, Leanza Y, Boilard A, et al. Sleep and quality of life in urban poverty: the effect of a slum housing upgrading program. *Sleep*. 2013;36(11):1669-1676.
  53. Krieger J, Higgins DL. Housing and health: Time again for public health action. *American Journal of Public Health*. 2002;92(5):758-768.

Table 1: Sample descriptive statistics

	Overall			Sleep Sample		
	%/Mean (SD)	95% CI	N	%/Mean (SD)	95% CI	N
<b>Gender</b>						
Male	44.9	36.1, 54.1	118	40.9	31.0, 51.6	88
Female	55.1	46.8, 65.1		59.1	48.4, 69.0	
<b>Race/Ethnicity</b>						
Black	67.8	58.7, 75.7	118	67.4	56.8, 76.5	89
Hispanic	23.7	16.8, 32.4		23.6	15.8, 33.7	
Other	8.5	4.6, 15.2		8.9	4.5, 17.2	
<b>Age</b>						
18-24	25.0	18.0, 33.6	120	25.8	17.7, 36.1	89
25-44	35.0	26.9, 44.1		37.1	27.5, 47.7	
45+	40.0	31.5, 49.1		37.1	27.5, 47.7	
<b>Education</b>						
Less than high school education	28.9	21.3, 37.7	118	24.1	16.2, 34.4	87
High school/GED	39.8	31.3, 49.0		37.9	28.2, 48.7	
Some College or more	31.4	23.5, 40.3		37.9	28.2, 48.7	
<b>Income</b>						
Less than \$25,000	71.6	62.5, 79.1	116	70.1	58.5, 78.9	87
\$25,000+	28.4	20.9, 37.5		29.9	21.1, 40.5	
<b>Employment</b>						
Full-time	14.4	9.1, 22.1	118	16.1	9.7, 25.6	87
Part-time	18.6	12.5, 26.8		19.5	12.4, 29.4	
Not working	66.9	57.9, 74.9		64.4	53.6, 73.9	
<b>BMI</b>						
BMI (SD)	29.4 (7.8)	27.9, 30.7	120	29.4 (8.1)	27.7, 31.1	89
Underweight	1.7	0.04, 6.5		1.1	0.002, 7.8	
Normal	31.7	23.9, 40.6		33.7	24.5, 44.3	
Overweight	26.7	19.4, 35.4		24.7	16.7, 34.9	
Obese	40.0	31.5, 49.1		40.4	30.6, 51.1	
<b>Sleep Duration</b>						
Total hours of sleep	6.5 (1.8)	6.2, 6.9	95	6.5 (1.8)	6.1, 6.9	89
Less than 7 hours (“Insufficient”)	53.7	43.5, 63.6		55.1	44.5, 65.2	
At least 7 hours (“Sufficient”)	46.3	36.4, 56.5		44.9	34.8, 55.6	
<b>Sleep Quality</b>						
Good (Very Good+Fairly Good)	69.5	60.5, 77.2	118	66.3	55.7, 75.5	89
Bad (Very Bad+Fairly Bad)	30.5	22.8, 39.5		33.7	24.5, 44.3	

*Note:* Sleep sample included respondents who had valid data for sleep duration and overall spatial stigma, however regression results in Table 2 use available case analysis for each model to maximize power. Additional sample comparisons for sleep duration and other stigma items, including media image, external perception, and judgment from others, showed no significant differences from the full sample.



Table 2: Associations between neighborhood stigma and sleep

	<b>Model 1: Sleep Duration</b>				<b>Model 2: Sleep Quality</b>			
	$\beta$	95% CI	<i>p</i> -value	N	RR	95% CI	<i>p</i> -value	N
<b>Overall Spatial Stigma</b>								
Moderate	0.10	-0.94, 1.13	0.85	83	1.68	0.61, 4.58	0.32	99
Bad	-0.85	-1.93, 0.23	0.12		2.06	0.67, 6.32	0.21	
<b>Positive Media Image</b>								
No	-0.96	-1.69, -0.22	0.01	59	2.64	1.32, 5.26	<0.01	69
<b>Negative external perception</b>								
Yes	0.05	-0.43, 0.54	0.82	60	0.97	0.45, 2.09	0.94	75
<b>Judgment from others</b>								
Yes	0.24	-0.55, 1.04	0.54	75	0.78	0.38, 1.61	0.50	88

*Notes*

Models adjusted for age, gender, race/ethnicity, income, education, employment status, obesity, census block percent non-Hispanic black and census block median household income

For overall spatial stigma, the reference group is “Good” perceptions of the neighborhood

For positive media image, the reference group is "Yes, overall media image is positive"

For negative external perception, reference group is "No, people in my neighborhood are not seen negatively outside the neighborhood"

For judgment, reference group is "No, people do not judge me because I live in low-income/subsidized housing"