Title

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Authors

Gonzalez, Angelica
Navarro, Cristina Acosta
Ghimire, Prashamsa
et al.

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The Ties Between Socioeconomic Status and Redlined Communities and its Effects on Maternal and Fetal Health: A Literature Review

Cristina Acosta Navarro, Prashamsa Ghimire, Nisha Kaneriya, Jasleen Kang
Mentor: Angelica Gonzalez

Public Health and Health Sciences Undergraduate Laboratory at Berkeley
University of California, Berkeley

Abstract

Government policies often target vulnerable communities on the premise of their socioeconomic status, race, gender, etc., and hinder their ability to attain proper resources. These discriminatory practices can have consequences that span generations when enforced upon expecting mothers that lack access to preventative care. Whether it be for education, basic needs, or even health, access is undoubtedly disproportionate. Redlining is a specific policy that has seeped its way into communities and continues to affect the socioeconomic status of hundreds of thousands of families. One aspect of health that is especially impacted is maternal and fetal health. Findings show increased health risks for mothers and an increase in potential fetal mortality in these areas. Expanding research on the topic is crucial to promoting policies and the expansion of programs that will help subside these harmful effects that pose a risk to these communities. Our environments, both physical and social, are determinants of our health and in reviewing existing literature, it is clear that where we live is vital to our livelihoods.

Introduction

In the U.S., maternal mortality remains a deeply concerning problem within healthcare. Within developed countries, the U.S. is leading in maternal mortality. Reports cite that the mortality rate has also increased, between 2019 and 2018 the rates were 20.1 and 17.4 per 100,000 live births respectively (Hoyert, 2019), and these numbers have significant disparities along racial and ethnic lines. To investigate this trend, this report will focus on how the practice of redlining has built the foundations of racist structures across the U.S. and caused the conditions facilitating this issue.

To understand the importance of redlining and the role it plays in health disparities, the context of redlining must be established. Historically, deeply rooted systemic faults have placed

and kept certain people in outcasted communities. Redlining is defined as “discriminatory practices which denied access to credit and insurance for borrowers in neighborhoods that were economically disadvantaged and/or had high percentages of minorities” (NCRC 2021). The most affected groups by this issue were low-income, and largely black and brown communities. Due to the nature of the practice, redlining since the 1930s has resulted in fewer resources being allocated to these areas and the impact is generations of families being prevented from building wealth. This has led to vast disparities in homeownership and other sectors, such as healthcare (McCarthy, 1992).

Previous work on the individual impacts of residing in redlined communities has described the environmental discrepancies that affect health — such as lack of green space. Our research question, “How do socioeconomic status and residence in redlined neighborhoods affect maternal and infant health?” furthers our understanding of this topic by investigating possible connections between socioeconomic status and residing in redlined neighborhoods, and how the two contribute to maternal and fetal health. We predict that low-socioeconomic status makes individuals more likely to live in redlined communities, and this living situation leaves mothers more vulnerable to birth complications and mortality.

We anticipate that our further investigation into the consequences of socioeconomic hardship and redlining will influence additional research that results in the collection of more concrete data. This will hopefully provide a path to a feasible solution that aid in improving maternal and fetal health and provide awareness of these consequences.

Background

Structural racism is embedded in the U.S. housing market, which is displayed in the practice of redlining. Redlining originates from the red lines on maps that associated Black

neighborhoods, as well as other minority groups, such as immigrants from Asia and southern Europe as "hazardous." Beginning in the 1930s, loan corporations used these maps to decline lending services to these groups of people. Although the Fair Housing Act of 1968 made racial discrimination in housing-related transactions illegal, it never truly fulfilled its key goal to further integration and equality in terms of resources. Our means of data collection thus rely on various forms of qualitative analysis performed in prior research studies. Many of these studies were longitudinal research projects that began in the 1990s as research emerged to investigate the practice of neighborhood redlining. Studies such as those executed by Anderson and Feinsten are prime examples of the studies that arose to understand the health impacts that socioeconomic status had on communities. These studies emphasize that low socioeconomic status and redlining hinder access to necessities such as healthcare, health education, housing, and nutrition, and increase exposure to emotional stress.

Methods & Data Collection

To collect initial data we began by searching PubMed seeking research on the context of our investigation. By using words like "socioeconomic status" "redlining communities" and "maternal health" and phrases including the combined terms, we came across several articles that discussed the historical context of our study and recent similar research. We also utilized platforms such as Google Scholar and the UC Berkeley Library Databases inputting the same keywords. We gathered the references listed in this article and identified those relevant by filtering the results in an attempt to find literature reviews similar to our own, however, this seems to be the first of its kind. In total, we collected roughly 20 papers, of which only 12 were used in this analysis. Those rejected were excluded on the criteria that they discussed connections of living conditions to broader health outcomes not specific to populations of

pregnant women or their infants. We rendered these sources irrelevant to our literature review and utilized only those that specifically focused on redlining health outcomes with a narrowed scope on our populations of interest. We will continue this procedure as needed to collect more data.

Additionally, members of our research group conducted two interviews with current scholars in the field. We spoke to David J.X. Gonzalez who is a current post-doctoral fellow at the University of California Berkeley studying the effects of industrial pollution on reproductive health and health inequities. He guided our work and narrowed the focus of our study from "the effects of redlining on maternal health" to "maternal and fetal health". This focus on fetal health encompassed our mission to understand the generational repercussions that living in poorly served areas gives rise to. Members of our group also conducted another interview with Xing Gao, a graduate student at UC Berkeley pursuing a career in social epidemiology. Both of these interviews granted our team first-hand insight into the real-time progress of studies in our field of interest as well as directed our attention to the often overlooked investigation of maternal health.

Results & Discussion

Current research on the legacy of historical redlining strongly suggests that its prevalence throughout the 20th century has led to ongoing racial disparities despite the practice being outlawed. Notable evidence of socioeconomic status having significant effects on mortality is described by work such as that of Anderson et al.. This study relies on family income as an indicator of socioeconomic status (SES) and this information was used to provide context for the data to be collected. Death rates by each income level were categorized based on factors like "age, race, and sex" and the authors ultimately found 30-40% higher levels of mortality for those living in lower-income areas. Such conclusions support the argument that socioeconomic status

has significant impacts on an individual's health, and in the case of detrimental impacts, they are likely exacerbated in women who are pregnant. Increased health risks for pregnant women impact the mother's health, but also that of the developing child who is at a greater risk of mortality.

Socioeconomic status was further utilized as a restrictive tool to prevent certain populations from residing in developing areas. "Institutional Racism and Pregnancy Health: Using Home Mortgage Disclosure Act Data to Develop an Index for Mortgage Discrimination at the Community Level" underlines the discriminatory practices that are meticulously used to keep families, particularly, those of color, from accessing housing in more highly funded areas of cities (Mendez et al, 2011). The Home Mortgage Disclosure Act (HDMA) is an exemplification of systemic racism on a much smaller scale, closely resembling the outlawed practice of redlining (Mendez et al., 2011). The denial of mortgage loans to families was disproportionately utilized against Black families consistently for the duration of the study. " The average black applicant was more likely to be denied a loan compared with a white applicant for all six years (e.g., 1999 OR=2.16, 95% confidence interval [CI] 1.96, 2.39; and 2004 OR=2.51, 95% CI 2.30, 2.74)" (Mendez et al., 2011). Despite attempts to control for other factors such as loan amounts and gender, the data consistently pointed at Black Americans as being the greatest victim of this discrimination. The higher probability of Non-Hispanic Black families living in redlined neighborhoods held greater implications for expecting mothers. According to Mendez et al.'s cohort study on pregnant women, 77% of these individuals resided in redlined communities, with members exhibiting a greater likelihood of developing substance use and low-birth weights (Mendez et al., 2011). These findings urge the need for investigation of the lasting consequences living in redlined communities had on fetal health. Mendez et al. ultimately emphasized that

institutional racism leads to a separation of racial groups (such as in residential segregation), disinvestment in racially mixed or non-white communities, and directing financial resources into homogenous, all-white communities. Residential redlining is likely a cause of residential segregation, which has caused a lack of equal resources and environments for individuals. This, in turn, has caused impediments in relation to health circumstances–especially birth outcomes. Such relations are diagrammed in the figure below.

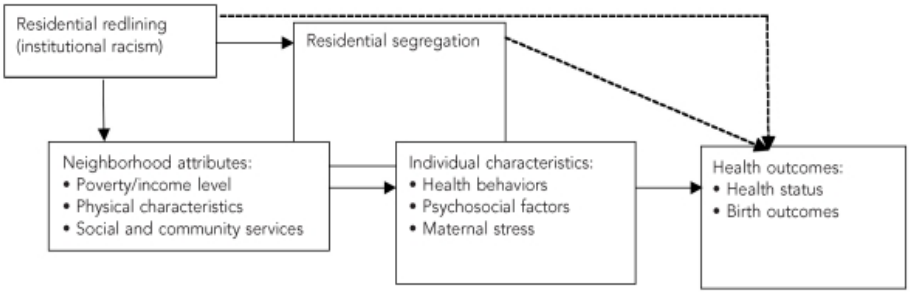

Figure 1: A diagrammed representation of the connections between neighborhood redlining, segregation, and health outcomes (Mendez et al., 2011).

A recent study led by Dr. David Gonzalez of the University of California's School of Public Health began to investigate historically redlined locations and their proximity to oil wells. This study proposes that oil wells function as a possible mechanism by which community health is declining. The emission of greenhouse gasses such as methane by these oil wells is a major toxin that members of redlined communities are exposed to for extended periods of time. These exposures disproportionately affected Black and Hispanic communities and were considered to be the origin of prevalent health disparities. Dr. Gonzalez and his colleagues found strong evidence that "exposure to oil and gas production was associated with a higher risk of spontaneous preterm birth among parents in the San Joaquin Valley, California, and that the risk was confined to parents who were Hispanic, Black, or had not completed high school," (González et al., 2022). This finding is a crucial example highlighting the mechanisms through

which exposure to environmental outlets associated with redlined communities can have negative influences on biological expressions. The placement of primarily Hispanic and Black families in closer proximity to oil wells and other sources of air and environmental pollutants is a major contributor to their increased maternal and infant health risks compared to white counterparts.

Comparisons of health in redlined and non-redlined communities are explored in the journal "Health outcomes in redlined versus non-redlined neighborhoods: A systematic review and meta-analysis". Though Eun Kyung Lee et al. did not emphasize maternal and fetal health, their work provides a social context that is key to understanding the common stresses that pregnant women face living in redlined neighborhoods. Lee et al. note a strong correlation between redlined communities and the development of adverse health outcomes (Lee, 1982). Continued research on the biological mechanisms that underlie these increased risks is required, broader physiological studies often emphasize the vulnerability of individuals to develop illnesses while under chronic conditions of stress. Residents in redlined areas typically endure chronic stressful conditions as these areas not only provide them a lack of access to healthcare, but also a lack of access to safety.

"A Framework for Analyzing the Determinants of Maternal Mortality" stresses that the probability of death is strongly influenced by one's position in society. In most situations and for most diseases, including maternal mortality, the poor and disadvantaged are more likely to die than affluent individuals (McCarthy, 1992). Specifically in maternal mortality and morbidity, socioeconomic status plays, as mentioned before, an important role and can eventually lead to premature deaths. Status, or one's position in society, is characterized by several factors. For one, it can be the level of education achieved, total income, and whether or not one is able to make

their own decisions (McCarthy, 1992). Marginalized communities that were previously redlined often see high levels of individuals with only a high school diploma and who often fall below the poverty line – these "determinants" can shape the course of a pregnancy. As outlined in the figure below, these factors can contribute to an inability to access prenatal care which can be critical and can ultimately lead to drastic outcomes such as hypertension, or even death. Redlining has undoubtedly influenced the conditions in communities that facilitate the outcomes drawn out by McCarthy and others in their work.

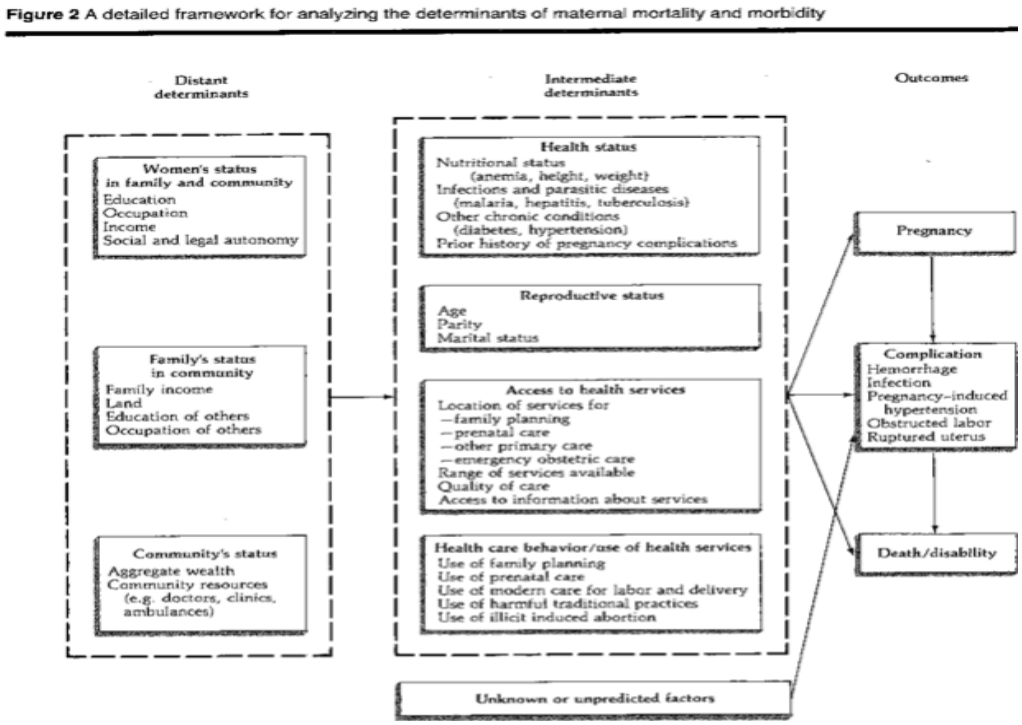

Figure 2: Scheme for analyzing the effects of several determinants on maternal and fetal health (McCarthy, 1992).

Mark Michaud, from the University of Rochester Medical Center, explains that in the 1930s and '40s, the American government created various descriptions of cities, and these policies signaled areas where mortgages could be insured. The term redlining is rooted in the color on HOLC (Home Owners' Loan Corporation) maps to recognize neighborhoods with a

majority of people of color. Redlining plans stood intact until the 1960s and created a buildup of poverty and a lack of investment in these communities. Although the consequences of redlining in relation to health and maternal issues were hinted at for a long time, the HOLC maps that have recently been digitized by the University of Richmond Mapping Inequality project have allowed researchers to analyze maternal health issues in a more detailed manner.

Studies have shown African American, American Indian, and Alaska Native women have two to three times higher mortality rates than white women (Hoyert, 2019). Especially in regards to African American women, racism has had a tremendous effect on maternal mortality, as it has manifested a lack of aid from health care professionals, low-income pay, and so forth. Data shows a large gap in wealth among African American families in comparison to white families, and it has made it difficult for many individuals to have proper health insurance (Illing, 2020).

In “Associations Between Historically Redlined Districts and Racial Disparities in Current Obstetric Outcomes,” it is explained that racial and ethnic disparities in pregnancy outcomes are clearly documented. It is emphasized that Black women carry a large burden of heightened morbidity and mortality, and “the risk for Black women is persistently around 3-fold higher than for White women " (Hollenbach 2021). In a study conducted by Hollenbach et al., patients with live births from 2005 until 2018 in the city of Rochester, New York, in Monroe county, plus 8 counties south and east of Monroe county, the form of analysis was live births clustered within zip codes that were organized by HOLC grades (also known as the redlining map). From 2005 until 2018, the data contained information for 210,984 live births. A total of 199,088 live births were eligible for inclusion as being associated with a zipcode containing more than 100 deliveries in the study period resulting in 120 zip code cohorts. Of these births, there were 64,804 within the 15 zip codes that were redlined and had HOLC grades in Rochester,

New York. “It was found that the rate of perceivable birth was 3-fold higher in a ‘hazardous’ neighborhood than a “desirable” neighborhood (26 births [0.75%] vs 7 births [0.24%])” (Hollenbach, 2021).

Limitations

The current scope of our study is very limited. Due to the historic prevalence of racist, discriminatory practices, there was a popular tendency to avoid documentation of these ongoing events. The lack of written documentation on redlining and the families forced into these areas leads to an overwhelming gap in the knowledge of personal family histories and living situations. Limited family residential information makes it substantially more difficult for researchers to trace which individuals once lived in priorly redlined areas themselves or have descendants that did so as well. The possibility of conducting helpful longitudinal cohort studies is, therefore, essentially impossible to execute and greatly limits the capacity of researchers to explore the effects of redlining on the victims themselves and to understand the underlying biological mechanisms of generational exposures. The inability to access information on the current health status of individuals whose families once endured these poor living conditions increases the difficulty in proving the detrimental effects that such a discriminatory policy has on communities.

As current drivers of research in the studies linking environment and health, David González and Xing Gao reported facing a lot of backlash for their work. The struggle of publishing work is exacerbated by peer reviews who have reported commenting on the irrelevance of their work (Gao, 2022). They discussed receiving feedback from peer reviewers encouraging them to pursue work in other fields due to redlining and other malpractices “being in the past” (González, 2022). Such comments exemplify the lack of consideration for the

generational implications of historical racism and the importance of the environment on human health. Blatant disregard for the lasting consequences of redlining and socioeconomic discrimination has led to an inheritance of predisposition to chronic illnesses primarily among communities of color.

The majority of the work on this topic is further limited in its focus being primarily on fetal health. Studies such as those referenced by Hollenbach, González, and Mendez et al., center their work on the implications of redlined communities and exposures on birth outcomes and impacts on fetal health, but very few consider the health of the mother as she experiences the poor living conditions. Focus on the mother would require researchers to know the history of their social mobility and various other external factors that significantly complicate the task of understanding connections between redlined community conditions and maternal health.

Conclusion: A Call to Action

The search for data on our topic was cut short. Redlining and the effects it once had and continues to have on marginalized populations is an up-and-coming research question. As David González, a post-doctoral fellow at UC Berkeley, emphasized, researchers in various fields are just beginning to piece together that this discriminatory policy had the capacity to impact the health of people within these communities. Historical normalization of discriminatory practices led to a substantial lack of documentation Work such as this is vital in closing health disparities and providing marginalized people with the proper resources for care.

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