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Original article

# Consumer credit scores as a novel tool for identifying health in urban U.S. neighborhoods

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ABSTRACT

*Purpose:* Credit scores may operate as a socioeconomic indicator of health: they represent cumulative financial history that directly influences ability to access financial and nonfinancial resources related to health. Yet, little is known about the relationship of credit score and health or to traditional measures of socioeconomic position (SEP). Our objectives were to (1) evaluate the association between area-level credit score and individual self-rated health and (2) compare credit score to traditional markers of area-level SEP in predicting self-rated health.

*Methods:* Equifax estimates of average household credit score in 2015 among nine-digit zip code regions were combined with a representative survey of 2083 residents of Philadelphia to estimate the correlation with income, housing value, education, and occupational status and then predict the odds of self-rated health for credit score and each SEP measure.

*Results:* Credit score was moderately correlated with SEP markers ($r = -0.78$ to 0.49). After adjusting for area- and individual-level SEP and demographic factors, each SD increase in credit score is associated with 26% greater odds of better self-rated health (odds ratio = 1.26, 95% confidence interval: 1.09–1.46). Credit score had a larger effect size than other SEP markers.

*Conclusions:* Credit score may be a useful complement to traditional measures of SEP in assessing health outcomes.



Credit scores represent a person's financial situation, and low credit score has been linked to worse outcomes for both acute and chronic diseases [1–4]. In the United States, credit scores are numeric estimates of an individual's likelihood of paying debts on time [5] based on past payment behavior, current credit utilization, history or length of credit use, new accounts and credit inquiries, and mix of credit in use [6]. Credit scores may be negatively affected by missed payments, past debts written off by creditors or sent to collections agencies, repossessions or voluntary surrenders, foreclosures, and bankruptcy. Despite many ways in which credit scores might influence health, few studies on health have used credit scores, and none have assessed potential effects of credit score on overall self-rated health.

Studies that have used credit scores suggest that socioeconomic factors and behavioral factors plausibly link credit to health outcomes. For example, a previous study linking higher credit scores with lower cardiovascular disease risk found that education and behavioral factors explained 45% of the relationship between credit and health [1]. A study suggesting higher credit default rates coincided with higher influenza rates posited that illness represents an economic shock that disrupts income and financial security and might influence credit scores [4]. Yet, studies have not assessed how credit scores are linked to measures of financial security or socioeconomic position [7]. Socioeconomic position (SEP) is an aggregate latent construct that includes both resource-based (income, wealth, education) and prestige-based (education, social connections, and status) measures that represent one's social position and access to material goods [8]. As a cumulative measure of financial decisions, credit may reflect the resources an individual has to manage a disease or respond to economic shocks due to disease.

As with measures of SEP, credit score may be a salient risk factor for health at both the individual level and area level. Credit score may directly affect overall health through an increase or decrease in the amount of material resources an individual has to manage one's own health. For example, those with good credit scores receive

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larger mortgage loans with lower interest rates, allowing them to purchase a home in a safer neighborhood. At a neighborhood level, access to consumer credit may be lower in neighborhoods with a higher concentration of minority residents, leading to poorer credit scores among residents of those neighborhoods and thus lower access to credit-related resources [9]. Financial strain among those with low credit scores may lead to unhealthy coping mechanisms, leading to or exacerbating poor health outcomes. Some employers even use credit score as a screening tool, meaning that those with low credit may be more likely to face unemployment and the resulting health risks [10]. Credit scores may also indirectly affect self-rated health if debt or other adverse events that lower credit score lead to depression or anxiety.

## Objectives

The objectives of this analysis are to (1) evaluate the association between area-level credit score and individual self-rated health and (2) compare credit score to traditional markers of area-level SEP in predicting self-rated health. To the best of our knowledge, this is the first study to consider credit score as a risk factor for self-rated health and to compare socioeconomic correlates of credit score. This work could lead to improved measurement of SEP and risk profiling of individuals and communities.

## Methods

This cross-sectional secondary data analysis did not include any identifiable individual-level data and qualified as exempt from Johns Hopkins University Institutional Review Board review.

### *Data sources*

The main exposure of interest is credit score. Here, credit score is Equifax's calculation of the average credit score in nine-digit zip code regions for the year 2015. Equifax is one of three major credit reporting agencies in the United States; Equifax credit scores range from 300 to 850 [6]. The nine-digit zip code (also referred to as zip code plus four) was the smallest unit at which credit score data were available, to protect the privacy of households. Among nine-digit zip code areas with at least seven households (which Equifax terms “microneighborhoods”), household credit data are aggregated to the microneighborhood level to create the nine-digit zip code area averages used in this analysis. Zip codes are used by the United States Postal Service to organize mail delivery routes; nine-digit zip codes are smaller subdivisions of these areas [11].

The outcome is individual self-reported general health status, from Public Health Management Corporation's (PHMC) 2014–2015 Southeastern Pennsylvania Household Health Survey. The PHMC survey is a random digit dialing cellular and landline telephone survey of individuals aged $\geq$18 years from a probability sample of over 10,000 households in Southeastern Pennsylvania. This analysis used deidentified data from adults who reside in Philadelphia and for whom residential address could be matched to a nine-digit zip code. Demographic, socioeconomic, and health information for the household is collected by interviewing one adult. Respondents were asked, “Would you say that in general your health is excellent, very good, good, fair, or poor?” This single-item self-rated health question has been previously validated against clinical measures of health and is a gold standard for assessing self-reported general health [12]. Credit score data were appended to PHMC data through a collaboration between PHMC and Equifax: PHMC matched each participant to a credit score based on the participant's nine-digit zip code and provided a deidentified data set to the study team.

Microneighborhood-level SEP indicators included the following: median income, percent of adults 25+ with a graduate degree (a proxy for education attainment), percent of adults with a white-collar job (i.e., professional, technical, managerial, sales, or administrative occupations), percent single-parent households, median housing value, and median rent, as well as demographic factors such as percent black, percent white, and median age. These indicators were selected because they are measures most often used to capture individual and neighborhood income, education, and occupation in research on the health effects of SEP. These are census-derived nine-digit zip level data compiled by EASI [13]. Individual covariates included race, sex, age, education, and income.

### *Analysis*

Means and SDs were calculated overall and by Equifax categories of credit scores (excellent/very good, 750–850; good/fair, 650–749; and poor/very bad, 300–649). ANOVA was used to test whether mean values were statistically significant between categories of credit score. We estimated Pearson correlation coefficients to evaluate correlation between credit score and other indicators of neighborhood level SEP.

To evaluate credit score as an independent risk factor for general health, we used ordinal logistic regressions to model the association between credit scores, income, education, housing values, proportion with white-collar jobs, percent single-parent households, and demographic factors at the nine-digit zip code level. We also included one model with individual-level covariates: race, age, sex, education, and income. The individual-level income variable was missing for 22% of respondents and was imputed based on age, sex, race, and education in the analysis.

All variables were standardized with a mean of 0 and SD of 1, so that effect size could be compared between variables. Odds ratios from these models can be interpreted as the odds of a one-unit increase in the outcome, that is, of moving to a better category of general health, per SD increase in the explanatory variable. In a sensitivity analysis, we applied the survey weights provided by the PHMC survey.

We were not able to use multilevel modeling methods because there were very few respondents clustered in the same nine-digit zip code regions: the 2083 participants lived in 2015 nine-digit zip code regions and no region had more than three participants. Nested models were compared using a likelihood ratio test. *P*-values less than .05 were considered statistically significant.

## Results

A total of 2083 respondents lived in 2015 nine-digit zip code areas in Philadelphia in 2015. Microneighborhood credit scores in our sample ranged from 531 to 804, with the majority of participants living in areas with good/fair credit (48%) or poor/very bad credit (41%). Table 1 shows that microneighborhoods with excellent/very good credit scores were significantly more likely to have lower population density, a higher percentage of white residents, and a lower percentage of black residents, and older residents than areas with good/fair or poor/very bad credit. In addition, areas with excellent/very good credit have higher median income, more adults with graduate degrees and white-collar jobs, and higher median rent and housing value. While 18% of the overall sample reported “excellent” self-rated health, respondents were significantly more likely to report “excellent” health if they lived in a nine-digit zip code region with excellent/very good credit.

Table 2 shows the correlations between credit score, demographic factors, and traditional markers of socioeconomic