



Connecting Self-reported COVID-19 Needs with Social Determinants of Health

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Abstract. COVID-19 rapidly challenged and changed our understanding of what needs were unmet in the community and the reality of how stable communities were with respect to basic daily needs like transportation, access to medications, how financial reserves. In this study, we report on a set of hyper-local community-based surveys (N = 44796; N = 1039) developed by stakeholders from across the community using a social determinants of health lens to rapidly measure these evolving needs. Findings were stratified across a financial sustainability measure and focused on understanding where people would and were looking for support for medication and healthcare needs as well as the basic life necessities of food, water, utilities, and shelter. Survey results were shared with health system and community leaders as well as elected officials to support real-time data-driven decision making within our local community as needs rapidly evolved.

Keywords: COVID-19 · Social Determinants of Health (SDOH) · community survey · community partnerships

1 Introduction

The novel coronavirus disease 2019 (COVID-19) was a world-wide pandemic that struck rapidly causing approximately 56,498,113 infections and 1,345,205 deaths within the first months of the spread, from March to November 2020. Identifying the social impacts of COVID-19 is essential in understanding the totality of the pandemic. Research into social impacts span from public perceptions [1] to mental health effects [2] to disparity related to social determinants of health (SDOH), such as racial/ethnic based differences [4, 5], socioeconomic indicators [6], and the need for targeted response to support communities most vulnerable to complications of COVID-19 infection [7]. Emerging data within the United

States shows that using social determinants of health as a lens to community-level impacts of COVID-19 is useful. These inquiries have largely been focused on treatment of and susceptibility to the disease among specific communities. One example of these efforts comes from Chin et al., who created a SDOH-focused vulnerability map of U.S. counties, highlighting social determinants that might increase or decrease its residents' risk of contracting the disease (e.g., age, population density, poverty, job insecurity, and health insurance) per county [7]. This geocoding map extends research demonstrating that particular SDOH factors relate to hospitalization and mortality. For example, a study conducted in New York City showed that the highest rates of COVID-19 hospitalizations and deaths were found in neighborhoods with the highest rates of poverty [8]. Additionally, COVID-19 has been found to disproportionately impact minority communities in both infection and mortality rates [9,10], and thus the allocations of resources and support should include this consideration [11].

Although most of COVID-19 studies address SDOH factors from disease vulnerability, treatment, or mortality perspective, the impacts of COVID on communities is broader than just the impact of the disease itself. Indeed, some disparities in SDOH factors that lead to illness vulnerability (e.g., financial instability and access to health care and support services), might be exacerbated as communities were coping with the pandemic and its associated mandates (e.g. limited hours of operation for businesses). The movement restrictions imposed by COVID-19 mandates alone were related to severe economic costs among both regional and national governments and their vulnerable citizens [12]. Hence, when communities chose to respond to COVID-19 and health disparities, generally, a coordinated effort between municipal, philanthropic, and public and private organizations was essential to tackle the myriad effects the pandemic or other public health threats might bring. In line with models which address health disparities through grants and coordinated efforts among community organizations [13], this research study was developed to understand the impacts of COVID-19 and consequences of public health restrictions put in place to control the spread of the infection within a localized context in order to support decision-making for resource allocation and concentrated community aid.

A collaboration in Northeast Indiana was formed between the Allen County Health Department, Parkview Health System and local business, city and philanthropy leaders. Stakeholders met in early March 2020 to develop a set of community surveys. These surveys focused on three key foci for social determinants of health as defined in Healthy People 2020: 1) economic stability (employment, food insecurity, housing instability, poverty), 2) health and healthcare (access to health care, access to primary care, health literacy), and 3) neighborhood and built environment (access to local support services, crime and violence, environmental conditions). Due to the known deleterious impact of social determinants on health outcomes, we expected to find differences in survey responses based on financial solvency, and we expected financial solvency reports to be consistent with traditional area income boundaries in our area (i.e., those in low income neighborhoods reporting the lowest rates of financial solvency). Finally, across surveys (and after the implementation of stay-at-home orders), we aimed

to gather information about the extent to which individuals were seeking and receiving services and assistance with social needs impacted by the pandemic across the three main domains of SDOH, access to healthcare services and managing their own and their family health; impact of their neighborhood and built environment; and economic stability.

2 Related Work

2.1 What Are SDOH?

Over the last 30 years, researchers have focused on understanding the critical impacts that social factors have on our everyday health and wellness [35–39]. Social determinants of health are the “conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality of life outcomes and risks” [31]. The individual determinants include education access and quality, economic stability, healthcare access and quality, social connections, and neighborhoods/the built environment. Within each of these domains, there are a host of more granular issues at play (see Fig. 1).

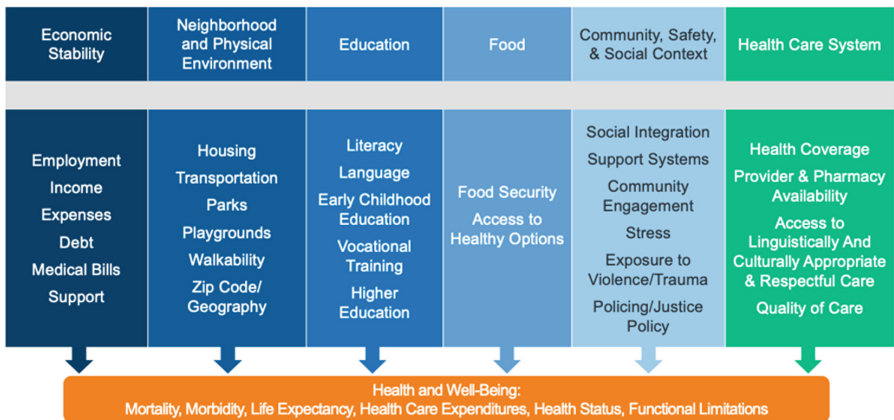


Fig. 1. Social Determinants of Health [33]

Research shows that resources that enhance the quality of life can have profound outcomes at the population level [32]. The World Health Organization estimates that SDOH account for between 30–55% of all health outcomes [34, 59].

2.2 SDOH and HCI

The pervasive health community and HCI community has conducted research that explores almost every social determinant. These include nutrition [21, 27, 28],

telehealth to expand access to healthcare [22, 23], access to maternal healthcare [23, 24], low-income community needs [24, 25], transportation [26], and access to affordable prescription medication [29, 30]. Additionally, research has focused on health monitoring and support [41, 42] as well as home health aides [40]. These bodies of research focus on understanding the interplay or impacts of technology in better articulating or understanding issues within these domains, not SDOH as a whole. Recent scholarship has looked at SDOH in a more holistic manner. Debopadhya et al., recently looked at how temporal analysis of SDOH are associated specifically with COVID-19 mortality using county-level data from across the United States [43]. During a powerful keynote presentation, Grimes-Parker discussing health equity from a global perspective, highlighting the potential and pitfalls of intelligent interfaces in support them [44]. Additionally, focus has been given to appropriate approaches needed in research to achieve equity [45]. The research presented here takes a different approach - activating a diverse community stakeholder group via a socio-technical systems approach to identify real-time needs within a community during an evolving community health emergency.

2.3 Surveying of SDOH During Times of Crisis

Many surveys have been conducted with regards to measuring SDOH. Within the general population, these have focused on people with diabetes [50], children [49], cancer patients [47], people going through menopause [46], and even populations of immigrants [48]. However, all of these surveys have not focused on a hyper-local context - taking into consideration multiple communities to better understand the sub-population of interest. With respect to surveying SDOH needs during COVID, recent research has assessed pregnant women [54], nursing homes [53], ethnic groups [52], and children with mental health needs [51]. Several have looked at location-based needs [52, 57, 58]. However, none of this research was conducted within the contexts of a socio-technical system, nor do they discuss how findings were operationalized by community organizations or governments to make decisions on how to support communities during the pandemic. The only examples of SDOH and COVID surveys helping coordinate care or response to needs are focused within international contexts [55, 56].

3 Method

Two cross-sectional surveys were developed and administered to understand the relation between COVID-19 impacts and components of social determinants of health in Northeastern Indiana. This research was approved by the Parkview Institutional Review Board on March 27, 2020. Survey A was developed by a multi-disciplinary group convened by the Health Commissioner in early March 2020. This group included representatives from the following agencies: Allen County Health department, Parkview Healthcare system, local government officials, the Allen County Commissioner's Office, business leader associations, local

philanthropic and not-for-profit groups, and civic leaders. After results from Survey A were analyzed a disseminated, refinements were made by representatives from the health department, research scientists, government officials and local philanthropic groups to address the evolving situation resulting in Survey B.

3.1 Survey Objective

The first survey (Survey A) was conducted prior to the state mandated shelter-in-place and was focused on understanding anticipated community resources to sustain basic needs for individuals facing economic insecurity. The second survey (Survey B) was conducted during the shelter-in-place time period and had the additional aims of determining if community needs were being met and where individuals were finding resources as well as ascertaining the levels of employment and barriers to accessing unemployment benefits. Racial and gender data were not collected in Survey A to engender a sense of privacy for respondents.

3.2 Participants and Procedure

Data were from two brief online surveys discussed above (Survey A and B). Respondents to Survey B were able to complete the survey on behalf of others due to feedback from community stakeholders regarding concerns about getting an increased response rate for elderly, Spanish and Burmese speaking populations. Respondents were completely anonymous. The survey was available on the Allen County Health Department's COVID-19 website and the link was shared via community organizations, listservs, and social media. Additionally, the surveys were promoted through television via press conferences and the local public broadcasting station's weekly COVID-19 programming¹. We utilized data from March 13 to June 22, 2020, in which a total of 6,031 surveys with an Indiana zip code were collected (4,992 from Survey A and 1,039 from Survey B).

3.3 Measures

Financial Solvency. Respondents indicated the length of time that they could sustain their household without additional income (1–2 weeks, 3–4 weeks, 5–6 weeks, 7+ weeks). The 5–6 weeks and 7+ weeks responses were combined to create a 3-level categorical variable.

Healthcare Related Characteristics. Respondents reported their health insurance status, whether they had an established healthcare provider (for self and dependents), members of household with chronic health condition (yes/no), type of prescriptions from a list of 7 general categories of medication with a free text option, ability to pay for medical treatments, and potential barriers to access and pay for medications during the pandemic.

¹ <https://www.pbs.org/video/coronavirus-a-live-community-forum-april-3-2020-ke73wk/>.

Service Preferences (Survey A ONLY). Types of organizations providing assistance with utilities, food/water, and healthcare were listed for respondents to select their preferred type of organization for receiving each type of assistance. Organizations included community, government, and faith-based groups. Service providers (Survey B ONLY). Respondents indicated which type of organizations they used to obtain assistance with utilities, food/water, and healthcare. Types of organizations included community, government, and faith-based groups.

Employment Status (Survey B ONLY). Respondents reported their current levels of employment (the same as pre-COVID, the same as pre-COVID but furloughed, the same as pre-COVID but taking a leave of absence, different job than pre-COVID, not currently employed, or N/A), how compensation compared to pre-COVID if employed (the same amount, more pay, less pay), and income source if a job was recently lost (severance, unemployment insurance, no income/unemployment denied, no income/do not qualify for unemployment, no income/have not applied for unemployment yet). Respondents reported whether their spouse or partner was employed and, if not, whether they received unemployment benefits

Needs (Survey B ONLY). Respondents indicated the extent to which the following needs were being met: stress/emotional support, transportation, utilities, rent/mortgage, accessing unemployment funds, accessing mental healthcare, accessing healthcare, obtaining food/water, obtaining medications, access to the internet, access to information/curriculum/government forms online. The response set was a 5-point Likert type (1 = none, 2 = some, 3 = half, 4 = most, or 5 = all). For those needs that respondents sought support, respondents specified sources of support from the following options: doctor/local healthcare provider, non-profit organization, family/friends, local school, church, local government agency, 2-1-1 (specialists available by phone to locate local resources and services), or Internet. Respondents were asked if the local stay of evictions was lifted, would they be able to pay current and/or back rent/mortgage (response categories: 1 = yes/have the funds to pay, 2 = yes/have some of the funds to pay, 3 = no/I do not have the funds to pay, 4 = I am not at risk of being evicted for non-payment).

3.4 Data Analysis

Descriptive summary statistics were calculated. The primary independent variable of interest was a 3-level categorical variable indicating number of weeks that households could sustain financially without additional pay (1–2 weeks, 3–4 weeks, 5 or more weeks). These three groups were compared using chi-square tests of independence or one-way ANOVA tests, as appropriate, and post hoc pairwise comparisons made between groups. Analyses were conducted using SAS software version 9.4 (Cary, NC).

4 Results

A total of 4992 Indiana residents completed Survey A. Data validity checks resulted in removing 7 respondents (6 respondents indicated their household included 30 or more members, 1 respondent indicated 125 individuals would need eldercare). An additional 3.8% (189/4992) of respondents did not complete the financial security question and were removed. The final sample included 4796 respondents. A total of 1101 residents of Northeast Indiana initiated Survey B; however, only 1039 responses were included in analyses due to missing data on the financial solvency item. Nearly all respondents completed Survey B on their own behalf (93.7%, 974/1039) and most were White (87.9%, 913/1039). In most cases, data presented refer to “survey results,” generally; specification of Survey A or Survey B can be discerned from number of respondents and/or specific questions on the survey as listed in the methods section.

4.1 Economic Stability

As shown in Table 1, 43.9% (Survey A) and 21.3% (Survey B) of respondents indicated that their household could sustain without additional pay for 1–2 weeks, 24.9% (Survey A) and 19.8% (Survey B) for 3–4 weeks, and 31.3% (Survey A) and 58.9% (Survey B) for 5 weeks or longer. An inspection of respondent zip codes provided an indication of where need could be anticipated. Typically, non-profit organizations focus attention in high poverty zip codes. However, low financial solvency, as self-reported in this survey, was not limited to these high poverty zip codes. Another 10 zip codes each had 100 or more respondents indicating limited financial solvency; in total, respondents in these zip codes accounted for 66.8% (1405/2105) of the low financial solvency group. On average, households that could sustain for 5 weeks or more had the fewest number of household members, minor dependents, and dependents with special needs. Also, about 33% of respondents from households able to sustain for 1–2 weeks reported that they would need to find childcare; whereas less than 20% of respondents from households able to sustain for 5 weeks or more reported that they would need to find childcare. Also, about 65% of the low financial solvency group were concerned about finding or purchasing food.

Overall, the rate of unemployment was 17.1% (148/868) for respondents and 20.3% (111/546) for significant others (as reported by respondents). However, only 36 respondents reported receiving unemployment compensation, and 23 reported that their significant other received unemployment. The majority (81.7%, 709/868) of respondents had the same job as prior to the COVID-19 pandemic, but for these that were employed, 13.4% (119/891) of respondents and 17.9% (78/435) of significant others were receiving less pay than prior to the pandemic.

Health and Healthcare Characteristics. Table 2 highlights the insecurities related to healthcare (including medical characteristics and medications).

Table 1. Characteristics of sample by financial solvency group

Household Characteristics	How many weeks could you financially sustain your household if your workplace closed and received no additional pay?			Group Comparison
	1-2 weeks	3-4 weeks	5+ weeks	
Number in household, avg(SD)				
	<i>Survey A - 2082</i>	<i>Survey A - 1173</i>	<i>Survey A - 1487</i>	
	<i>Survey B - 221</i>	<i>Survey B - 206</i>	<i>Survey B - 612</i>	
Survey A	3.14 ^a (1.8)	3.3 ^b (1.7)	3.0 ^c (1.6)	<0.001
Survey B	3.7 ^a (3.7)	3.1 ^b (1.6)	2.9 ^b (2.2)	<0.001
Number of dependent children requiring substitute childcare				
Survey A	<i>n=2082</i>	<i>n=1173</i>	<i>n=1487</i>	<0.001
0	67.1%	74.5%	82.9%	
1	11.6%	10.7%	6.3%	
2	13.5%	10.7%	7.3%	
3+	7.9% ^a	4.2% ^b	3.6% ^c	
Number of dependent children				
Survey B	<i>n=221</i>	<i>n=206</i>	<i>n=612</i>	
0	47.1%	50.0%	61.4%	0.004
1	20.4%	19.4%	14.1%	
2	21.3%	18.9%	13.7%	
3+	11.3% ^a	11.7% ^a	29.9% ^b	
Number of individuals with special needs				
Survey A	<i>n=2082</i>	<i>n=1173</i>	<i>n=1487</i>	
0	84.6%	88.8%	91.8%	0.01
1+	15.4% ^a	11.2% ^{ab}	8.2% ^b	
Survey B	<i>n=221</i>	<i>n=206</i>	<i>n=612</i>	
0	90.5%	90.3%	96.4%	<0.001
1+	9.5% ^a	9.7% ^a	3.6% ^b	
Worried about finding/purchasing food				
Survey A	<i>n=510</i>	<i>n=309</i>	<i>n=393</i>	
	64.5% ^a	46.0% ^b	23.7% ^c	<.001
Unemployed				
Survey B	<i>n=190</i>	<i>n=175</i>	<i>n=503</i>	
	16.3%	16.0%	17.7%	0.84
Significant and other unemployed				
Survey B	<i>n=102</i>	<i>n=111</i>	<i>n=333</i>	
	20.6%	17.01%	21.3%	0.63
Received stimulus check				
Survey B	<i>n=198</i>	<i>n=184</i>	<i>n=560</i>	
	71.7% ^a	63.6% ^{ab}	57.1% ^b	0.002
Risk of eviction/ability to pay current and back rent or mortgage				
Survey B	<i>n=163</i>	<i>n=161</i>	<i>n=498</i>	
0	42.9%	48.5%	56.6%	<0.001
1	14.1%	4.4%	0.6%	
2	14.1%	8.7%	1.0%	
3+	28.8% ^a	38.5% ^b	41.8% ^c	

Note: Superscripts indicate group differences such that those with different subscripts are significantly different ($p < 0.05$) from one another, and those with the same subscript are not significantly different.

Interestingly, about 90% of respondents that reported the lowest financial security had health insurance, which could have included Medicaid or Medicare, but only 40% (Survey A) and 43% (Survey B) of this group had the financial resources to pay for medical treatment. Leading up to the stay-at-home orders, 42% (Survey A) were worried about finding or purchasing medications and 6.3% (49/777) of the sample had issues obtaining medications since the beginning of the COVID-19 pandemic (Survey B), the rate of problems disproportionately affected respondents in the 1–2 week financial solvency group. The top barriers to obtaining medications were ‘Not able to have an appointment with my physician or provider’ and ‘Can’t pay for medications.’ A few respondents reported seeking medical care in the Emergency Department (n = 12) and Urgent Care (n = 12) due to inability to obtain their medications.

The most common medications prescribed were for treating mental health concerns and regulating blood pressure across the three financial groups. In a test of independence, prescriptions for these two medications was not independent of financial solvency group. However, slightly different patterns emerged. The lowest financial solvency group reported highest rate of prescriptions for mental health concerns, and the highest financial solvency group reported highest rate of blood pressure medications. As shown in Table 2, across the three financial groups, the top medications prescribed were for treating mental health concerns and regulating blood pressure.

Sources of Assistance. Respondents were asked to report where they might seek assistance for key issues within three social determinants of health domains: health and healthcare; neighborhood and built environment; and economic stability. Across all respondents there was a preference towards accessing government resources for assistance with utilities or healthcare; however, they preferred community organizations for assistance with food and water. Respondents with less financial solvency (1–2 weeks) were more likely to report that they would rely on government resources for assistance with all needs when compared with those with greater reported financial security (see Table 3).

Respondents were asked where they had found assistance for key issues within three social determinants of health domains: health and healthcare; neighborhood and built environment; and economic stability. All groups primarily relied on family and friends for help. Respondents in the 5 or more weeks financial solvency group tended to rely on resources from church more than the 1–2 week financial solvency group. While those with less financial security (1–2 weeks solvency) reported they received more support from non-for-profit organizations (See Table 4).

Overall, respondents across all levels of financial solvency reported that at least half to most of their needs were being met. The highest category of needs was access to mental healthcare and stress/emotional support (see Table 5). As shown in Table 5, needs that were being met to a lesser extent were access to unemployment funds, and access of information and forms online. These gaps are most apparent among the 1–2 week financial solvency group.

Table 2. Health and Healthcare characteristics of sample by financial solvency group

Medical Characteristics	How many weeks could you financially sustain your household if your workplace closed and received no additional pay?			Group Comparison
	1-2 weeks	3-4 weeks	5+ weeks	
Established healthcare provider for self				
	<i>Survey A - 2103</i>	<i>Survey A - 1191</i>	<i>Survey A - 1496</i>	
	<i>Survey B - 163</i>	<i>Survey B - 159</i>	<i>Survey B - 501</i>	
Survey A	78.7% ^a	85.1% ^b	87.9% ^c	<0.001
Survey B	87.7% ^{ab}	82.4% ^a	90.4% ^b	0.02
Established healthcare provider for dependents				
	<i>Survey A - 2022</i>	<i>Survey A - 1137</i>	<i>Survey A - 1432</i>	
	<i>Survey B - 164</i>	<i>Survey B - 160</i>	<i>Survey B - 502</i>	
Survey A	78.0% ^a	82.0% ^b	81.9% ^b	0.004
Survey B	87.2% ^a	87.3% ^a	94.2% ^b	0.02
Health insurance				
	<i>Survey A - 2041</i>	<i>Survey A - 1151</i>	<i>Survey A - 1379</i>	
	<i>Survey B - 117</i>	<i>Survey B - 110</i>	<i>Survey B - 294</i>	
Survey A	89.8% ^a	93.5% ^b	97.4% ^c	<0.001
Survey B	89.6% ^a	88.8% ^a	95.6% ^b	0.02
Financial resources to pay for medical treatment for self or household member				
	<i>Survey A - 2016</i>	<i>Survey A - 1135</i>	<i>Survey A - 1429</i>	
	<i>Survey B - 164</i>	<i>Survey B - 159</i>	<i>Survey B - 501</i>	
Survey A	40.6% ^a	69.3% ^b	88.9% ^c	<0.001
Survey B	42.7% ^a	59.1% ^b	89.8% ^c	<0.001
Worried about finding or purchasing medication for self or household member				
	<i>n=475</i>	<i>n=297</i>	<i>n=371</i>	
Survey A	41.7% ^a	26.0% ^b	16.7% ^c	<.001
Have not been able to obtain medication				
	<i>n=140</i>	<i>n=148</i>	<i>n=489</i>	
Survey B	12.9% ^a	8.8% ^a	3.7% ^b	<.001
Medication Type	How many weeks could you financially sustain your household if your workplace closed and received no additional pay?			Group Comparison
	1-2 weeks	3-4 weeks	5+ weeks	
Survey B	<i>n=162</i>	<i>n=159</i>	<i>n=496</i>	
None	21.6%	22.6%	24.8%	0.66
Mental Health	51.9% ^a	44.0% ^a	31.3% ^b	<0.001
Blood Pressure	40.7%	45.9%	37.3%	0.15
Inhalers	26.5% ^a	23.9% ^a	16.5% ^b	0.008
Pain Medication	19.1% ^a	10.7% ^b	9.1% ^b	0.002
Diabetes	17.3%	21.4%	15.5%	0.23
Blood Thinners	10.2%	17.1%	14.1%	0.32
Heart Failure	5.6%	4.4%	4.2%	0.78
Oxygen	4.3% ^a	1.9% ^{ab}	0.6% ^b	0.004
Cancer Therapies	1.2%	0.0%	2.6%	0.08

Note: Superscripts indicate group differences such that those with different subscripts are significantly different ($p < 0.05$) from one another, and those with the same subscript are not significantly different.

Table 3. Counts of preferences for obtaining resources for utilities, food/water, and healthcare from government, community, and faith-based organizations (Survey A Only)

What local resources would you use if you needed help with the items below?	How many weeks could you financially sustain your household if your workplace closed and received no additional pay?			Group Comparison p-value
	1-2 weeks	3-4 weeks	5+ weeks	
Utilities				
	<i>n</i> =1933	<i>n</i> =1060	<i>n</i> =1323	
Government	26.9% ^a	23.3% ^b	19.1% ^c	<0.001
Community Orgs	15.0%	14.3%	12.3%	0.10
Faith-Based	14.0% ^a	17.9% ^b	16.2% ^b	0.01
Food/Water				
	<i>n</i> =1958	<i>n</i> =1102	<i>n</i> =1373	
Government	21.7% ^a	17.9% ^b	16.2% ^b	<0.001
Community Orgs	26.5% ^a	30.6% ^b	29.6% ^b	0.03
Faith-Based	23.3%	26.0%	25.2%	0.21
Healthcare				
	<i>n</i> =1971	<i>n</i> =1114	<i>n</i> =1380	
Government	28.5% ^a	26.8% ^a	21.9% ^b	<0.001
Community Orgs	9.2%	7.6%	8.0%	0.25
Faith-Based	6.9%	7.5%	5.9%	0.31

Note: Superscripts indicate group differences such that those with different subscripts are significantly different ($p < 0.05$) from one another, and those with the same subscript are not significantly different.

Table 4. Resources used to address household needs (utilities, healthcare, food, transportation, emotional support, rent/mortgage, unemployment funds, internet, information) by financial solvency group (Survey B Only).

For the needs you have listed, have you received support from the following:	How many weeks could you financially sustain your household if your workplace closed and received no additional pay?			Group Comparison p-value
	1-2 weeks	3-4 weeks	5+ weeks	
	<i>n</i> =122	<i>n</i> =113	<i>n</i> =345	
Doctor or local healthcare provider	53.3%	46.9%	47.5%	0.51
Non-profit organization	18.0% ^a	9.7% ^{ab}	4.9% ^b	<0.001
Family and friends	67.2%	75.2%	65.8%	0.17
Local school(s)	6.6%	15.0%	8.7%	0.06
Church	6.6% ^a	11.5% ^a	22.0% ^b	<0.001
Local government agency	3.3%	1.8%	2.0%	0.68
2-1-1 (state-based resource hotline)	1.6% ^{ab}	2.7% ^a	0.0% ^b	0.007
Internet resources	38.5% ^a	36.2% ^a	49.6% ^b	0.01

Note: Superscripts indicate group differences such that those with different subscripts are significantly different ($p < 0.05$) from one another, and those with the same subscript are not significantly different.

Table 5. Mean level of household needs (utilities, healthcare, food, transportation, emotional support, rent/mortgage, unemployment funds, internet, information) by financial solvency group (Survey B Only).

Mean level of household needs that were met	How many weeks could you financially sustain your household if your workplace closed and you received no additional pay?					Group Comparison p-value	
	1-2 weeks		3-4 weeks		5+ weeks		
	n	Mean	n	Mean	n	Mean	
Economic Stability							
Access to unemployment funds	23	3.83	20	4.30	47	4.38	0.15
Obtaining food/water	156	4.40 ^a	155	4.65 ^b	466	4.85 ^c	<0.001
Utilities	151	4.43 ^a	155	4.76 ^b	459	4.92 ^c	<0.001
Rent/mortgage	133	4.43 ^a	147	4.77 ^b	387	4.95 ^c	<0.001
Transportation	144	4.72 ^a	144	4.85 ^a	447	4.94 ^a	<0.001
Health and Healthcare							
Access to mental healthcare	88	3.65 ^a	84	3.92 ^a	210	4.49 ^b	<0.001
Access to healthcare	130	4.02 ^a	130	3.98 ^a	396	4.40 ^b	<0.001
Obtaining medications	137	4.48 ^a	138	4.72 ^b	412	4.89 ^c	<0.001
Neighborhood and Built Environment							
Stress/emotional support	138	3.46 ^a	143	3.71 ^b	443	4.14 ^c	<0.001
Access to online support	43	3.53	45	3.53	75	3.60	0.85
Access to the internet	158	4.65 ^a	152	4.82 ^b	468	4.86 ^b	<0.001

Respondents used a 5-point Likert scale to indicate extent to which each need is being met, 1=NONE of my need is being met, 5=ALL of my need is being met. Superscripts indicate group differences such that those with different subscripts are significantly different (p < .05) from one another, and those with the same subscript are not significantly different.

Respondents reported negative effects of social distance for self and other household members, regardless of financial solvency group. However, only 15.2% (93/612) of entire sample sought mental health resources (see Table 6).

Table 6. Impact of social distancing on household members and mental health help by financial solvency group (Survey B Only).

Currently, is the social distancing and isolation having a negative effect on the mental health of the following:	How many weeks could you financially sustain your household if your workplace closed and received no additional pay?			Group Comparison p-value
	1-2 weeks n=133	3-4 weeks n=135	5+ weeks n=317	
Myself	72.9% ^a	68.8% ^b	60.3% ^b	0.02
My spouse/partner	43.6%	44.6%	40.7%	0.53
My children	46.6%	44.0%	39.8%	0.37
Sought help for mental health impact	21.2% ^a	10.8% ^b	14.5% ^b	0.05

Note: Superscripts indicate group differences such that those with different subscripts are significantly different (p < 0.05) from one another, and those with the same subscript are not significantly different.

4.2 Overall Community Impacts

The results from the surveys were analyzed immediately and distributed back to the network of stakeholders that helped build the original survey. This led to real-time, data-driven responses across the community at all levels. Figure 2

highlights some of these outcomes and the different stakeholder groups that were impacted by the data².

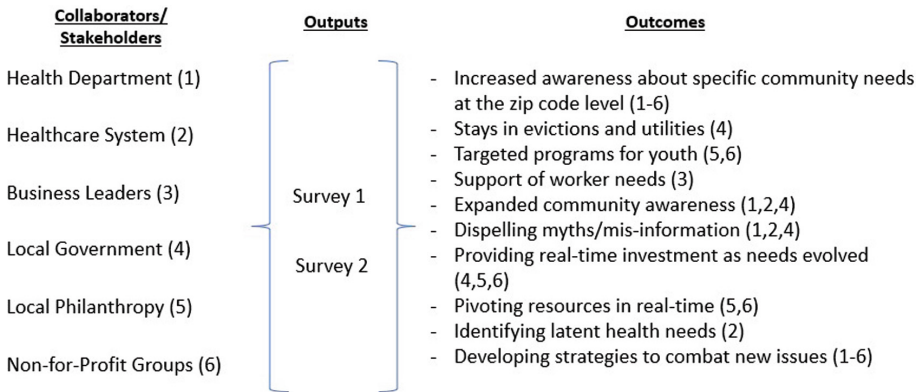


Fig. 2. Impact of Survey Findings on Different Stakeholder Groups

5 Discussion

In response to emerging needs within our community due to the COVID-19 pandemic, leaders from the areas of public health, health systems, government entities, local business, and philanthropy convened and developed a sequence of two community surveys. The community-based surveys revealed consistent trends regarding the widespread impact of COVID-19 on social determinants of health and also provided the impetus for collaborative community efforts towards resource allocation. The results were used by public health officials, city government, and other community organizations to develop wide-scale, targeted efforts in response to the pandemic that affected not only disease spread and mortality but also other aspects of living, such as the ability to travel, work outside the home, and receive standard and emergency medical and psychological treatment.

These findings are useful from a research perspective because they identify SDOH disparities through the lens of financial solvency and provide a model for informatics professionals to lend their skill set to community agencies during a crisis. In line with previous studies of SDOH [14–17], respondents who were less financially solvent reported inequalities in almost every area (e.g., unemployment, children in home requiring care, medications taken, and healthcare and insurance characteristics) than those with more financial solvency. Those in the lowest financial solvency group also reported more SDOH-related needs and willingness to engage with community organizations helping with economic stability, health and healthcare, and neighborhood and built environment.

² <https://www.inputfortwayne.com/features/community-needs-mirro.aspx>.

Interestingly, and in contrast to our prediction, some of these financially insecure families were outside of traditional low-income areas. Thus, mitigation and prevention efforts using geocoding to help address pandemic- or other crisis-related needs (e.g., [7,9]) should not rely simply on county residency or zip codes for their targeted efforts. In times when crises restrict movement, work, and/or childcare, SDOH needs transcend these traditional income boundaries. Activation and advertisement of community resources might be especially important for those facing financial solvency issues for the first time. Perhaps, these families may not have been familiar with the organizations or processes that would allow them to address some of their SDOH needs. This study provides a direction for future research and points to the importance of using community-based, data-driven approaches, preferably just-in-time analyses, and not simply relying on categorical data, like zip codes, when developing social policy and relief measures.

In an effort to measure a wide range of health needs, we also surveyed participants on their mental health issues. Many, especially those in the low financial solvency group, reported that the shelter-in-place mandates had a negative effect on their mental health and the mental health of their family members [60]. This finding reinforces assertions that mental health supports are critical during times of disaster or infectious disease outbreak [17]. Respondents also reported that less than half of their mental health needs were being met. Additionally, despite negative mental health effects of social distancing reported by many respondents, only 15% sought mental health resources during sheltering-in-place. Medications for mental health needs were also amongst the highest concern for those in the lowest (1–2 weeks) financial solvency group and the second highest for everyone else. This points to the importance of public policy that addresses the mental health needs along with the physical health needs of our population in times of pandemic or other public health crises.

Importantly, the just-in-time analyses of these data led to actionable plans for community resource allocation. This demonstrates the feasibility of community, grant-based collaborations, like those which have been used in non-pandemic times to address the needs of those who are at greatest disadvantage from a SDOH perspective [13]. Specifically, using the results from the first survey (Survey A), the local city government made legislative mandates to aid those with low financial solvency, including enacting an order to prevent utilities services discontinuance due to non-payment and a moratorium on evictions due to non-payment of rent. Philanthropic groups also used the results from Survey A to justify special grant awards prioritizing community organizations demonstrating strategies impacting identified areas of need.

There is evidence that these community need surveys, just-in-time analyses, and related coordinated action plans made an immediate impact [18]. From an individual perspective, prior to the shelter-in-place orders, respondents less financially secure anticipated the primary source of support coming from the government. However, after shelter-in-place took effect, this group reported community organizations being a primary source of support, which may reflect the

actions taken by local community and philanthropic groups in response to our analyses of Survey A, including directing resources to help families pay for food, housing, and medical care. Meanwhile, from an organizational/municipal perspective, our initiative demonstrated that by quantifying constituent concerns, regional and local governments may be able to leverage that data for state and national funding. As an example, in our district, the Mayors and Commissioners Caucus of Northeast Indiana were able to develop a request for the Governor's Office that illustrated a \$300+M need for state assistance.

A limitation of this work includes potential under-representation of communities that are in the most need due to COVID-19. Because of the pandemic, traditional methods of access/canvassing were not possible when recruiting for the survey. Additionally, the methods do not allow us to parse the levels of needs of social determinants of health prior to the pandemic. However, as noted in the text, survey results uncovered zip codes where public data would indicate financial stability where the surveys uncovered lack of stability/fragility.

6 Conclusion

To effectively govern, it is important that government leaders have an ability to understand the current tenor of the community. During a pandemic, the ability to quantify constituent need is even more essential. The identification of those needs, via our community needs assessment surveys, allowed government officials to come together and conduct weekly press briefings for the public to work toward allaying some of the more predominant concerns. Additionally, in gaining a better understanding of the limits being placed on the lives of constituents, priorities were developed by city and county governments to allow for a smoother transition in the lives of those community members affected by the pandemic. Considering that COVID-19 disproportionately impacts various populations [19,20], our social determinants of health lens helped to disentangle the complexity of the impacts of this disease, which helped community leaders develop targeted interventions for those most in need.

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