Individual Health Care System Distrust and Neighborhood Social Environment: How Are They Jointly Associated with Self-rated Health?

Tse-Chuan Yang, Stephen A. Matthews, and Carla Shoff

ABSTRACT *Americans' distrust in the health care system has increased in the past decades; however, little research has explored the impact of distrust on self-rated health and even less is known about whether neighborhood social environment plays a role in understanding the relationship between distrust and self-rated health. This study fills these gaps by investigating both the direct and moderating associations of neighborhood social environment with self-rated health. Our analysis is based on the 2008 Philadelphia Health Management Corporation's household survey and neighborhood-level data. Findings from multilevel logistic regression show that after controlling for individual- and neighborhood-level covariates, distrust is directly and adversely related to self-rated health, and that neighborhood social affluence and stability are directly and negatively associated with the odds of reporting poor/fair health. Neighborhood disadvantage and crime rates are not directly related to self-rated health, but increase the odds of having poor/fair health via distrust. Overall, our results suggest that macro-level actions can alter individual's perception of residential environment and lead to improved health. To improve the public health in an urban setting, rebuilding confidence in the health care system is integral, and the policies that help establish safe and cohesive neighborhoods may reduce the adverse effect of distrust on self-rated health.*

KEYWORDS *Health care system distrust, Self-rated health, Neighborhood social environment, Multilevel modeling, Philadelphia*

INTRODUCTION

The past decades have witnessed a remarkable decline in trust in the American health care system, from a high record of 70%+ of adult Americans reporting a great deal of confidence in medicine in 1966, to a record low of 20% in 1991, and more recently 34% in 2010.¹ It is noteworthy that health care system distrust does not translate into high levels of distrust in personal physicians or health care providers.² Indeed, over 80% of Americans believed their doctors “always” or “most of the time” do the right thing in delivering care.^{3–5} Although previous research has documented that the level of distrust in physicians is associated with individual behaviors, such as seeking medical care, maintaining appropriate health

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care, and adhering to medical advice,^{6–8} relatively little is known about whether health care system distrust (hereafter distrust) is associated with self-rated health, a predictor of numerous health outcomes.^{9–11} Moreover, even less is known about whether neighborhood social environment plays a role in understanding the association between distrust and self-rated health. The goal of this study is to answer these questions with the institutional performance model (discussed below) and examine a theoretical framework where social environment is hypothesized to moderate the effect of distrust on self-rated health.

Previous research on self-rated health has provided consistent findings that individual factors are important determinants. Unemployment, poverty, low educational attainment, and age are adversely related to self-rated health, but marriage can be protective.^{12–14} Using different measures of distrust, 2 recent studies in the USA and Sweden found that high levels of distrust were related to poor self-rated health.^{15,16} These findings were robust even after controlling for individual access to health care, personal care-seeking behavior, patient's trust in their own primary health providers, and other socioeconomic and demographic variables. From a practical and theoretic perspective, high distrust complicates many facets of health care, including the dissemination and adoption of health information, enrolment in clinical trials, use of innovative treatments, and the maintenance and continuity of treatment.^{17–19} Such adverse associations imply distrust is negatively associated with self-rated health.¹⁵

Several studies have found direct effects of neighborhood-level social factors on human health, such as socioeconomic composition (social affluence and disadvantage), neighborhood stability, and community safety.^{20–22} Although distrust and direct effects of the social environment have been increasingly incorporated into research on self-rated health, due to data limitations, it remains unclear whether neighborhood social environment moderates this relationship.

The institutional performance model has been used to explain the increasing levels of distrust over the past decades.²³ The underlying assumption of this model is that individuals judge the medical system not by what the leading players in the system do, but by their overall perception of how things are going around them. Hence, the declining trust in the health care system is believed to be associated closely with the declining trust in government and other social institutions beyond health care institutions, such as banks, Congress, and the Executive branch.^{23,24} Explicitly, the institutional performance model leads us to anticipate that the levels of distrust vary by social environment, despite those factors undermining trust in medical system, e.g., continually rising insurance premiums, rising prescription costs, large numbers of uninsured, managed health care, limits on patients' choice of health services, and general commercialization of medical care.^{25–29} As the social environment, to some extent, determines the level of distrust, the impact of distrust on self-rated health could, thus, depend on the local residential environment where people live; that is, what is going on in their neighborhood.

Following the institutional performance model, we argue that social environment should moderate the association between distrust and self-rated health. We test the following hypotheses: (1) High distrust is associated with poor self-rated health, even after controlling for both individual and neighborhood covariates, and (2) the social environment is directly associated with self-rated health, including (2.a) neighborhood affluence is positively related to self-rated health, (2.b) neighborhood disadvantage is associated with poor self-rated health, (2.c) high crime rates are associated with poor self-rated health, and (2.d) neighborhood stability is

positively associated with self-rated health; (3) we expect that social environment moderates the relationship between distrust and self-rated health and hypothesize that the association between distrust and self-rated health is to be (3.a) stronger in the neighborhood with higher crime rates, (3.b) less pronounced in the neighborhood with higher levels of social affluence, (3.c) enhanced by neighborhood disadvantage, and (3.d) reduced by neighborhood stability.

DATA AND METHODOLOGY

Data Source

Individual-level data are drawn on the Philadelphia Health Management Corporation's (PHMC) 2008 Household Health Survey, a biannual telephone survey that collects information on health behavior and health care experience in a 5-county area in southeast Pennsylvania.³⁰ Using a stratified sampling frame to ensure representation within metropolitan Philadelphia, the interviews were conducted between June and October 2008 via a random-digit dialing methodology. Although the response rate for the PHMC 2008 was 25% based on the American Association for Public Opinion Research response rate criterion #3,³¹ the PHMC 2008 sample closely matches the demographic and socioeconomic structure as reported in the 2006–2008 American Community Survey and mirrors the 2008 Behavioral Risk Factor Surveillance Survey (BRFSS) for Philadelphia.^{32,33} This study is based on the 4,394 adult respondents of Philadelphia County and uses a balancing weight in the statistical analysis. Since the 1980s, local planners and officials have divided Philadelphia County into 45 neighborhoods based on aggregations of census tracts.³⁰

Measures

Individual Level The dependent variable is self-rated health. The respondents were asked to evaluate their health as poor, fair, good, or excellent. We dichotomized responses into poor/fair and good/excellent (the reference group, coded 0). Even though self-rated health could be treated as an ordinal variable, dichotomizing self-rated health is common and facilitates comparison with earlier studies.^{16,34,35}

The independent variables can be categorized into 4 groups. Of primary substantive interest to us is a 9-item health care system distrust scale developed by Shea et al.³⁶ The reliability and validity of this scale have been tested and reported elsewhere.³⁶ Using the 2008 data and factor analysis with the varimax rotation method, we follow Shea et al. and divide distrust into 2 sub-scales that capture different dimensions of distrust: competence and values distrust. Table 1 reports the factor loadings for each item on the sub-scales. Responses were answered on a 5 level Likert scale from “strongly agree” to “strongly disagree.” Each item loaded on only 1 dimension. The eigenvalues were 3.52 and 1.19, respectively, and the total variance explained was 52%, which was similar to the original paper. We generated 2 factor scores based on regression methods and included these in our analysis as measures of distrust.³⁷ While missing data on any 1 item were rare, we imputed missing values based on an EM algorithm for continuous variables.³⁸ Imputed scores were rounded to the nearest whole number to reflect the Likert scales.

Demographic characteristics were the second group of predictor variables and were all self-reported by the participants. Age was treated as a continuous variable

TABLE 1 Health care system distrust factor loadings (with varimax rotation)

Actual questions	Component	
	Competence	Values
Health Care System makes patients' health better ^a	0.745	0.127
Health Care System covers up its mistakes	−0.075	0.658
Patients receive high quality care from Health Care System ^a	0.792	0.158
Health Care System makes too many mistakes	0.253	0.626
Health Care System puts making money above patients' needs	0.356	0.620
Health Care System gives excellent medical care ^a	0.798	0.159
Patients get same medical treatment regardless of race ^a	0.579	0.264
Health Care System lies to make money	0.315	0.682
Health Care System experiments on patients without them knowing	0.178	0.652

^aItem is reverse coded

and gender was treated as a dichotomous variable with males coded 1 and females coded 0. Race/ethnicity comprised 4 categories: Black (reference group), White, Hispanic, and other race/ethnicity. Marital status was classified into 3 groups: single (reference group); married or cohabiting; and widowed, divorced, or separated (WDS in tables).

The third set of variables captured socioeconomic status (SES). Employment status was dichotomized into employed and others (e.g., disabled, unemployed, or retired; reference group). Poverty status was determined according to the 2008 federal poverty guideline. Those respondents in households with incomes below the poverty line were classified as poor and coded 1, otherwise 0. Educational attainment had 5 groups: did not graduate from high school (reference group), high school diploma, some college, an associate/bachelor degree, and post-college diploma.

Our final group of individual-level covariates were related to access to medical services. Those with health insurance, either public or private, were coded as 1, otherwise 0. Having a regular source of health care (i.e., private doctor's office or community health center) was coded 1, otherwise 0. Participants who had cancelled a medical appointment due to transportation difficulties were coded 1, in contrast to those without this experience (coded 0).

Neighborhood Level We utilized 5 variables to capture neighborhood social environment. The 2000 Census data at tract level were aggregated to Philadelphia neighborhoods to create the following covariates: residential stability, social affluence, and neighborhood disadvantage. These measures were motivated by Sampson and colleagues and other studies.^{20,39,40} Residential stability was derived from 2 variables: the percent of house owners and the percent of residents living at the same address over 5 years. Due to the high correlation between these 2 variables (0.71 [$p<0.01$]), we standardized the 2 variables and averaged the scores to yield one single indicator of residential stability. Social affluence and neighborhood disadvantage were 2 factor scores derived from 8 census variables. Five variables loaded on "social affluence": percent of households with resident/room ratio greater than 1 (factor loading=0.77), percent of female-headed households (0.85), unemployment rate (0.94), poverty (0.96), and percent of people receiving public assistance (0.89). Neighborhood disadvantage included 3 variables: percent of residents having at least a bachelor's degree (0.96), percent of people reporting

managerial or professional occupations (0.96), and percent of people whose annual income is higher than \$75,000 (0.66). These 2 factors accounted for over 90% of the total variance among the 8 variables.

The final 2 variables relate to neighborhood crime. We obtained the 2004 tract-level crime data from the Philadelphia Police Department and aggregated these to the neighborhood level separately for property and violent crime (and converted to rates per 1,000 resident population). Total property crimes include residential and commercial burglaries, theft, auto theft, and arson, while violent crimes include robberies and aggravated assaults. In contrast to property crimes, violent crimes were relatively rare and it is appropriate to analyze them separately.

Analytic Strategy

To test our hypotheses, logistic multilevel models were implemented in HLM 6.⁴¹ We first conducted a model where distrust variables and 3 random effects were included (see Eq. 1). If the Chi-square tests for the random effects were statistically significant, this is evidence that multilevel analysis may be used and that neighborhood-level covariates may explain the variation across neighborhoods.

$$\begin{aligned}
 \eta_{ij} &= \log\left(\frac{\phi_{ij}}{1 - \phi_{ij}}\right) = \beta_{0j} + \beta_{1j}x_{\text{competence}} + \beta_{2j}x_{\text{values}} + r_{ij} && \text{Individual Level} \\
 \beta_{0j} &= \gamma_{00} + u_{0j} && \text{Neighborhood Level} \\
 \beta_{1j} &= \gamma_{10} + u_{1j} \\
 \beta_{2j} &= \gamma_{20} + u_{2j} \\
 \eta_{ij} &= \log\left(\frac{\phi_{ij}}{1 - \phi_{ij}}\right) = \gamma_{00} + u_{0j} + (\gamma_{10} + u_{1j})x_{\text{competence}} + (\gamma_{20} + u_{2j})x_{\text{values}} + r_{ij}
 \end{aligned} \tag{1}$$

where

η_{ij} —is the log odds of reporting poor/fair for the i th individual in the j th neighborhood

ϕ_{ij} —is the log odds of reporting poor/fair self-rated health

r_{ij} —is the random effect for the i th individual in the j th neighborhood

γ_{00} —is the intercept in the data

γ_{10} —is the fixed effect of the competence distrust

γ_{20} —is the fixed effect of values distrust

u_{0j} —is the random effect for the j th neighborhood

u_{1j} —is the random effect for competence distrust at the j th neighborhood

u_{2j} —is the random effect for values distrust at the j th neighborhood

Next, the associations between other individual-level variables and self-rated health were examined. In doing so, the first hypothesis can be tested. If the random effects are significant after accounting for individual characteristics in the models, we then take neighborhood social environment covariates into account. Eq. 1 can be expanded into Eq. 2 (below) and the direct associations between neighborhood social environment and distrust can be examined:

$$\begin{aligned}
 \eta_{ij} &= \log\left(\frac{\phi_{ij}}{1 - \phi_{ij}}\right) = \gamma_{00} + u_{0j} + (\gamma_{10} + u_{1j})x_{\text{competence}} + (\gamma_{20} + u_{2j})x_{\text{values}} \\
 &\quad + \sum \gamma_{0l}w_{lj} + \sum \beta_{kj}x_{ijk} + r_{ij}
 \end{aligned} \tag{2}$$

where

γ_{01} – is the direct effect of neighborhood social environment l
 w_{lj} – is the neighborhood social environment feature l of j th neighborhood
 β_{kj} – is the fixed effect of individual covariate k
 x_{ijk} – is the covariate k of individual i at neighborhood j

To test if neighborhood social environment moderates the relationships between distrust and self-rated health, the interactions between individual distrust scores and social environment need to be considered,⁴² as shown in Eq. 3. The statistically significant $\gamma_{\text{competence},l}$ or $\gamma_{\text{values},l}$ indicate that the associations of distrust with self-rated health vary as a function of the neighborhood social environment measures.

$$\beta_{\text{competence},j} = \gamma_{10} + \sum \gamma_{\text{competence},l} w_{lj} + u_{1,j}$$

$$\beta_{\text{values},j} = \gamma_{20} + \sum \gamma_{\text{values},l} w_{lj} + u_{2,j}$$

where

$\gamma_{\text{competence},l}$ – is the moderating effect of competence distrust of the neighborhood feature l

$\gamma_{\text{values},l}$ – is the moderating of valid distrust of the neighborhood feature l

$$\begin{aligned} \eta_{ij} &= \log \left(\frac{\phi_{ij}}{1 - \phi_{ij}} \right) \\ &= \gamma_{00} + u_{0j} + \left(\gamma_{10} + \sum \gamma_{\text{competence},l} w_{lj} + u_{1j} \right) x_{\text{competence}} \\ &\quad + \left(\gamma_{20} + \sum \gamma_{\text{values},l} w_{lj} + u_{2j} \right) x_{\text{values}} + \sum \gamma_{0l} w_{lj} + \sum \beta_{kj} x_{ijk} + r_{ij} \end{aligned} \quad (3)$$

RESULTS

Table 2 displays the descriptive statistics for all individual- and neighborhood-level variables used in our analyses. The mean age was 51, and one-third of the respondents were male. Almost 30% of the respondents reported poor/fair health status and more than 40% were African Americans. While 25% of the respondents were widowed, divorced, or separate, 2 out of 5 individuals were married or cohabiting. Fifteen percent were in poverty and 88% had graduated high school. In terms of access to medical services, 10 percent did not have health insurance, almost 90% identified a regular source of care, and 12% had cancelled a medical appointment due to transportation difficulties.

The average rate of violent crimes and property crimes was approximately 13 and 48 crime incidents per 1,000 population in a neighborhood, respectively. However, the high standard deviations suggest that crime rates varied greatly across neighborhoods.

The results of the individual-level models are provided in Table 3. Without controlling for other variables, values distrust, though not competence distrust, was associated with poor/fair health. However, it should be noted that the 3 random effects (variance components) were all statistically significant in model I, indicating the importance of the neighborhood contexts used in this study. Inclusion of demographic predictors in model II did not change the associations of distrust with self-rated health. When SES factors are added (model III) however,

TABLE 2 Descriptive statistics of variables at both levels

Variables	Mean/percent ^a	SD	Min	Max
Individual level (N=4,394)				
Dependent variable				
Self-rated health (1=poor/fair, 0=good/excellent)	0.28	0.45	0.00	1.00
Independent variables				
Competence distrust	0.00	1.00	-3.05	3.45
Values distrust	0.00	1.00	-4.36	3.19
Age	50.88	16.88	18.00	100.00
Gender (1=male, 0=female)	0.32	0.46	0.00	1.00
Black (ref)	0.43	0.50	0.00	1.00
White	0.42	0.49	0.00	1.00
Latino	0.08	0.27	0.00	1.00
Other races	0.07	0.21	0.00	1.00
Single (ref)	0.32	0.47	0.00	1.00
Married	0.42	0.49	0.00	1.00
WDS	0.26	0.44	0.00	1.00
Employed (1=employed, 0=otherwise)	0.58	0.49	0.00	1.00
No high school diploma (ref)	0.12	0.32	0.00	1.00
High school	0.39	0.49	0.00	1.00
Some college	0.21	0.41	0.00	1.00
College	0.18	0.38	0.00	1.00
Post-college	0.11	0.31	0.00	1.00
Poverty (1=poor, 0=otherwise)	0.15	0.35	0.00	1.00
Insured (1=insured, 0=otherwise)	0.91	0.29	0.00	1.00
Regular source of care (1=yes, 0=no)	0.89	0.31	0.00	1.00
Transportation problem (1=yes, 0=no)	0.12	0.33	0.00	1.00
Neighborhood level (N=45)				
Stability	0.00	0.93	-3.25	1.64
Disadvantage	0.00	1.00	-1.38	2.40
Affluence	0.00	1.00	-1.21	3.02
Violent crime rates	12.60	6.52	2.17	28.56
Property crime rates	47.94	17.14	22.48	107.95

SD standard deviation, Min minimum, Max maximum, WDS widowed/divorced/separated, ref reference group

^aFor dummy variables, the mean values represent the percents of the groups coded 1

both competence and values distrust became significant determinants of poor/fair health. This result echoed a recent finding—distrust varied by demographics and SES covariates, but had an independent impact on self-rated health.^{15,36,43} The access to medical services measures (model IV) did not change this substantive finding.

For completeness, we discuss the findings at the individual level based on model IV. After controlling for all individual-level variables, both dimensions of distrust were positively associated with the odds of reporting poor/fair health. Moreover, the magnitudes of their effects were similar, where a one unit increase in the standardized distrust scores is associated with over a 10% increase in the odds of evaluating overall health as poor/fair.

A 10-year increase in age is associated with an almost 20% increase in the odds of reporting poor/fair health ($1.016^{10}=1.172$). White respondents were 30% less likely to have poor/fair health compared with black respondents. Although

TABLE 3 The multilevel logistic regression results of self-rated health with individual-level variables (N = 4,394)

Variables	Model I	Model II	Model III	Model IV
	Odds ratio (95% CI)	Odds ratio (95% CI)	Odds ratio (95% CI)	Odds ratio (95% CI)
Intercept	0.403 (0.355, 0.458)***	0.175 (0.136, 0.225)***	0.680 (0.484, 0.956)*	0.401 (0.265, 0.605)***
Distrust				
Competence	1.010 (0.940, 1.085)	1.064 (0.989, 1.145)	1.131 (1.036, 1.235)**	1.106 (1.004, 1.218)*
Values	1.151 (1.057, 1.252)**	1.111 (1.022, 1.208)*	1.142 (1.042, 1.252)**	1.113 (1.016, 1.220)*
Demographics				
Age		1.024 (1.018, 1.029)***	1.012 (1.006, 1.019)***	1.016 (1.009, 1.023)***
Gender (ref: female)		1.061 (0.923, 1.219)	1.041 (0.901, 1.203)	1.111 (0.964, 1.281)
Races (ref: Black)				
White		0.623 (0.507, 0.767)***	0.684 (0.548, 0.853)***	0.705 (0.567, 0.875)**
Latino		1.096 (0.775, 1.551)	0.979 (0.704, 1.361)	0.974 (0.699, 1.357)
Others		0.998 (0.661, 1.507)	1.142 (0.713, 1.771)	1.164 (0.741, 1.830)
Marital status (ref: single)				
Married		0.711 (0.567, 0.891)**	0.897 (0.713, 1.128)	0.936 (0.743, 1.180)
WDS		1.034 (0.832, 1.284)	0.993 (0.792, 1.245)	0.973 (0.773, 1.225)
SES				
Employed (ref: not employed)			0.395 (0.316, 0.492)***	0.441 (0.350, 0.555)***
Education (ref: no high school diploma)				
High school			0.655 (0.501, 0.856)**	0.666 (0.504, 0.879)**
Some college			0.430 (0.325, 0.569)***	0.443 (0.334, 0.587)***
College			0.331 (0.256, 0.428)***	0.333 (0.254, 0.437)***
Post-college			0.281 (0.193, 0.410)***	0.302 (0.203, 0.449)***
Poverty (ref: non-poor)			1.665 (1.329, 2.085)***	1.462 (1.194, 1.789)***
Access to medical services				
Insured (ref: non-insured)				0.967 (0.700, 1.335)
Regular source of care (ref: no)				1.124 (0.829, 1.523)
Transportation problem (ref: no)				3.189 (2.564, 3.966)***
Variance components				
Intercept	0.154***	0.119***	0.052***	0.056***
Competence distrust	0.011*	0.009*	0.021*	0.032**
Values distrust	0.031**	0.026*	0.028*	0.027*

CI confidence interval, WDS widowed/divorced/separated, SES socioeconomic status
*p<0.05; **p<0.01; ***p<0.001

marriage/cohabitation showed a protective effect on self-rated health in model II, this relationship became insignificant after accounting for SES. Educational attainment, employment, and poverty status were all significantly associated with self-rated health. For example, those in poverty were almost 50% more likely to have poor/fair health compared with those above the poverty line. An education attainment gradient is evident, with the odds of poor/fair health decreasing as the highest level of attainment increases. Insurance status and regular source of care were not related to self-rated health; however, transportation difficulties tripled the odds of reporting poor/fair health status. The neighborhood-level random effects of both distrust scores remained significant, suggesting that neighborhood features may explain why the relationships between distrust and self-rated health differ by neighborhood.

Table 4 displays the results of the 2-level logistic regression models. Model V included stability, disadvantage, and affluence. The inclusion of these neighborhood features did not affect the findings at the individual level. Both distrust scores, for instance, remained positively related to self-rated health. At the neighborhood level, only affluence was negatively associated with health status. Specifically, other things equal, a one standard deviation increase in the neighborhood affluence score was associated with a 30% decrease in the odds of evaluating health as poor/fair. The variance components of distrust scores were unchanged between models IV and V, but the included neighborhood characteristics reduced the magnitude of the random effect of the intercept by roughly 36% $((0.056 - 0.036)/0.056 = 0.36)$. That is, neighborhood characteristics are of relevance to self-rated health.

We also considered the role of the neighborhood social environment in moderating the associations between distrust and self-rated health. In model VI, the results suggested that disadvantage enhanced the association between competence distrust and poor/fair health. Specifically, competence distrust was associated with an additional 20% increase in the odds of reporting poor/fair health if the respondent had resided in a neighborhood with one standard deviation higher in the disadvantage score. It should be noted that this moderating association did not alter the direct relationship between competence distrust and self-rated health.

With the crime rates added in model VII, the association between competence distrust and self-rated health became stronger (a 30% increase in the odds of having poor/fair health) and values distrust was insignificant. Even with these model refinements, the associations of the individual demographic, SES, and access to medical services predictors with self-rated health were stable. The inclusion of crime rates in models VI and VII is indicative of their role in distrust formation. Stability was a significant determinant of self-rated health, where living in a stable neighborhood reduced the odds of having poor/fair health by 19%. This finding corresponded to a recent study that investigated the impact of neighborhood stability on health.²⁰

Though we did not find a direct association between either violent or property crimes and self-rated health in our final model, these variables were indirectly related to poor/fair health via distrust, the moderating associations. Specifically, the relationship between values distrust and self-rated health seem not to differ by neighborhood social environment factors. Nonetheless, the association between competence distrust and poor/fair health status was enhanced by crime rates. When holding constant competence distrust, the odds of having poor/fair health raised with the increase of crime rates. More specifically, property crime rates had a significant

TABLE 4 The multilevel logistic regression results of self-rated health with individual and neighborhood-level covariates

	Model V	Model VI	Model VII
Variables	Odds ratio (95% CI)	Odds ratio (95% CI)	Odds ratio (95% CI)
Individual level (N=4,394)			
Intercept	0.388 (0.251, 0.600)***	0.382 (0.246, 0.594)***	0.478 (0.269, 0.849)*
Distrust			
Competence	1.111 (1.006, 1.225)*	1.122 (1.023, 1.231)*	1.323 (1.026, 1.705)*
Values	1.112 (1.013, 1.219)*	1.114 (1.017, 1.220)*	1.415 (0.993, 2.016)
Demographics			
Age	1.016 (1.009, 1.023)***	1.016 (1.010, 1.023)***	1.016 (1.009, 1.023)***
Gender	1.111 (0.961, 1.284)	1.119 (0.965, 1.298)	1.127 (0.970, 1.310)
Races			
White	0.700 (0.552, 0.888)**	0.701 (0.551, 0.892)**	0.713 (0.558, 0.911)**
Latino	0.952 (0.685, 1.324)	0.954 (0.684, 1.331)	0.982 (0.701, 1.375)
Others	1.155 (0.735, 1.813)	1.149 (0.731, 1.806)	1.150 (0.726, 1.822)
Marital status			
Married	0.945 (0.750, 1.191)	0.941 (0.746, 1.188)	0.944 (0.746, 1.196)
WDS	0.974 (0.773, 1.228)	0.975 (0.773, 1.231)	0.978 (0.774, 1.236)
SES			
Employed	0.437 (0.346, 0.552)***	0.435 (0.343, 0.551)***	0.430 (0.339, 0.545)***
Education			
High school	0.673 (0.508, 0.890)**	0.679 (0.551, 0.902)**	0.680 (0.510, 0.907)**
Some college	0.452 (0.341, 0.598)***	0.454 (0.343, 0.603)***	0.457 (0.344, 0.606)***
College	0.346 (0.265, 0.453)***	0.348 (0.265, 0.455)***	0.349 (0.265, 0.460)***
Post-college	0.324 (0.218, 0.483)***	0.325 (0.217, 0.488)***	0.326 (0.216, 0.492)***
Poverty	1.446 (1.179, 1.774)***	1.454 (1.184, 1.786)***	1.458 (1.186, 1.792)***
Access to medical services			
Insured	0.969 (0.701, 1.338)	0.962 (0.695, 1.333)	0.957 (0.692, 1.324)
Regular Source of care	1.120 (0.826, 1.517)	1.128 (0.832, 1.529)	1.153 (0.850, 1.564)
Transportation problem	3.167 (2.543, 3.944)***	3.154 (2.537, 3.922)***	3.177 (2.554, 3.952)***
Neighborhood level (N=45)			
Direct associations			
Stability	0.865 (0.734, 1.020)	0.861 (0.728, 1.018)	0.811 (0.664, 0.991)*
Disadvantage	0.861 (0.688, 1.077)	0.852 (0.681, 1.066)	0.853 (0.685, 1.061)
Affluence	0.730 (0.585, 0.910)**	0.716 (0.575, 0.892)**	0.710 (0.568, 0.889)**
Violent crimes			1.005 (0.978, 1.032)
Property crimes			0.994 (0.988, 1.000)
Moderating associations			
Competence distrust			
Stability		1.027 (0.895, 1.178)	1.037 (0.855, 1.215)
Disadvantage		1.206 (1.019, 1.428)*	1.265 (1.058, 1.513)*
Affluence		1.099 (0.973, 1.241)	1.137 (0.959, 1.348)
Violent crimes			0.961 (0.928, 0.994)*
Property crimes			1.007 (1.001, 1.014)*
Values distrust			
Stability		1.047 (0.902, 1.214)	1.019 (0.855, 1.215)
Disadvantage		1.105 (0.915, 1.334)	1.132 (0.897, 1.429)
Affluence		1.050 (0.885, 1.245)	1.067 (0.870, 1.307)
Violent crimes			0.982 (0.944, 1.022)
Property crimes			1.000 (0.992, 1.007)
Variance components			
Intercept	0.036**	0.036**	0.026*
Competence distrust	0.033**	0.142*	0.010*
Values distrust	0.027*	0.157*	0.022*

CI confidence interval, SES socioeconomic status

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

impact on moderation. A one standard deviation increase (17.14 per 1,000 population) was associated with 13% increase in the odds of reporting poor/fair health. Our findings here corresponded to the institutional performance model—distrust varying by neighborhood social environment, and hence affecting self-rated health differently. Furthermore, comparing model VII with model IV, the variance components of the intercept and competence distrust decreased by 54% $((0.056 - 0.026)/0.056)$ and 69% $((0.032 - 0.010)/0.032)$, respectively. These reductions can be understood as neighborhood social environment explaining the variation in the odds of reporting poor/fair health across neighborhoods.

DISCUSSION

This study uses an institutional performance model framework to explore whether neighborhood social environment moderated the association between health care system distrust and poor/fair health. Our hypotheses (3.a) and (3.c) are verified—neighborhood disadvantage and crime rates increase the odds of having poor/fair health via high competence distrust. We did not find evidence for the moderating effects of social affluence and stability; however, these 2 neighborhood features are directly associated with poor/fair health (hypotheses 2.a and 2.d). That is, our study suggests that specific attributes of the neighborhood social environment link to self-rated health, and do so in different ways. Without studying the interactions between individual distrust and neighborhood environment, this would not be revealed. Finally, even after controlling for individual- and neighborhood-level covariates, distrust is directly related to self-rated health, confirming hypothesis (1).

Not only does this study provide evidence in the health literature of *whether* neighborhood environment matters,^{20,21} but also advances the literature by demonstrating *how* the neighborhood social environment affects individual health status. While associations between crime rates and mental health have been found,^{44,45} we did not find a direct association with self-rated health. By expanding the institutional performance model, we argue that an individuals' residential environment is relevant in their personal evaluation of their self-rated health.

This paper has several limitations. Firstly, there is no consensus on the definition of a neighborhood.⁴⁶ While we used the neighborhood boundaries defined by local planners and policy makers, other areal definitions may alter the calibration of social environment variables and the findings aforementioned may be changed. Secondly, our statistical modeling assumes that individuals are only affected by their residential neighborhood. The impacts of other places on self-rated health, e.g., the neighborhood where people work and shop, are ignored. Thirdly, the PHMC covers the Philadelphia metropolitan area, so caution is required in generalizing these findings to other metropolitan areas or populations. Fourthly, although we used different cross-sectional datasets in our analysis, a longitudinal and quasi-experimental research design is preferable in untangling any causal relationships between neighborhood social environment, distrust, and health. Finally, the survey data are self-reported and subject to recall bias and measurement errors.^{47,48}

Several policy implications may be drawn from the findings. As distrust is directly linked to self-rated health, a valid predictor for many other health outcomes,¹¹ rebuilding confidence (reducing distrust) in the health care system is integral to improving public health. For instance, a recent study has suggested that high levels of distrust in the health care system is associated with low odds of using preventive health services, controlling for other competing explanations.⁴⁹ Our results also imply that

policies that target crime to help establish safe and cohesive neighborhoods may further reduce the impact of distrust on self-rated health. These macro-level actions can increase individuals' perception of health care performance and facilitate health.

In conclusion, by using a newly developed health care system distrust scale and the institutional performance theory, this study tested both the direct and indirect associations of neighborhood social environment with self-rated health. Social affluence and stability were directly associated with poor/fair health, but crimes and neighborhood disadvantage influenced health via distrust. Although multilevel modeling has been popular in health studies, little research has explicitly examined the interactions between individuals and neighborhood social environments.

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