**ORIGINAL PAPER**

# Stress and Health Status Among Members of a Disadvantaged Community in Flint, Michigan in the Early Phase of the COVID-19 Pandemic

Woojong Kim[1] · Sheryl Renee Groden[1]

## Abstract

The COVID-19 pandemic creates psychological concerns and stress and its impacts are more extreme for those with health concerns residing in socially and economically disadvantaged communities, such as residents of Flint, Michigan. This study assesses the stress level among people who received community assistance in the first 3 months of COVID lockdowns. Further, it examines associations between stress and physical and mental health status. We measured perceived stress, health concerns, mental distress, and perceived physical and mental health from 106 survey respondents. Comparisons of stress levels by demographics showed that females, high school graduates, and homeowners had higher stress levels than its counterparts. Results from general linear models showed that stress was highest among those with high levels of psychological distress, perceived poor mental health, and more health concerns. The associations between poor perceived physical health and stress were marginal. Homeowners and high school diploma holders showed lower stress levels. This research suggests community health practices tailored to community characteristics and culture will have the greatest impact on stress and health problems in underserved communities.

**Keywords** Flint · Stress · Physical health · Mental health · Covid 19

## Introduction

The COVID-19 pandemic, much like prior pandemics, has increased health and psychological risks and challenges in the United States [1]. Such stress disproportionately affects socially and economically disadvantaged communities, not least because it has aggravated disparities in health, social, economic, and environmental domains [2]. Decreased access to health care services, financial uncertainty, social isolation caused by the lockdown, and higher risk of exposure to the disease through employment that requires in-person contact also further imperil vulnerable people [2, 3].

Flint, Michigan, has had a large socioeconomically disadvantaged population since General Motors closed multiple plants in the city in the 1970s and 80s. The city has suffered high unemployment rates, escalating crime rates, unstable housing, high rates of food insecurity, and multiple environmental challenges. Research on Flint specifically and the United States broadly shows that food insecurity and unstable living conditions contribute to uncertainties, physical health problems, and mental health issues [4, 5]. Then in 2016 the Flint water crisis, in which the city drinking water contained high lead levels increased poor physical and psychological health outcomes [6]. Residents reported that the water crisis increased their stress levels, including their household labor stress and emotional stress, as concerns about water quality continued and uncertainty as to the long term effects of the crisis was high [7–9]. A comparison of mental and physical health status among Flint residents in 2016 and 2018 showed that crisis-related stress and fear remained high [10]. Residents of Flint had behavioral health concerns, poor perceived mental and physical health, and health problems associated with lead exposure [8, 10–12]. Additionally, the stigma of poverty and social failure and financial burdens created by the water crisis increased stress as well [9, 13]. Residents had experienced financial difficulties and increased distrust of the health care system, public health officials, and local and state governments [8, 14].

✉ Woojong Kim
  kwoojong@umich.edu

1 Social Work Department, University of Michigan-Flint, 303
  E. Kearsley Street, Flint, MI 48502, USA

COVID-19 exacerbated trauma and stress in the community, and it hit Flint hard. Almost a fifth (18.3% of residents) had been infected by May 2022 [15]. As well, vaccination rates were low, likely reflecting the impact of trauma and distrust in government [16]. Genesee County overall had a vaccination rate of 59%, while lower than 40% of Flint residents had been vaccinated by May 2022 [15].

The current study assesses stress levels and physical and mental health status of economically and environmentally disadvantaged Flint residents as reported in March 2020 to May 2020. We hypothesize that Flint residents who are concerned about their health but have limited mobility, either from a lack of transportation or due to physical limitations, as well as limited financial resources may show the greatest impact. This group would have limited health care access during the COVID-19 lockdown. Likewise social isolation might exacerbate their mental and physical challenges, with those facing food insecurity and lack of infrastructure experiencing the greatest impact.

Examining their stress level and the health status will increase our understanding of degrees of stress among Flint residents and areas that community health and social services can address. Further, by revealing associations between stress and health status, the analysis will detect groups that are particularly vulnerable in stressful situations such as a global pandemic, offering guidelines for the targeting of interventions to decrease stress and improve health status among the most vulnerable.

## Materials and Methods

### Sample

This community-based survey research is based on partnership and collaboration between a non-profit agency and a university research team. The R. L. Jones community outreach center (COC), the community partner, working in collaboration with Flint's Mass Transportation Authority (MTA Flint), provides a weekly delivery service to eligible Flint residents. Its clients consist of residents who qualify for free public transportation by MTA Flint due to limited or low income and limited mobility due to disability or lack of transportation, or due to family situation (e.g. care taking). Most of its clients live in North Flint (zip codes 48504 and 48505), which has a high poverty rate and meets the U.S. Department of Agriculture definition of a food desert.

Some clients directly contacted the COC for food aid, but many come through referrals from community agencies such as the Genesee Health Systems and the Community Health Access Programs. COC workers deliver canned food, dried food, fresh produce, and frozen meats along with water filters and information about available community services (such as fliers and informational brochures, community news, and website information). COC purchases the food delivered from the Food Bank of Eastern Michigan.

### Data Collection Procedure

Data was collected through a self-reported questionnaire survey. A trained undergraduate research assistant accompanied the two COC staff members making deliveries. The research staff explained the purpose of the survey and handed it to clients in the first week of March, 2020. At the time COC was making deliveries to 904 households every week; at 642 households (71.02%) someone was present to receive the delivery and the survey was disseminated to them. A week later Flint's COVID-19 lockdown began and the COC service coordinator called each household that received the survey and encouraged them to return it. By May 2020, 108 (16.82% of those distributed) had been returned.

The Institutional Review Boards at the University of Michigan (HUM00172134) approved this study. The Community Based Organization Partners Community Ethics Review Board, which conducts a community-based and community driven review process in Flint, also reviewed it, as it does all community-academic partnerships conducted in the city.

### Missing Data

Among 108 surveys returned, two (1.86%) were not included in the data. In one case the respondent did not sign the consent form and the other they completed only the first page, resulting in 106 usable surveys (98.14%). The remaining surveys contained an acceptable amount of missing data (8.53% of total data points). We estimated missing data using expectation maximization in order to maximize statistical power and reduce potential bias caused by ad hoc methods of handling missing data [17]. Little's Test of Missing Completely at Random (Little's MCAR) showed that the pattern of missing data could be considered "ignorable," or missing at random and appropriate for estimation (Little's MCAR $\chi^2 = 3595.073$ (df = 3611), $p = 0.571$).

### Measurement

#### Perceived Stress

We used the Perceived Stress Scale (PSS 10-items, [18]) to measure life stress among residents. The PSS is a standardized measurement which assesses globally perceived stress as a degree to which respondent's life is appraised as stressful, unpredictable, uncontrollable, and overloading [18]. Ten items started with the following statement: "During the last month, how often have you felt that…" Six items indicated

negative perception (e.g., "Upset because of something that happened unexpectedly," "Nervous and stressed") and four items indicated positive perception (e.g., "Confident about my ability to handle my personal problems"). Responses were given on the 0 to 4 scale, ranging from never (0) to very often (4). After reversing responses of the four positive items, total scores were calculated by summing up all items. A higher score indicates greater stress. The PSS has demonstrated adequate internal consistency and validity [18] and showed invariant regarding race, sex, and education [19]. The internal reliability (Cronbach's alpha) for PSS was 0.71.

### Health Status

**Physical Health** We measured residents' physical health status in two different ways: the number of health concerns they reported and their perceived physical health status. Residents were asked to mark all health concerns that they currently have among 10 items including diabetes, hypertension, high blood cholesterol, heart disease, stroke, asthma, arthritis (joint symptoms), skin cancer, other cancer, and kidney disease (e.g. kidney stones, bladder infection). Those items were selected from the Behavioral Risk Factor Surveillance System (BRFSS), which collects health-related risk behaviors, chronic conditions, and perceived health in all 50 states and the District of Columbia via annual telephone surveys [20]. Then we counted the number of health concerns that respondents reported to create a continuous variable which indicates the current health concerns. Additionally, we used a survey question to create a variable which indicates a resident's perceived physical health: "Would you say that in general your physical health is… (a) excellent, (b) very good, (c) good, (d) fair, or (e) poor." We combined these categories into two groups. Those who answered that their physical health is excellent, very good, or good were coded as having good perceived physical health, and those who reported fair or poor were coded as having poor perceived physical health.

**Mental Health** Mental health status was measured in two different ways. First, the survey asked about perceived mental health using the following statement: "Would you say that in general your mental health is…" Those who perceived their mental health was "excellent," "very good," or "good" were coded as having *good* mental health, and those who reported "fair" or "poor" were coded as having *poor* mental health. Additionally, we measured psychological distress using the Kessler Screening Scale for Psychological Distress (K6). The K6 is a six-item scale developed to provide a brief valid screen for the *Diagnostic and Statistical Manual of Mental Disorders* 4th edition serious mental illness [21]. The K6 has been widely validated nationally and internationally as a tool to assess serious mental illness and

psychological distress with adequate internal consistency and reliability [21]. Respondents were asked how often in the preceding 30 days they had felt nervous, hopeless, restless or fidgety, worthless, so depressed that nothing could cheer them up, and felt everything was an effort. Responses were given on a scale from 0 (none of the time) to 4 (all of the time) and summed to calculate total scores. The internal reliability (Cronbach's alpha) for K6 was 0.93.

### Demographics

We collected demographics such as gender (male vs. female), education level (High school graduate vs. less than high school graduate), ethnicity (African American or other races), housing tenure (living in a home they own vs. living in the rental housing or other arrangement), living alone (yes or no), having a disability (yes or no), and age to understand the sample characteristics.

### Data Analysis

We conducted the data analysis using SPSS 28.0. The characteristics of the survey participants were described by the mean, standard deviation (SD), frequency, and percentages. Independent samples t-tests were used to examine different stress levels by demographics and the health status. General linear regressions were used to examine the associations of stress with physical and mental health status after controlling for demographics.

## Results

Table 1 describes the characteristics of respondents. They were 61 years old on average (SD = 13.2) ranging from 29 to 97. The majority were female (n = 77, 72.6%) and African American (n = 82, 77.4%). 41.5% (n = 44) had completed high school education or had higher levels of education. 40.6% (n = 43) lived alone. More than three quarters (n = 81, 76.4%) reported that they had a disability. The majority (n = 82, 77.4%) were not homeowners. On average respondents had 2.2 health concerns (SD = 1.6). The average stress level score was 16.7 (SD = 6.5) and psychological distress score was 6.0 (SD = 6.2). Almost half (n = 51, 48.1%) perceived that their physical health status was poor and 36.8% (n = 39) perceived their mental health status as poor.

Table 2 describes the differences in the stress level by demographic characteristics and health status among the study sample. An independent sample t test showed that females (M = 17.5, SD = 6.8) had higher levels of stress than males (M = 14.7, SD = 5.3) in the study sample, $t(104) = 2.05$, $p = 0.043$. Those who completed high school or had higher levels of education (M = 14.7, SD = 6.0)

**Table 1** Sample Statistics (N=106)

| Items (range) | Mean | Standard deviation |
|---|---|---|
| Age (29–97) | 60.9 | 13.2 |
| Number of health concerns (0–6) | 2.2 | 1.6 |
| Stress level (PSS: 0–35) | 16.7 | 6.5 |
| Mental distress score (K6: 0–24) | 6.0 | 6.2 |
| | N | % |
| Gender | | |
| Female | 77 | 72.6 |
| Male | 29 | 27.4 |
| Race | | |
| African American | 82 | 77.4 |
| Other races | 24 | 22.6 |
| High school grad or higher | 44 | 41.5 |
| Having disability | 81 | 76.4 |
| Live in their own house | 24 | 22.6 |
| Live alone | 43 | 40.6 |
| Perceived health | | |
| Poor physical health | 51 | 48.1 |
| Poor mental health | 39 | 36.8 |

had lower levels of stress than those who did not complete high school (M = 18.2, SD = 6.6), $t(104) = 2.82$, $p = 0.006$. Those who lived in their own house (M = 13.8, SD = 6.2) had low stress scores compared to those who lived in the rental housing or had other arrangements (M = 17.6, SD = 6.4), $t(104) = 2.58$, $p = 0.011$. The stress levels varied by physical and mental health perceptions. Those who perceived physical health as poor (M = 18.5, SD = 5.0) had higher stress scores than those who perceived physical health as good (M = 15.1, SD = 7.4), $t(104) = 2.76$, $p = 0.007$. Those with poor perceived mental health (M = 20.9, SD = 5.6) had a lot higher levels of stress than those with good perceived mental health (M = 14.3, SD = 5.8), $t(104) = 5.68$, $p < 0.001$.

We conducted generalized linear modeling to examine the associations between health status and stress by controlling demographics. Table 3 presents four different models which show the results from generalized linear modeling of four different physical and mental health indicators for stress. Residents who perceived their mental health as poor ($\beta = 5.45$, $p < 0.001$) and had high levels of psychological distress ($\beta = 0.61$, $p < 0.001$) were found to have high levels of stress. Those who perceived physical health as poor had high stress levels but it was marginally significant ($\beta = 2.48$, $p = 0.051$). Those with more health concerns had high levels of stress ($\beta = 0.89$, $p = 0.046$). Those who lived in their own house ($\beta$ ranged from −3.43 to -3.07) and completed high school ($\beta$ ranged from −3.35

to −2.47) had low levels of stress except for psychological stress in Model 4.

## Discussion

This study revealed the stress level and health status among samples experiencing economic and other hardship drawn from a city that had already experienced profound environmental hardship in years leading up to the pandemic, as well as in the early months of the COVID-19 pandemic. By highlighting the physical and mental health statuses of residents and examining their relationships with perceived stress, this study suggests the directions and strategies which are suited for those who have physical and psychological concerns by considering community-specific challenges and characteristics.

Descriptive statistics show that the stress score of the study sample was 16.7 on average (SD = 6.5). This is considerably higher than the general population showed in the previous study, which was 13 [22], and comparable to the general population during the economic downturn in 2008–2009 [22]. The current study did not capture the major cause of stress. However, previous studies suggest that elevated stress levels during this period stemmed from the increased health risks, lockdown, and social isolation [1]. Given evidence that stress and concerns regarding financial issues and water quality remained strong in 2018 [10], lingering effects of the Flint water crisis may also play a role.

**Table 2** Difference in stress levels by demographics and health (N=106)

| | Stress score | | t statistics |
|---|---|---|---|
| | M | SD | |
| Gender | | | |
| Female (n=77) | 17.5 | 6.8 | 2.05* |
| Male (n=29) | 14.7 | 5.3 | |
| Race | | | |
| African American (n=82) | 16.6 | 5.8 | 0.29 |
| Other race groups (n=24) | 17.2 | 8.7 | |
| Complete high school | | | |
| Yes (n=44) | 14.7 | 6.0 | 2.82** |
| No (n=62) | 18.2 | 6.6 | |
| Having disability | | | |
| Yes (n=81) | 17.2 | 6.9 | 1.21 |
| No (n=25) | 15.4 | 5.2 | |
| Living arrangement | | | |
| In their own house (n=24) | 13.8 | 6.2 | 2.58* |
| In the rental housing or other (n=82) | 17.6 | 6.4 | |
| Live alone | | | |
| Yes (n=43) | 16.9 | 5.6 | 0.18 |
| No (n=63) | 16.7 | 7.2 | |
| Physical health | | | |
| Good (n=55) | 15.1 | 7.4 | 2.76** |
| Poor (n=51) | 18.5 | 5.0 | |
| Mental health | | | |
| Good (n=67) | 14.3 | 5.8 | 5.68*** |
| Poor (n=39) | 20.9 | 5.6 | |

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

Diverse environmental challenges that Flint residents have been exposed to, such as lack of infrastructure, poverty, food desert, and uncertainty of water quality, may lead to chronic life stress as well.

The percentage reporting poor physical health, 48.1%, was a lot higher than the 18.9% who reported poor perceived physical health in the BRFSS Prevalence and Trends data showed in that period in the state of Michigan generally [23]. This gap may be partially explained by the characteristics of the study sample, such as having low income [24], living alone [25], and being African Americans [26, 27].

The results of the t test showed that both physical and mental health had relationships with stress levels among the study population. General linear modeling confirmed these findings by showing that both poor perceived mental health and psychological distress were associated with high levels of stress. Having more physical health concerns was also associated with elevated stress levels. These findings suggest that the stress caused by COVID-19 and the lockdown may be greater for those with poor mental health and physical health concerns than others. Previous studies have established the link between stress and health outcomes (see for example [28, 29]). The high stress level among those with poor mental and physical health imply that along with limited health care access and increased risk this may have worsened study samples' health status during the COVID-19 pandemic. Given the associations among mental health, physical health concerns, and perceived stress, health care practices should address behavioral, social, and psychological factors along with physical health concerns. For example, community health care infrastructure which includes health care services along with other professional support, such as social workers and counselors, may address the community members' needs

**Table 3** General linear model results of health conditions and mental distress for stress

| | Model 1 Poor physical health | Model 2 Poor mental health | Model 3 Number of health concerns | Model 4 Psychological distress |
|---|---|---|---|---|
| | Beta (standard error) | | | |
| Poor physical health | 2.48 (1.25)+ | | | |
| Poor mental health | | 5.45 (1.18)*** | | |
| Number of health concerns | | | 0.89 (0.44)* | |
| Psychological distress | | | | 061 (0.09)*** |
| Female (vs. male) | 1.68 (1.40) | 1.69 (1.26) | 1.82 (1.38) | 0.20 (1.20) |
| African American (vs. other races) | − 0.94 (1.45) | − 0.55 (1.33) | − 0.23 (1.45) | 0.43 (1.24) |
| High school completion | − 3.35 (1.22)** | − 2.47 (1.14)* | − 3.22 (1.22)** | − 1.23 (1.09) |
| Having disability | 0.60 (1.44) | 0.73 (1.30) | 0.21 (1.49) | 0.41 (1.21) |
| Living in the own house | − 3.39 (1.60)* | − 3.07 (1.48)* | − 3.43 (1.60)* | − 2.63 (1.37)+ |
| Live alone | − 0.41 (0.05) | − 0.97 (1.22) | − 1.03 (1.34) | − 0.18 (1.13) |
| Age | − 0.05 (0.05) | − 0.03 (0.05) | − 0.08 (0.05) | 0.02 (0.04) |

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, +$p < 0.075$

more effectively. However, COVID-19 limited integrated health practices in certain communities and for certain people because of financial disadvantage, widespread distrust in the public health system, and mobility limitations (both lack of transportation and physical disability), while making them critical, given the trauma and stress the pandemic created [30]. In light of this, targeting access to health care towards those with particularly high levels of stress and health concerns may be wise. By using an effectively established relationship and trust between residents and community agencies, local health care systems and professionals can increase awareness and access to health services. For example, health care professionals or social workers can visit residents' homes with the community service staff during their regular service delivery and conduct physical and mental health screening, stress assessment, and information sharing. Also, training religious leaders to increase the awareness of mental health supports and creating referral systems between community organizations and health care systems, based on an existing trust, may increase access to health services. Faith based organizations play a large role, especially in many African American communities, in service provision and informal mental health services [31]. Future research might examine the uses of a community-based health care referral system and evaluate its effectiveness.

While having physical health concerns increased the stress level, we found that poor physical health perception was marginally significant with stress level. This may be partly because the data was collected in the early phase of the pandemic when there were a very small number of cases in the Flint community. It is possible that stress might have been higher among those who perceive their physical health as poor later in the pandemic.

The results from the t test showed that housing tenure, education level, and gender were related to stress level. After controlling other variables, living in their own house and completing high school stayed significant as being negatively associated with stress. This confirms the previous finding on association of housing tenure with mental health [32]. Perhaps, homeowners may have lower stress levels than non-homeowners by securing the place to live. It is possible that the reason race, gender, living alone, and having a disability were not significantly associated with stress has to do with the small and relatively homogenous study sample. Further research with a larger and more heterogeneous sample might produce different results.

Although this study increased our understanding of health status and its associations with stress among Flint residents with limited financial resources, it has several limitations. Given the social situation of the people in the sample, it is unsurprising that it is predominantly old, female, and African American but nonetheless it represents a limitation. As well, the survey research was conducted with those who received the community service during the service delivery time, between 8 am to 5 pm. This may have created a skewed sample and we regret that we were not able to visit the households again due to research restrictions of the authors' institution during the COVID-19 pandemic. This study also used a cross-sectional study design, which did not allow us to examine causal directions among variables.

## Conclusions

This study demonstrated that at the beginning of the COVID-19 lockdown stress levels among Flint residents with limited mobility and acute financial needs were high. Community members and agencies need to develop concrete and well-organized community-based approaches to address stress among residents, especially those who have mental and physical health challenges. Given the associations between health status and stress among those with limited mobility and financial resources, the typical clinic visit may not be effective in improving health status in certain Flint communities. Local government and health and social service providers should include intentional communication and outreach to foster trust and closer connections with local grassroots community agencies, faith-based organizations, and neighborhood groups in order to provide comprehensive services for community members and increase understanding of community's needs.

Efforts to improve access to health care should be expanded beyond the response to COVID-19. The Flint community has experienced multiple challenges in its history and cumulative impacts last long in the community. Policy makers should pay attention to how they might improve the quality of mental and physical health and create a tailored health care system based on the community's needs and situations, regardless of the pandemic. Creating a well-established supporting service and health care system and supporting community-oriented activities and service provision are imperative to empower communities such as the one studied here, to reduce frustration and create a sense of control over the community concerns, and end inequity in health.

**Author Contributions** WK: Conceptualization, data analysis, writing. SRG: Writing.

**Data Availability** The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Code Availability** Not applicable.

## Declarations

**Conflict of interest** The authors have no competing interests to declare that are relevant to the content of this article.

**Ethical Approval** The study was approved by the Institutional Review Boards at the University of Michigan [HUM00172134].

**Consent to Participate** All participants provided their informed consent to participate in the study.

**Consent for Publication** All participants provided their informed consent for their de-identified data to be published.

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