Public Health
Prevent. Promote. Protect.

TABLE OF CONTENTS

EDITORIAL

Make the Most of Your State Public Health Journal

Sheryl L. Chatfield

Kent State University, College of Public Health, Kent, OH

Back in 2016, the journal *Nature* published an article entitled "Scientific Literature: Information Overload."[1] In this article, the author described the increasing challenge for researchers who aim to stay current with regard to trends and findings in their areas of specialization, as a result of the continual growth in the number of potential resources. One example provided in this article is that PubMed indexes more than 1 million new papers per year.

Recommended strategies which scholars might use to stay current in their knowledge include development of team and self-curation processes, reliance on high quality blogs, or use of researcher-developed aggregators that identify and sort new publications. The creator of one such aggregation system noted it required daily commitment of 2 to 3 hours of review time to scan newly published papers of interest.[1] In the years since the *Nature* article was published, the number of scientific publications has continued to increase on an annual basis,[2] so it might reasonably be assumed that staying current with published research in a given field has become progressively more time-consuming. More recently, scholars have explored use of machine learning[3] to identify and organize newly published research. Undoubtedly, many scholars are also exploring use of generative artificial intelligence models to help them rapidly gain, identify, and learn from new publications in their respective areas of interest.

My aim with this editorial is not to dissuade publications or discourage scholars but rather to encourage all of *Ohio Journal of Public Health's* (OJPH) public health-engaged readers to consider developing and submitting publishable papers to OJPH. Because many things that impact the range of Ohioan's health opportunities and outcomes are influenced by local and regional contexts, OJPH presents a unique opportunity for the community of Ohio-based public health scholars and practitioners to develop our own state-specific curated research resource. At present, OJPH is a reliable, current, open access source for information about programs, trends, and other information related to a variety of interests related to public health research, practice, and education in Ohio. With increasing author support, the range of information available in OJPH can continue to expand.

As described in the Op-Ed contributed by editorial assistant Michael Anguilano, which is also the final paper included in Volume 5, Issue 2 of OJPH, local health departments in Ohio have a mandate to earn accreditation, and accreditation standards include the requirement to "use and contribute to developing research."[4(p238)] Clearly, some local health departments in Ohio have a history of participating in and publishing research; examples are readily available for readers who search the archives of this journal. However, an increase in submissions from local health departments, and other nonacademic organizations, would be a welcome trend for OJPH.

In closing, I challenge you all to make the most of the potential of your state public health journal to improve public health in this state, by sharing the benefits of your knowledge, successes, and lessons learned with the community of public health professionals in Ohio.

REFERENCES

1. Landhuis E. Scientific literature: information overload. *Nature.* 2016; 535:457-458.
    https://doi.org/10.1038/nj7612-457a

2. White K. *Publications Output: US Trends and International Comparisons.* National Science Board; 2019. National Center for Science and Engineering Statistics report 20206. Retrieved June 24, 2023.
    https://ncses.nsf.gov/pubs/nsb20206/

3. Nicholson JM, Mordaunt M, Lopez P, et al. scite: a smart citation index that displays the context of citations and classifies their intent using deep learning. *Quant Sci Stud.* 2021: 2(3):882-898.
    https://doi.org/10.1162/qss_a_00146

4. Public Health Accreditation Board (PHAB). *Standards and Measures for Initial Accreditation, Version 2022.* Retrieved June 24, 2023.
    https://phaboard.org/wp-content/uploads/Standards-Measures-Initial-Accreditation-Version-2022.pdf

Local Health Departments are Not Using Enough Public Health Research

Michael Anguilano[1]

[1]Cleveland Department of Public Health, Cleveland, OH

Corresponding Author: Michael Anguilano, 75 Erieview Plaza, Cleveland, OH 44114, MAnguilano@clevelandohio.gov

In 2013, the 130th Ohio General Assembly codified the requirement for all local health departments (LHDs) in the state to apply for and become accredited by the Public Health Accreditation Board (PHAB).[1] This standardization is meant to improve quality and efficiency of all LHDs in the state of Ohio, which ranks 47th in the United States in health value according to the Health Policy Institute of Ohio.[2] While Ohio is the only state to have such a mandate, hundreds of health departments across the country are striving toward or have been accredited. One factor to achieving accreditation is the use of public health research, which is often overlooked by health agencies as a component of program implementation or policy advocacy. Despite PHAB pushing health departments to use and participate in public health research,[3] there continues to be reluctance at the state and local level.

Evidence-based public health backed by research has the potential to have numerous direct and indirect benefits, such as higher quality information on best practices, a higher likelihood of successful programming and policy implementation, greater workforce productivity, and better allocated resources.[4] Health departments pursuing either initial or reaccreditation through PHAB are required to demonstrate the use of public health research in the development of policies or programs.[3] The purpose of this is to ensure that LHDs are aware of practices that have been found to be effective and incorporate them in their jurisdictions.

The reality is, unfortunately, that LHDs still have a way to go in utilizing public health research on a more consistent basis. According to a survey conducted by the National Association of County and City Health Officials (NAACHO), only 8% of all LHDs in the country have agreements with academic institutions to provide them with scientific and professional journals, down from 11% as recorded in 2016, and 62% did not participate in any research activities at all in the last year. The prospect of conducting research is low as well, with only 9% of all LHDs saying that they are establishing or revising policies or procedures to embark on research activities.[5] Only 54% of Ohio LHDs responded to the 2019 NAACHO survey, down from 74% in the 2016 survey, so data are disappointingly limited.

State health agencies, which are supposed to be drivers for the LHDs, are only marginally better at conducting and using public health research than the local agencies they oversee. According to the 2016 Association of State and Territorial Health Officials (ASTHO) profile of activities, state health agencies reported using public research 52 times in a 2-year span, up from 42 recorded in 2012.[6] That is modest growth, although it is not translating down to the LHDs that are served by the state agency.

There are steps that can be taken at all levels of public health to help increase the utilization and creation of public health research. Creating partnerships with universities, neighboring health departments, or state, regional, or national public health journals and conference organizers to ensure consistent 2-way communication would be an excellent first step. Local health departments should also prioritize training or hiring of staff with a background in research and formalize procedures pertaining to the utilization or creation of research. Academic health departments (AHDs) should also be explored, as they can enhance public health education, training, research, and services. State health agencies must also encourage greater use of public health research at the local level. This can come through incorporating the use of research in grants and other funding opportunities, partnering with public health journals to create a listserv of LHDs, or holding training opportunities for LHD directors and commissioners on how to use public health research effectively.

Despite public health accreditation mandating the use of research, data demonstrate that there is still work to do in establishing a culture of evidence-based practices and using public health research in LHDs. Ohio, as the only state mandating public health accreditation, is no exception.

REFERENCES

1. *Department of health–powers.* Ohio Revised Code, §3701.13(2021). Accessed June 24, 2023.
   https://codes.ohio.gov/ohio-revised-code/section-3701.13

2. Reem A, Stevens AB, Reat Z. *2021 Health Value Dashboard - Health Policy Institute of Ohio.* Health Policy Institute of Ohio. 2021. Retrieved June 24, 2023.
   https://www.healthpolicyohio.org/wp-content/uploads/2021/04/2021_HealthValueDashboard_FINAL.pdf

3. Public Health Accreditation Board (PHAB). *Standards & Measures for Initial Accreditation, Version 2022.* Retrieved June 24, 2023.
   https://phaboard.org/wp-content/uploads/Standards-Measures-Initial-Accreditation-Version-2022.pdf

4. Lhachimi SK, Bala MM, Vanagas, G. Evidence-based public health. *Biomed Res Int.* 2016; 2016:5681409.
   https://doi.org/10.1155/2016/5681409

5. National Association of County and City Health Officials (NACCHO). *National Profile of Local Health Departments;* 2019. Retrieved June 24, 2023.
   https://www.naccho.org/uploads/downloadable-resources/Programs/Public-Health-Infrastructure/NACCHO_2019_Profile_final.pdf

6. Association of State and Territorial Health Officials (ASTHO). *ASTHO Profile of State and Territorial Public Health, Volume 4.* Retrieved June 24, 2023.
   https://www.astho.org/globalassets/pdf/profile/profile-stph-vol-4.pdf

RESEARCH ARTICLE

Examining Suicidal Thoughts and Behaviors Among Ohio Youth with Oppressed Identities Using the 2019 Ohio Youth Risk Behavior Survey

C. Rosie Bauder[1]; Austin G. Starkey[1]

[1]Department of Psychiatry and Behavioral Health, College of Medicine, The Ohio State University, Columbus, OH

Corresponding Author: C. Rosie Bauder, 3650 Olentangy River Road, Suite 330, Columbus, OH 43214, (614) 257-2071, rosie.bauder@osumc.edu

ABSTRACT

Background: Suicide is the second leading cause of death among youth aged 10 to 14 years and third for those aged 15 to 24 years in the United States and in Ohio. Suicidal thoughts and behaviors disparately affect youth with oppressed identities, including those with oppressed racial, ethnic, gender, and sexual minority identities. The purpose of this study was to examine the relationship between self-reports of suicidal thoughts and behaviors among Ohio youth with oppressed identities. This research also contextualizes relationships between these indicators through the context of intersectionality.

Methods: This cross-sectional descriptive study used responses from the 2019 Ohio Youth Risk Behavior Survey (YRBS; n = 1263) to examine the relationships between identity variables and suicidal thoughts and behaviors through a series of logistic regression models.

Results: Female youth have higher odds of reporting persistent feelings of sadness and hopelessness and seriously considering suicide than male youth. Lesbian, gay, or bisexual (LGB) youth have higher odds of reporting all outcome measures of suicidal thoughts and behaviors (STBs), and youth with oppressed racial and ethnic identities were in general more likely to report higher odds of STBs when compared to White youth.

Conclusion: Suicidal thoughts and behaviors disparately affect youth with these oppressed identities. Our findings suggest further examination of these youth nationally may influence public health suicide prevention strategies. Implications also suggest that researchers, practitioners, and organizations across the spectrum of youth suicide prevention in Ohio should understand the increased risk that youth with multiple, intersectional oppressed identities face for suicide.

Keywords: Suicide; Youth Risk Behavior Survey; YRBS; Intersectionality; Ohio youth; Oppressed identities

INTRODUCTION

In 2020, over 45 000 people died by suicide in the United States.[1] Suicide is largely considered to be a public health crisis, especially among those with oppressed gender, sexual, or racial identities[2-5]—identities that have been minoritized and historically excluded.[6] Suicide has emerged as the second leading cause of death for those aged 10 to 14 years and the third leading cause of death for those aged 15 to 24 years; between 2011 and 2020, the number and rate of suicide deaths among youth increased overall.[7-9] Researchers and practitioners in the field of suicidology have

acknowledged that, despite strides in identifying risk and predictive factors related to suicide, the increase in these deaths is cause for alarm: suicide research receives far less funding than other leading preventable causes of death.[10] Less attention has been paid to the social and cultural contexts that may influence suicide risk at the population level, as well as the influence of the confluence of these factors for communities holding oppressed gender, sexual, and racial identities.[10-15] The historical emphasis on identifying individuals at risk of suicide through assessment and screening leads to a shift toward investigation opportunities into public health and population-based approaches to understanding suicide

risk and protective factors.[12] Additionally, suicide presents as an increasingly more prevalent phenomenon among those with oppressed gender, sexual, and racial identities, and, as such, unique consideration and continued research are needed to examine the intersection of these identities as it pertains to suicide risk, particularly from a social justice, intersectional, or critical lens.[11,14-17]

Ohio's suicide rate among youth and adults is commensurate with the national average.[7,18] It is important to note that among both youth and adults, suicidal thoughts, attempts, and deaths are rarely caused by any single factor, yet the confluence of environmental, systemic, and contextual factors that elevate one's risk of suicide disparately impact those with oppressed racial, ethnic, gender, and sexual identities.[15,19-23] There are unique differences in the prevalence of suicidal thoughts and behaviors (STBs) between youth and adults; suicidal behaviors, such as a suicide attempt, commonly develop over time, whereas the prevalence of thoughts of suicide are more common at the beginning of adolescence, with researchers identifying the ages of 12 to 17 years as critical periods.[24-26] In the United States, youth with oppressed identities, including those who identify as lesbian, gay, or bisexual (LGB),[15,23,27] youth with oppressed racial and ethnic identities,[19,28] and girls,[21,27] are found to be at an increased risk for suicidal thoughts and behaviors (STBs).

Adolescence is a stage of life marked by a combination of psychological development and, at times, increased impulsivity and risk-taking behaviors.[25,29] As such, adolescence is associated with higher age-adjusted rates of mental health concerns and suicide, especially for youth who are predisposed to multiple risk factors.[30,31] Engaging in risky health behaviors ultimately shapes the morbidity and mortality of the country's youth across racial, ethnic, and other oppressed identity groups.[32,33] Yet, these risk behaviors and potential protective factors do not affect all cultural and identity groups in the same manner. Oppressed identity groups, including those with shared racial, ethnic, gender, or sexual identities, are disparately affected by poorer health outcomes.[34]

Significant gender differences in both suicidal thoughts and suicidal behaviors have been noted between male and female-identifying youth, as well as gender nonbinary and gender nonconforming youth; these variations also exist around diagnosis of psychiatric disorders.[13,35] Girls are more likely than boys to have developed plans for suicide (18.1% and 15%, respectively) and tend to develop suicidal ideation earlier than their male peers.[36] Researchers have posited that the disparity in deaths may be attributed to the lethality of means used in suicide attempts, such as firearms or intentional overdose for male and female youth, respectively.[25]

Much of the research that does exist on youth suicide has predominantly involved White youth with sparse examination among other cultural groups.[15] Nearly 3000 Black Americans die by suicide each year, and suicide is the third leading cause of death for Black adolescents and young adults aged 15 to 24 years.[7] Black and Afri-

can American youth are more likely to face racial discrimination, especially multigenerational discrimination which has been found to play a factor in the development of STBs.[37,38] Among Hispanic youth, attempts and behaviors are more common among females; responses from the 2013 national YRBS indicated that Hispanic female youth, as well as Black and White female youth, were more likely to consider suicide than their male counterparts, respectively. Of Hispanic female youth who responded, 26% had seriously considered attempting suicide in the last 12 months. Hispanic female youth were also more likely to make a suicide plan and attempt suicide than Black and White female youth, and all male youth who responded.[27]

Mueller and colleagues[15] found that sexual minority youth were much more likely to report suicidal ideation regardless of their race, ethnicity, gender, or whether or not they had been bullied. Moreover, the prevalence of endorsed suicidal ideation varied among heterosexual and LGB youth at the intersection of race and ethnicity; they found that White and Hispanic gay and bisexual male youth among others were more likely to be bullied than White heterosexual adolescents.[15] Despite these alarming findings, our understanding of suicidal thoughts and behaviors in LGB youth is limited.[39]

The purpose of this study was to examine race, sexual orientation, and sex as predictors of STBs among Ohio youth using responses to the 2019 Ohio YRBS. We discuss our findings through an intersectional lens to contextualize the implications for public health practice and to inform subsequent research. It is less common to contextualize epidemiological research, including STBs among youth with oppressed racial, gender, and sexual identities, through a critical or intersectional lens. Given the consistent loss of lives to suicide in the United States, it is essential to understand the nuances of suicide risk and related mental health concerns and the impact of living within intersecting structures of oppression and discrimination.

Intersectionality Theory

Intersectionality theory is the deliberate focus on multiple identities of privilege and oppression a person may experience throughout their lifetime.[40,41] Intersectionality theory appreciates that unique historical, social, cultural, and political factors inform the intersections of gender, race, sexual identity, as well as other identities, and therefore differentially influence life experiences, including health.[42] Each identity jointly contributes to consequences of systemic and social oppression that place those with intersectional oppressed identities at a greater risk of negative health outcomes, including death by suicide.[13,16,43] Intersectionality can be used to contextualize methodology in health behavior and social science research as well as the interpretation of quantitative analyses, especially in supporting that the integration of 2 or more unique, often oppressed, identities is not generalizable; there may be the common association of increased discrimination and negative health outcomes, but beliefs, values, and behaviors vary as

widely within identity groups as between identity groups.[44] Intersectionality theory provides promising opportunities for those involved in population health research, particularly with a quantitative focus, to challenge notions of additive effects when examining race, ethnicity, sex, gender identity, sexual orientation, and disability.[44-47] It is with tenets of intersectional theory that population health and similar researchers may communicate the vitality and nuance of the contexts in which these people live.[45]

METHODS

Participants and Procedures

The current study employed responses to the 2019 Ohio Youth Risk Behavior Survey (YRBS). The YRBS monitors health-risk behaviors and environmental factors that impact youth health and safety in the United States.[48] The YRBS employs a 2-stage, cluster sample design to reflect a representative sample of students in the 9th through 12th grades.[49] The first sampling stage identifies schools in the state of Ohio with probability proportional to school enrollment size, and the second sampling stage selects required classes at random. Surveys with response rates over 70% are weighted based on characteristics of other students in the jurisdiction, such as grade, race, and gender identity. These data were provided by the Ohio Department of Health. The Ohio Department of Health specifically disclaims responsibility for any analyses, interpretations, or conclusions. This secondary data analysis was exempt from institutional review board approval due to the use of publicly available, deidentified data.

Measures

Students responded to 4 demographic questions relating to sex, sexual orientation, race, and ethnicity which were used as predictors in examining the 4 STB outcome items. The sample was 50.6% (n = 635) male and 49.4% (n = 620) female. Most participants were between 14 and 18 years of age (86.9%). Most partici-

pants identified as heterosexual or straight (n = 1017; 86%) with approximately 8% identifying as bisexual (n = 94). Approximately 3% of students identified as either gay or lesbian (2.7%; n = 32), or not sure (3.3%, n = 39). Most participants identified as White, non-Hispanic (56%; n = 690) with nearly a quarter of youth identifying as Black or African American, non-Hispanic (24%; n = 291) and 10% (n = 124) identifying as Hispanic. Descriptive statistics of the sample can be found in Table 1.

Suicidal Thoughts and Behaviors.

Three items directly address STBs within the past 12 months including "Did you ever seriously consider attempting suicide?," "Did you make a suicide plan?," and "How many times did you actually attempt suicide?" Additionally, participants were asked if, during the last 12 months, "did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?" Participants were asked to indicate either "yes" or "no" for each question or to indicate the number of times they attempted suicide from 5 potential options. For this study, and as consistent with previous research on STBs items from the YRBS,[21] youth who reported at least 1 suicide attempt were coded as "yes" and those without a history of suicide attempts were coded as "no."

Statistical Analysis

Our statistical analyses accounted for both the sample and survey design, including the parameters used for weighted sampling techniques by the Centers for Disease Control and Prevention (CDC) and the Ohio Department of Health. All analyses were conducted using Stata IC 16.0.[50] Data edits to responses that were logically inconsistent with other items were conducted with such conflicting responses set to blank. We first examined our predictor and outcome variables using descriptive statistics, including frequencies and proportions. Next, we used bivariate logistic regression analyses to examine odds ratios for youth with oppressed racial

Table 1. Unweighted Frequencies and Weighted Proportions of Participant Demographics

N = 1263	Frequency (n)[a]	Proportion
Sexual orientation		
Heterosexual/straight	1017	0.88
Lesbian, gay, or bisexual (LGB)	165	0.12
Not sure		
Sex		
Male	635	0.51
Female	620	0.49
Race/Ethnicity		
White, non-Hispanic	690	0.73
Black, non-Hispanic	291	0.15
Hispanic	124	0.05
Other	122	0.07
Felt sad or hopeless	430	0.33
Suicidal thoughts and behaviors (STBs)		
Considered suicide	216	0.16
Made a suicide plan	150	0.11
Attempted suicide	86	0.07

[a]Frequencies will not total to the entire sample size due to missing item responses.

and sexual identities in reporting STBs. Lastly, we ran several step-wise multivariate logistic regression analyses to examine potential moderating characteristics for STBs, however, these were not included. Goodness of fit of the final bivariate models was assessed using the Archer-Lemeshow statistic, which is used to estimate the F-adjusted mean residual test to ensure the fit of logistic regression models using survey data.[51] Logistic regression analyses yield odds ratios, with which we used 95% confidence intervals, which demonstrate the odds of youth experiencing the outcome variable of interest while controlling for predictor variables.[52]

RESULTS

Each model was examined using the Archer-Lemeshow (2006) goodness of fit test statistic to assess for model fit, which yielded an F-adjusted test statistic, all of which yielded *P* values greater than our critical alpha of .05. Our results indicate that each model met our assumptions of logistic regression models using survey data. Goodness of fit statistics are available upon request from the corresponding author.

Felt Sad or Hopeless

Results for each of our regression analyses examining STBs as an outcome are reported in Table 2. There were differences between male and female youth, with female youth twice as likely to report feeling so sad or hopeless almost every day for 2 weeks or more in a row that they stopped doing some usual activities as compared to male youth (OR = 2.70; 95% CI, 1.99-2.66). The results of our bivariate logistic regression revealed that LGB youth, as compared to their heterosexual/straight counterparts, had more than 7 times the odds of feeling sad or hopeless (OR = 7.33; 95% CI, 4.47- 12.1), and youth who reported "not sure" had about 2.5 higher odds of

reporting feeling sad or hopeless (OR = 2.47; 95% CI, 0.99- 6.13). Hispanic youth had twice the odds of reporting feeling sad or hopeless (OR = 2.07; 95% CI, 1.33-3.22) and those who were considered "other," all of whom reported an oppressed racial identity, had 1.6 higher odds of feeling sad or hopeless when compared to White youth (OR = 1.60; 95% CI, 1.12-2.28). In our bivariate model examining sadness/hopelessness as an outcome variable, we did not find a statistically significant difference among Black youth when compared to White youth (OR = 1.36; 95% CI, 0.82-2.26).

Considering Suicide

The results of our logistic regression analyses for seriously considering suicide are presented in Table 2. There were differences between male and female youth in reporting seriously considering suicide within the past 12 months, with female youth almost twice as likely to report as compared to male youth (OR = 1.87; 95% CI, 1.36-2.58). The results of our multinomial logistic regression revealed that LGB youth, as compared to their heterosexual/straight counterparts, had more than 8 times the odds of reporting strongly considering suicide (OR = 8.49; 95% CI, 5.18-13.9) and youth who reported "not sure" regarding their sexual orientation had about 5.5 times higher odds of reporting seriously considering suicide (OR = 5.54; 95% CI, 2.88-10.6). Hispanic youth had more than twice the odds of reporting seriously considering suicide (OR = 2.70; 95% CI, 1.76-4.14) and Black youth had approximately 1.6 higher odds of seriously considering suicide, compared to White youth, respectively (OR = 1.55; 95% CI, 1.04-2.30). In our bivariate model examining considering suicide as an outcome variable, we did not find a statistically significant difference among youth categorized as "other" when compared to White youth (OR = 1.12; 95% CI, 0.66-1.90).

Table 2. Bivariate Logistic Regression Analyses of Identity Characteristics Associated with Hopelessness and Suicidal Thoughts and Behaviors Among Ohio Youth, Weighted

Identity characteristics	Feeling sad/hopeless		Considered suicide		Made a suicide plan		Attempted suicide	
	n, (%)	OR [95% CI]	n, (%)	OR [95% CI]	n, (%)	OR [95% CI]	n, (%)	OR [95% CI]
Sex								
Male	154 (36.1)	--	78 (36.3)	--	68 (45.6)	--	42 (48.8)	--
Female	273 (63.9)	2.70 [1.99-2.66]***	137 (63.7)	1.87 [1.36-2.58]***	81 (54.4)	1.28 [0.82-1.97]	44 (51.2)	0.83 [0.45-1.51]
Race/Ethnicity								
White	216 (51.2)	--	101 (47.9)	--	61 (42.1)	--	26 (32.9)	--
Black, non-Hispanic	102 (24.2)	1.36 [0.82-2.26]	54 (25.6)	1.55 [1.04-2.30]*	42 (29.0)	1.99 [1.30-3.05]**	26 (32.9)	4.40 [1.5-10.5]**
Hispanic	54 (12.8)	2.07 [1.33-3.22]**	31 (14.7)	2.70 [1.76-4.14]***	23 (15.9)	3.09 [2.18-4.38]***	15 (19.0)	5.03 [2.72-9.33]***
Other	50 (11.9)	1.60 [1.12-2.28]*	25 (11.9)	1.12 [0.66-1.90]	19 (13.1)	1.46 [0.80-2.65]	12 (15.2)	2.09 [0.70-6.24]
Sexual orientation								
Heterosexual/straight	315 (75.4)	--	127 (62.9)	--	94 (63.1)	--	57 (68.7)	
Lesbian, gay, or bisexual	86 (20.6)	7.33 [4.47-12.1]	61 (30.2)	8.49 [5.18-13.9]***	49 (32.9)	8.08 [4.50-14.5]***	23 (27.7)	5.19 [2.71-9.97]***
Not sure	17 (4.1)	2.47 [0.99-6.13]*	14 (6.9)	5.54 [2.88-10.6]***	--	--	--	--

Notes: Statistically significant associations are notated as * <0.05, ** is <.01, *** is <0.001.

Making a Suicide Plan

The logistic regression results for making a suicide plan are presented in Table 2. There was no statistically significant difference between male and female youth in making a suicide plan within the past 12 months (OR = 1.28; 95% CI, 0.82-1.97). The results of our multinomial logistic regression revealed that LGB youth, as compared to their heterosexual/straight counterparts, had approximately 8 times the odds of making a suicide plan (OR = 8.08; 95% CI, 4.50-14.5). We did not report our results when including youth who reported "not sure" to the question asking to report sexual orientation given the small number of respondents in this category.

Hispanic youth had more than 3 times the odds of reporting making a suicide plan (OR = 3.09; 95% CI, 2.18-4.38) and Black youth had approximately twice the odds of making a suicide plan, compared to White youth, respectively (OR = 1.99; 95% CI, 1.30-3.05). In this bivariate model examining making a suicide plan as an outcome variable, we did not find a statistically significant difference among youth categorized as "other" when compared to White youth (OR = 1.46; 95% CI, 0.80-2.65).

Attempted Suicide

The results of our logistic regression analyses for attempting suicide are presented in Table 2. There was no statistically significant difference between male and female youth in reporting attempting suicide within the past 12 months (OR = 0.83; 95% CI, 0.45-1.51). The results of our multinomial logistic regression revealed that LGB youth, as compared to their heterosexual/straight counterparts, had approximately 5 times the odds of reporting a suicide attempt (OR = 5.19; 95% CI, 2.71-9.97). Again, we did not report our results when including youth who reported "not sure" to the question asking to report sexual orientation given the small number of respondents in this category.

Hispanic youth had more than 5 times the odds of reporting a suicide attempt within the past 12 months (OR = 5.03; 95% CI, 2.72-9.33). Black youth had approximately 4.5 times the odds of reporting a suicide attempt compared to White youth, respectively (OR = 4.40; 95% CI, 1.50-10.5). In this multinomial model examining suicide attempts as an outcome variable, we did not find a statistically significant difference among youth categorized as "other" when compared to White youth (OR = 2.09; 95% CI, 0.70-6.24).

DISCUSSION

The purpose of this study was to examine race, sexual orientation, and sex as predictors of STBs among Ohio youth using responses to the 2019 Ohio YRBS. We discuss our findings through an intersectional lens to contextualize the implications for public health practice and to inform subsequent research. The results of our analyses predominantly supported our first hypothesis for this study; identifying as LGB, holding an oppressed or minoritized racial or ethnic identity, as compared to White youth, being female,

would present with increased odds of reporting STBs, specifically, feeling sad or hopeless, considering suicide, making a suicide plan, and attempting suicide, with few exceptions.

Many of the findings from both the descriptive and univariate analyses of the 2019 Ohio YRBS were consistent with national profiles.[19,20] First, the odds of reporting persistent feelings of sadness and hopelessness and considering suicide were significantly higher among female youth as compared to male youth, however, there was no difference between male and female youth in reports of making a suicide plan or attempting suicide. Results from the national YRBS[19] also demonstrated a significant difference between male and female youth for all STBs, including making a suicide plan or attempting suicide. It was not anticipated that suicide attempts would be similar among female and male youth in Ohio. Of those youth sampled, the number who attempted suicide at least once in the past 12 months was nearly identical and proportionate between male (7.8%) and female (8.3%) youth. This contrasts with findings from the national 2019 YRBS, where male youth (6%) were less likely to attempt suicide than their female counterparts.[19]

Second, prevalence rates of persistent feelings of sadness or hopelessness were somewhat similar among Ohio LGB youth and youth nationally; as we examined LGB and youth who reported "not sure" when reporting sexual orientation, there are differences in the elevated reported odds among both samples.[19] Youth who indicated "not sure" were significantly more likely to report persistent sadness and hopelessness. As this group is comprised of a heterogeneous sample of youth, these elevated odds may be explained similarly to those among LGB youth and gender and sexual minority youth. The odds of seriously considering suicide for LGB youth and those who reported "not sure" were both significantly higher than heterosexual/straight youth. Elevated odds of reporting STBs was consistent when examining odds of making a suicide plan or attempting suicide between LGB youth and heterosexual/straight youth, which was similar to the national sample.[20] However, given the exclusion of youth who reported "not sure" in our reported results leads to limits in the generalizability of our findings in examining this group of youth.

Finally, Black and Hispanic youth and those with other oppressed racial identities had generally higher odds of persistent feelings of sadness or hopelessness, considering suicide, making a suicide plan, and attempting suicide; there were no significant differences among Black youth and those considered as "other" when compared to White youth reporting persistent feelings of sadness or hopelessness.

PUBLIC HEALTH IMPLICATIONS

The identification of youth with higher odds of experiencing and reporting STBs is fundamental in formulating appropriate prevention, assessment, and management of these behaviors. Public health strategies for robust suicide prevention must acknowledge

structures that disparately impact youth with oppressed identities through an intersectional lens, including social determinants of health, access to health care, and health literacy around help-seeking for mental health concerns and suicide. Such examples include empowering schools and administrators to take an active role in engaging youth on supporting the social and emotional needs of students, especially among youth with single and multiple oppressed identities.[53]

There are significant implications for public health and the evaluation and implementation of effective systemic strategies across the spectrum of primary, secondary, and tertiary prevention. First, primary prevention across systems can improve the manifestation of mental health concerns through education and addressing risk factors that moderate STBs, including discrimination and other social determinants of health. Secondary prevention may present opportunities for improved screening and identification of youth who are already experiencing mental health concerns and other risk factors. Tertiary prevention may serve to identify crucial strategies in preventing both suicide attempts and deaths, such as those through crisis support services and through lethal means counseling.

Limitations

There are several limitations to the YRBS and this study. Notably, the first is the absence of youth with transgender and gender-expansive identities within the sample. The Ohio YRBS offers limited items related to gender and sexual orientation, and as such those with minority gender and sexual identities may not be accurately captured in this dataset. This reduces generalizability to an otherwise at-risk population. However, given our findings, it may be that STBs among Ohio youth with minority gender identities share similar prevalence rates as youth nationally.

Second, the YRBS is administered once every 2 years and cannot lend information as to causal factors related to suicidal thoughts and behaviors. However, the YRBS and cross-sectional data, when examined carefully, can provide crucial information around health behaviors such as suicidal thoughts and behaviors. Third, the YRBS relies upon students to self-report the health behaviors of interest. Responses may be impacted by recall bias or response fatigue, as the YRBS in Ohio has historically been administered by "pen and paper." The 2021 Ohio YRBS will be distributed electronically. The YRBS requests responses regarding sensitive behaviors, including substance use, suicide, and sexual health practices. There is the risk that students' responses may be impacted by social desirability, which may cause students to under- or over-report behaviors. Given this limitation, however, the survey questions have demonstrated good test-retest reliability. Lastly, it should be noted that limitations in specificity and generalizability do not sacrifice the significance of findings based on population-based survey data. As the CDC and the Ohio Department of Health both employ stratified sampling methods to increase the meaningfulness of findings, we can more confidently report that these results are intended to be from a representative sample.

Conclusion

Suicide, especially youth suicide, is a devastating loss for families, friends, and communities. The findings of our research reiterate the disparate impact of STBs among youth with oppressed sexual, racial, and ethnic identities. The magnitude of these differences impacts all Ohioans; it is incumbent upon researchers and practitioners to share such findings to improve outcomes for all Ohio youth.

REFERENCES

1. Ehlman DC, Yard E, Stone DM, Jones CM, Mack KA. Changes in suicide rates—United States, 2019 and 2020. *MMWR Morb Mortal Wkly Rep*. 2022;71(8):306-312.
https://doi.org/10.15585/mmwr.mm7108a5

2. Brodsky BS, Spruch-Feiner A, Stanley B. The zero suicide model: Applying evidence-based suicide prevention practices to clinical care. *Front Psychiatry*. 2018;9.
https://doi.org/10.3389/fpsyt.2018.00033

3. Knox KL. Approaching suicide as a public health issue. *Ann Intern Med* 2014;161(2):151-152.
https://doi.org/10.7326/M14-0914

4. Knox KL, Conwell Y, Caine ED. If suicide is a public health problem, what are we doing to prevent it? *Am J Public Health*. 2004;94(1):37-45.
https://doi.org/10.2105/AJPH.94.1.37

5. Stone DM, Jones CM, Mack KA. Changes in suicide rates — United States, 2018–2019. *MMWR Morb Mortal Wkly Rep*. 2021;70(8): 261-268.
https://doi.org/10.15585/mmwr.mm7008a1

6. @JanelCubbage. We are not minorities, we have been minoritized. We are not underrepresented, we have been historically excluded. Language matters. Posted November 14, 2020. Accessed October 31, 2022. https://twitter.com/JanelCubbage/status/1327675879011520512?s=20

7. Centers for Disease Control and Prevention. Web-based injury statistics query and reporting system (WISQARS). Leading causes of death reports, 1981-2019. Centers for Disease Control and Prevention. Accessed Dec 30, 2021.
https://webappa.cdc.gov/sasweb/ncipc/leadcause.html

8. Centers for Disease Control and Prevention. Web-based injury statistics query and reporting system (WISQARS). Accessed January 4, 2023.
https://www.cdc.gov/injury/wisqars/index.html

9. Fortgang RG, Nock MK. Ringing the alarm on suicide prevention: A call to action. *Psychiatry*. 2021;84(2):192-195.
https://doi.org/10.1080/00332747.2021.1907871

10. Button ME, Marsh I, eds. *Suicide and Social Justice: New Perspectives on the Politics of Suicide and Suicide Prevention*. Routledge; 2020.

11. Cramer RJ, Kapusta ND. A social-ecological framework of theory, assessment, and prevention of suicide. *Front Psychol*. 2017;8.
https://doi.org/10.3389/fpsyg.2017.01756

12. Fitzpatrick SJ, River J. Beyond the medical model: Future directions for suicide intervention services. *Int J Soc Determinants Health HealthServ*. 2018;48(1):189-203.
https://doi.org/10.1177/0020731417716086

13. Standley CJ, Foster-Fishman P. Intersectionality, social support, and youth suicidality: A socioecological approach to prevention. *Suicide Life Threat Behav*. 2021;51(2):203-211.
https://doi.org/10.1111/SLTB.12695

14. White J. What can critical suicidology do? *Death Stud*. 2017;41(8):472-480.
https://doi.org/10.1080/07481187.2017.1332901

15. Mueller AS, James W, Abrutyn S, Levin ML. Suicide ideation and bullying among US adolescents: Examining the intersections of sexual orientation, gender, and race/ethnicity. *Am J Public Health*. 2015;105 (5):980-985.
https://doi.org/10.2105/AJPH.2014.302391

16. Standley CJ. Expanding our paradigms: Intersectional and socioecological approaches to suicide prevention. *Death Stud*. 2022;46(1):224-232.
https://doi.org/10.1080/07481187.2020.1725934

17. White J, Kral MJ. Re-thinking youth suicide: Language, culture, and power. *J Soc Action Couns Psychol*. 2014;6(1):122-142.
https://doi.org/10.33043/jsacp.6.1.122-142

18. Fontanella CA, Saman DM, Campo JV, et al. Mapping suicide mortality in Ohio: A spatial epidemiological analysis of suicide clusters and area level correlates. *Prev Med*. 2018;106:177-184.
https://doi.org/10.1016/j.ypmed.2017.10.033

19. Dickey lM, Budge SL. Suicide and the transgender experience: A public health crisis. *Am Psychol*. 2020;75(3):380-390.
https://doi.org/10.1037/amp0000619

20. Ivey-Stephenson AZ, Demissie Z, Crosby AE, et al. Suicidal ideation and behaviors among high school students — Youth Risk Behavior Survey, United States, 2019. *MMWR Suppl*. 2020;69(1): 47-55.
https://doi.org/10.15585/mmwr.su6901a6

21. Johns MM, Lowry R, Haderxhanaj LT, et al. Trends in violence victimization and suicide risk by sexual identity among high school students — Youth Risk Behavior Survey, United States, 2015–2019. *MMWR Suppl*. 2020;69(1):19-27.
https://doi.org/10.15585/mmwr.su6901a3

22. Liu RT, Walsh RFL, Sheehan AE, Cheek SM, Carter SM. Suicidal ideation and behavior among sexual minority and heterosexual youth: 1995–2017. *Pediatrics*. 2020;145(3):e20192221.
https://doi.org/10.1542/peds.2019-2221

23. Fish JN, Rice CE, Lanza ST, Russell ST. Is young adulthood a critical period for suicidal behavior among sexual minorities? Results from a US national sample. *Prev Sci*. 2019;20(3):353-365.
https://doi.org/10.1007/s11121-018-0878-5

24. Cha CB, Tezanos KM, Peros OM, et al. Accounting for diversity in suicide research: Sampling and sample reporting practices in the United States. *Suicide Life Threat Behav*. 2018;48(2):131-139.
https://doi.org/10.1111/sltb.12344

25. Nock MK, Green JG, Hwang I, et al. Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: Results from the national comorbidity survey replication adolescent supplement. *JAMA Psychiatry*. 2013;70(3):300.
https://doi.org/10.1001/2013.jamapsychiatry.55

26. Szlyk HS. Suicidal ideation among youths at risk of school dropout: Impact of student demographics, stressors, and academic self-concept. *Health Soc Work*. 2021:hlaa028.
https://doi.org/10.1093/hsw/hlaa028

27. Kann L, McManus T, Harris WA, et al. Youth risk behavior surveillance —United States, 2017. *MMWR Surveil Summ*. 2018;67(8):1-114.
https://doi.org/10.15585/mmwr.ss6708a1

28. Lindsey MA, Sheftall AH, Xiao Y, Joe S. Trends of suicidal behaviors among high school students in the United States: 1991–2017. *Pediatrics*. 2019;144(5):e20191187.
https://doi.org/10.1542/peds.2019-1187

29. Cloutier P, Martin J, Kennedy A, Nixon MK, Muehlenkamp JJ. Characteristics and co-occurrence of adolescent non-suicidal self-injury and suicidal behaviours in pediatric emergency crisis services. *J Youth Adolesc*. 2010;39(3):259-269.
https://doi.org/10.1007/s10964-009-9465-1

30. Hankin BL, Mermelstein R, Roesch R. Sex differences in adolescent depression: Stress exposure and reactivity models. *Child Dev*. 2007;78 (1):279-295.
https://doi.org/10.1111/j.1467-8624.2007.00997.x

31. Mathias CW, Dougherty DM, James LM, et al. Intolerance to delayed reward in girls with multiple suicide attempts. *Suicide Life Threat Behav*. 2011;41(3):277-86.
https://doi.org/10.1111/j.1943-278X.2011.00027.x

32. Eaton DK, Lowry R, Brener ND, Galuska DA, Crosby AE. Associations of body mass index and perceived weight with suicide ideation and suicide attempts among US high school students. *Arch Pediatr Adolesc Med*. 2005;159(6):513-519.
https://doi.org/10.1001/archpedi.159.6.513

33. Hafeez H, Zeshan M, Tahir MA, Jahan N, Naveed S. Health care disparities among lesbian, gay, bisexual, and transgender youth: A literature review. *Cureus*. 2017;9(4):e1184.
https://doi.org/10.7759/cureus.1184

34. Viner RM, Ozer EM, Denny S, et al. Adolescence and the social determinants of health. *Lancet*. 2012;379(9826):1641-52.
https://doi.org/10.1016/S0140-6736(12)60149-4

35. Kessler RC, Avenevoli S, McLaughlin KA, et al. Lifetime co-morbidity of DSM-IV disorders in the US National Comorbidity Survey Replication Adolescent Supplement (NCS-A). *Psychol Med*. 2012;42(9):1997-2010.
https://doi.org/10.1017/S0033291712000025

36. Boeninger DK, Masyn KE, Feldman BJ, Conger RD. Sex differences in developmental trends of suicide ideation, plans, and attempts among European American adolescents. *Suicide Life Threat Behav*. 2010;40 (5):451-464.
https://doi.org/10.1521/suli.2010.40.5.451

37. Arshanapally S, Werner KB, Sartor CE, Bucholz KK. The association between racial discrimination and suicidality among African-American adolescents and young adults. *Arch Suicide Res*. 2018;22(4):584-595.
https://doi.org/10.1080/13811118.2017.1387207

38. Bridge JA, Horowitz LM, Fontanella CA, et al. Age-related racial disparity in suicide rates among US youths from 2001 through 2015. *JAMA Pediatr*. 2018;172(7):697-699.
https://doi.org/10.1001/jamapediatrics.2018.0399

39. Michaels MS, Parent MC, Torrey CL. A minority stress model for suicidal ideation in gay men. *Suicide Life Threat Behav*. 2016;46(1):23-34.
https://doi.org/10.1111/sltb.12169

40. Merz S, Jaehn P, Mena E, et al. Intersectionality and eco-social theory: A review of potentials for public health knowledge and social justice. *Crit Public Health*. 2021.
https://doi.org/10.1080/09581596.2021.1951668

41. Hill Collins P, Bilge S, Polity P. *Intersectionality*. 2nd ed. Polity Press; 2021.

42. Bostwick WB, Meyer I, Aranda F, et al. Mental health and suicidality among racially/ethnically diverse sexual minority youths. *Am J Public Health*. 2014;104(6):1129-1136. https://doi.org/10.2105/AJPH.2013.301749

43. Poindexter B. *Examining Intersectionality Theory and Adolescent Motivations to Engage in Risky Sexual Behavior*. M.A. University of Rhode Island; 2013.

44. Bey G. Health Disparities at the intersection of gender and race: Beyond intersectionality theory in epidemiologic research. In Irtelli F, Durbano F, Taukeni SG, eds. *Quality of Life - Biopsychosocial Perspectives*. Intechopen; 2020. https://doi.org/10.5772/intechopen.92248

45. Bauer GR. Incorporating intersectionality theory into population health research methodology: Challenges and the potential to advance health equity. *Soc Sci Med*. 2014;110:10-17. https://doi.org/10.1016/j.socscimed.2014.03.022

46. Heard E, Fitzgerald L, Wigginton B, Mutch A. Applying intersectionality theory in health promotion research and practice. *Health Promot Int*. 2020;35(4):866-876. https://doi.org/10.1093/heapro/daz080

47. Higgins Tejera C, Horner-Johnson W, Andresen EM. Application of an intersectional framework to understanding the association of disability and sexual orientation with suicidal ideation among Oregon teens. *Disabil Health J*. 2019;12(4):557-563. https://doi.org/10.1016/j.dhjo.2019.05.006

48. Brener ND, Kann L, Shanklin S, et al. Methodology of the Youth Risk Behavior Surveillance System — 2013. *MMWR Recomm Rep*. 2013;62(1):1-20. https://pubmed.ncbi.nlm.nih.gov/23446553/

49. Underwood JM, Brener N, Thornton J. Overview and methods for the Youth Risk Behavior Surveillance System — United States, 2019. *MMWR Suppl*. 2020; 69 https://doi.org/10.15585/mmwr.su6901a1

50. *Stata Statistical Software: Release 16*. StataCorp LLC; 2019.

51. Archer KJ, Lemeshow S. Goodness-of-fit test for a logistic regression model fitted using survey sample data. *Stata J*. 2006;6(1):97-105. https://doi.org/10.1177/1536867X0600600106

52. Hosmer DW, Lemeshow S, Sturdivant RX. *Applied Logistic Regression*. vol 398. John Wiley & Sons; 2013.

53. Social and emotional learning: Past, present, and future. In: Weissberg RP, Durlak JA, Domitrovich CE, Gullotta TP, eds. *Handbook of Social and Emotional Learning: Research and practice*. The Guilford Press; 2015:3-19.

Mixed Methods Evaluation of State Targeted Response to the Opioid Crisis in Ohio

R. Thomas Sherba[1]; Julia Dionne[1]; Jessica V. Linley[1]

[1]Ohio Department of Mental Health and Addiction Services, Columbus, OH

Corresponding Author: R. Thomas Sherba, Office of Community Planning and Collaboration, Bureau of Quality, Planning and Research, Ohio Substance Abuse Monitoring (OSAM) Network, 30 East Broad Street, 8th Floor, Columbus, OH 43215, (614) 466-9020, r.sherba@mha.ohio.gov

ABSTRACT

Background: In 2017, the Substance Abuse and Mental Health Services Administration awarded State Targeted Response (STR) grants through the 21st Century Cures Act to help states address the opioid crisis. While there are publications that discuss how each state allocated their STR grant awards, there is a paucity of evaluations illustrating the impact of STR grant activities on clients of opioid use disorder (OUD) treatment, family members of persons living with OUD, community professionals whose work involves addressing OUD, as well as impacts on local communities. This longitudinal qualitative study assessed the impact of STR grant-funded projects on communities in Ohio particularly hard hit by the opioid epidemic.

Methods: Data were collected through a mixed research methodology from November 2017 through April 2019. Epidemiologists conducted focus groups and administered surveys in 4 geographically different areas of the state. Study objectives included assessments of community messaging related to opioids, level of perceived stigma for OUD, knowledge of available services and processes for accessing them, and perception of community treatment service needs.

Results: A total of 940 respondents participated in 3 cycles (6 months each) of focus groups. Key findings included increased naloxone knowledge and experience, increased proportion of persons living with OUD receiving medication-assisted treatment (MAT), and a 2.5 time increase in the number of reported positive observations of community change. While the level of perceived stigma for OUD remained consistent (moderate) throughout the study, respondents throughout cycles observed an increasing number of community approaches, such as public awareness campaigns and recovery rallies, to impart knowledge, change attitudes, and reduce stigma.

Conclusion: Evaluations of STR funded activities and programs could help illustrate the value that additional funding might have over time in reducing stigma related to OUD and increasing knowledge of available treatment services in communities.

Keywords: Cures Act; Medication-assisted treatment; MAT; Naloxone; Opioids; SUD treatment; Mixed methods

INTRODUCTION

Nationally, Ohio is one of the states that has been most adversely affected by the opioid epidemic.[1-3] According to data from the National Survey on Drug Use and Health (NSDUH), approximately 7.8% of Ohio's population 12 years of age and over (747 000 of 9 561 700 Ohioans) reported a substance use disorder (SUD) within the past year.[4] Additionally, an estimated 1.1%, or 103 000 Ohioans, demonstrated an opioid use disorder (OUD) within the last year, which is higher than the national OUD prevalence of 0.6%.[4]

Since 2007, unintentional drug overdose has been the state's leading cause of injury death, surpassing motor vehicle crashes.[5] Ohio's most recent data show that the unintentional drug overdose death rate increased 6.4% from a rate of 34.2 deaths per 100 000 population in 2018 to a rate of 36.4 deaths per 100 000 population in 2019.[5]

In 2016, the US Congress passed into law the 21st Century Cures Act to accelerate the discovery, development, and delivery of new cures and treatment.[6] In 2017, the Substance Abuse and Mental

Health Services Administration (SAMHSA) awarded Ohio a State Targeted Response (STR) to the Opioid Crisis Grant. The STR grants were funding to help states address the opioid crisis by providing support for increasing access to treatment, reducing unmet treatment need, and reducing opioid-related overdose deaths.[7]

As part of the evaluation of Ohio's STR projects, the Ohio Substance Abuse Monitoring (OSAM) Network designed a targeted response initiative to determine the impact of STR project activities on individuals, families, and local communities in targeted areas of the state over the 2-year STR grant period. The OSAM Network is a well-established mixed methods epidemiological research initiative that tracks drug trends in Ohio and produces biannual descriptions of regional substance use, using data collected through focus groups with persons engaged in SUD treatment and with community professionals whose work is impacted by substance use.[8]

In March 2020, the Office of Inspector General within the US Department of Health and Human Services released a report in brief outlining findings from a review of states' use of STR funds. The report outlined information that suggested that STR grants were likely successful in expanding access to general OUD treatment and recovery support services.[9] There are many publications that discuss how each state allocated their STR grant awards, yet very few recipients have published individual studies evaluating the impact of STR funded programs on targeted communities. Of the states that have published, most reported on preliminary data or data from pilot studies, rather than data collected over the entire 2-year grant program.[10,11] Additionally, the outcomes reported within these evaluations almost entirely focused on lessons learned to improve navigating bureaucracy and creating effective partnerships to successfully implement STR funded programs.[10,11] Evaluations illustrating the impact of STR grant activities on clients of OUD treatment, family members of persons living with OUD, community professionals whose work involves addressing OUD, as well as impacts on local communities, were nonexistent at the time of this present study.

Evaluating STR funded activities and programs could help illustrate the value that additional funding might have over time on reducing stigma related to OUD and increasing knowledge of available treatment services in communities. This paper seeks to assess the impact of STR funded activities on communities in diverse regions across Ohio. It was hypothesized that STR grant funding would have a positive effect over time on reducing stigma related to OUD, increasing knowledge of available treatment services in communities, and in identifying treatment needs.

METHODS

Data were collected through a mixed research methodology, utilizing quantitative and qualitative instrumentation from November 2017 through April 2019. There were 3 data collection cycles, each spanning 6 months: months 1 to 6 (cycle 1), months 7 to 12 (cycle 2), and months 13 to 18 (cycle 3). During each cross-sectional assessment period, 4 regional epidemiologists (REPIs), each assigned to 1 of the study's 4 designated county behavioral health board areas, conducted focus groups and administered surveys. Ohio has 50 county behavioral health boards that are the local planning authorities for services to communities in the areas of mental health and substance use and may encompass more than 1 county. The REPIs were professionals with at least a master's degree in a social science with relevant research experience in mixed methods data collection.

The study's 4 designated board areas represented communities particularly hard hit by the opioid epidemic. A participating board area either had the highest overdose death counts, the highest overdose death rates (particularly fentanyl deaths), or the highest overdose death rates and a high need for illicit drug treatment.[12] To ensure a diverse and representative sample of Ohio communities, researchers purposefully selected 4 highly impacted board areas, representing a total of 12 of the state's 88 counties, from 4 geographically different regions of the state: Appalachia, North Central, Northeast, and South.

Our sampling plan was based on strategies for mixed purposeful sampling. Purposeful sampling is selecting information-rich cases for in-depth study with sample size and specific cases dependent on the study's purpose.[13] The purpose of this research initiative was to gain a statewide perspective of communities particularly hard hit by the opioid epidemic. Our sampling combined the strategies of maximum variation sampling and convenience sampling. Maximum variation sampling picks a wide range in variation among persons of interest. Our sample size was determined based on time allotted and resources available for the study.

Participants were persons receiving treatment for OUD (clients), family members of persons living with OUD, and community professionals whose work involved addressing OUD (treatment providers and law enforcement). The REPIs aimed to conduct focus groups with a minimum of 50 clients, 20 family members, and 20 community professionals per board area every 6 months. Thus, the study's target sample size across the 3 data collection cycles was 1080: 600 clients, 240 family members, and 240 community professionals.

Data Collection

Clients were recruited to participate in the study through SUD treatment programs, usually an intensive outpatient program (IOP). The REPIs and the study coordinator contacted SUD treatment agencies by phone or email within designated board areas to invite study participation of agency staff, treatment clients, and family members of persons living with OUD who participated in agency family programming. Physicians, nurses, law enforcement officers, and other professionals whose work involved addressing OUD within designated board areas were contacted by phone or

email and solicited for study participation. Due to difficulty in obtaining parental consent for minor participants, only individuals aged 18 years or over were invited to participate in this study. The REPIs obtained participant informed consent, administered brief surveys, and conducted focus groups following scripted protocols. All focus group proceedings were conducted in person and audio recorded with participant full knowledge and informed consent. Each focus group consisted of no more than 12 participants and lasted approximately 1 to 2 hours. Clients and family members received a $20 retail gift card for focus group participation. An applicable institutional review board approved this study.

Study participation was voluntary. Participants were assured that all information shared/gathered was strictly confidential and they agreed not to reshare information provided by other participants in the focus group. All focus groups with clients and with family members were conducted at the location of an OUD treatment program. Potential participants were informed about the nature of the questions to be asked before consent for participation in the study was secured. All participants were provided with contact information for the study's principal investigator and study coordinator.

Prior to focus group start, all participants across participant types completed a brief pencil and paper demographic survey. The researchers wrote these surveys to capture the following information: sex, ethnicity, race, as well as additional characteristics by participant type. The client survey also captured age, level of education, household income, employment status, mental health diagnosis, illicit opioid use during the past 6 months, current medication-assisted treatment (MAT) status, and history of intravenous drug use. The family member survey also captured number of family members living with OUD and relationship to family member(s). The community professional survey also captured type of care provided, current profession, and length of time working with persons with OUD. In addition, all participant types were surveyed on their knowledge and experience with naloxone (medication to reverse an opioid overdose).

Client perceived stigma of addiction was measured using the Perceived Stigma of Addiction Scale (PSAS) prior to focus group start. The PSAS is a validated, 8-item, self-report pencil and paper questionnaire that measures the level of perceived stigma toward people who misuse substances.[14] Each item is measured on a 4-point Likert scale of 1 (strongly disagree), 2 (disagree), 3 (agree), and 4 (strongly agree). The PSAS scoring scale is 8 to 32. The closer the score is to 32, the greater the perceived stigma.

In focus groups, all participant types were asked open-ended questions to assess community messaging related to opioids in examination of perceived stigma around OUD. Clients and family members were asked a series of open-ended and Likert-scale questions to assess their knowledge of available community treatment services, as well as their knowledge of how to access needed services. Community professionals were asked open-ended and Likert-scale questions to assess their perceptions of community treatment service needs. All open-ended and Likert-scale responses were collected via round-robin method, meaning REPIs recorded an individual response from each participant during the focus group. For focus group questions (scripted protocols), see Appendix.

Data Analysis

All analyses of quantitative data were conducted using the Statistical Package for the Social Sciences (SPSS) and consisted of counts, frequencies, comparisons of means (one-way ANOVA), chi-square tests, and Fisher exact tests of independence. An alpha level of 0.05 was used for all statistical tests. All percentages provided in the Results section are valid percentages reflecting the number of participants that provided answers.

Qualitative data were analyzed using grounded theory, with response categories generated and abstracted to reflect the viewpoints of participants. Grounded theory is an inductive, systematic methodological process used in social science research. Through an iterative, nonlinear process of discovery, response categories are identified and defined.[15] A professional transcription service was used to transcribe focus group audio recordings for cycle 1. The REPIs and the study's authors independently analyzed transcripts, coded for participant responses per study question, and identified recurrent responses to generate question response categories. Authors reviewed and discussed the initial response categories, then independently analyzed category discrepancies, and further discussed additional discrepancies to establish full consensus on response categories. They reviewed and discussed this final coding until full consensus was reached on categories. The REPIs transcribed and coded for cycles 2 and 3 using question response categories established in cycle 1. Authors then reviewed REPI transcript coding to confirm response categories and to identify additional response categories not given in the previous cycle(s).

RESULTS

A total of 940 unique participants enrolled in 157 focus groups during the 3 data collection cycles, meeting 87.0% of the study's target enrollment goal (940/1080). All participant data were collected in focus groups stratified by participant type. The participant breakdown was: 554/600 consumers (92.3%), 156/240 family members (65.0%), and 230/240 professionals (95.8%). For number of focus groups and participants stratified by participant type for each data collection cycle, see Table 1.

Of 554 participating clients, most were female (55.2%), White (94.3%), and non-Hispanic (96.3%). The mean age was 33.9 years. In terms of employment, 46.9% of clients reported employment during the past 6 months. For additional client (study participant) demographic information and descriptive information for Ohio and designated board areas (study areas), see Table 2. In terms of drug use, 78.3% of clients indicated opioids as their primary drug of choice, while 71.6% reported having ever used needles to inject drugs. Of 394 clients that reported having used needles, 80.3%

Table 1. Number of Focus Groups and Participants by Participant Type per Cycle

Participant Type	Cycle	Number of Groups	Number of Participants	Participant Group Mean
Client	1	24	183	7.6
	2	26	199	7.7
	3	28	172	6.1
	Total	78	554	7.1
Family	1	8	54	6.8
	2	15	54	3.6
	3	10	48	4.8
	Total	33	156	4.7
Professional	1	19	97	5.1
	2	13	65	5.0
	3	14	68	4.9
	Total	46	230	5.0

Table 2. Demographic Profiles for Ohio, Study Areas, and Study Participants

Indicator[a]	Ohio	Study Areas	Study Participants
Total population, 2019	11 689 100	1 036 831	554
Gender (female), 2019	51.0%	55.2%	55.2%
White, 2019	81.7%	85.9%	94.3%
African American, 2019	13.1%	9.2%	7.7%
Hispanic or Latino origin, 2019	4.0%	1.9%	3.7%
High school graduation rate, 2015-19	90.4%	89.2%	78.6%
Median household income, 2019	$56 602	$46 195	$16 000-19 999[b]
Persons below poverty level, 2019	13.1%	15.2%	64.8%

[a]Ohio and study areas' statistics were obtained from the 2019 estimates of the US Census.
[b]Participants reported income by selecting a category that best represented their household's approximate income for the previous year.

reported having shared needles with other persons. Nearly two-thirds (65.3%) of all clients reported ever having a mental health diagnosis.

Of 156 participating family members, 66.0% reported having 1 family member currently in treatment for OUD, reporting their relationship to their family member living with OUD most often as parent (35.9%), followed by sibling (17.9%). Community professionals described their current workplace as providing the following types of care/services: outpatient SUD treatment (66.4%), services for persons living with dual diagnosis (33.6%), inpatient SUD treatment (26.6 %), and community-based mental health (24.0%). Of the 230 professionals, 52.9% reported their current profession as therapist/counselor or social worker and 35.5% reported having worked with individuals with OUD for more than 10 years.

Stigma

In focus groups, all participant types reported that messaging about the opioid epidemic was overwhelmingly negative. Participants discussed persons living with OUD as often assigned stigmatizing labels. A client shared, *"When* [the opioid epidemic] *is talked about, it is putting that person* [living with OUD] *down…. It is the social norm nowadays to put the 'addict' in this disgusting category below any human being and it makes you not want to talk about* [addiction]." For a complete list of preferred messaging, see Table 3.

The mean overall Perceived Stigma of Addiction Scale (PSAS) score for all clients throughout the study was 23.10 ($n = 543$, $R = 21$, $SD = 3.65$). There were no statistically significant differences between cycle means as determined by one-way ANOVA ($F(2, 540) = 2.53$, $p = 0.08$). Thus, PSAS mean scores did not differ significantly by cycle, suggesting that clients perceived a moderate level of stigma toward persons living with OUD and that these perceptions did not significantly differ throughout the study. For a comparison of client PSAS mean scores by cycle, see Table 4.

Community Approaches

Participants discussed many approaches employed in their communities to combat the opioid crisis. In focus groups, clients, along with family members and community professionals in all communities, discussed MAT as a common approach and critical strategy.

Table 3. Preferred Community Messaging Related to Opioids

Addiction affects the entire family/community
Addiction does not define a person
Addiction does not discriminate
Addiction is a disease
Do not use drugs/opioids
Family support is important
If you are going to use, be safe
People are dying/opioids kill
Recovery is a process
Stop stigma
Treatment/help is available
Treatment works

Table 4. Comparison of Client PSAS Cycle Mean Scores

Cycle	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	179	23.60	3.82	0.29	23.03	24.16	11	32
2	197	22.81	3.61	0.26	22.31	23.32	13	32
3	167	22.90	3.50	0.27	22.37	23.44	15	32
Total	543[a]	23.10	3.65	0.16	22.79	23.41	11	32

[a]Eleven cases were excluded due to missing or invalid responses.

Analysis of survey data found that, of 413 clients who reported opioids as a primary drug of choice, 58.6% reported receiving MAT. They reported Suboxone® (buprenorphine and naloxone) and Vivitrol® (naltrexone, a monthly injectable suspension) as the most common forms of MAT received. In terms of differences between cycles, there was a significant increase in the proportion of clients reporting current MAT from cycle 1 (50.3%) to cycle 2 (62.7%) to cycle 3 (63.6%) ($n = 413$, $\chi2 = 6.29$, $df = 2$, $p = 0.04$).

In focus groups, quick response teams (QRTs) were discussed as an important mode of outreach that has been successful in linking persons living with OUD to treatment. Quick response teams typically consist of a law enforcement officer, a paramedic, and a counselor/social worker that provide community outreach to those who have suffered an overdose, offering resources to persons who have overdosed and their families with the goal to connect them to treatment. There were a few additional approaches identified in cycle 3 that were not identified in previous cycles. Family members, along with clients, discussed the staffing of peer recovery coaches in emergency departments as a new approach to linking persons who have overdosed to treatment services. Another approach first reported in cycle 3 was wraparound services in which community-based services and supports wrap around a person with OUD to facilitate recovery. For a complete list of community approaches, see Table 5.

Analysis of survey data found that, of all clients across cycles ($N = 554$), 93.1% reported having heard of naloxone. In focus groups, clients discussed naloxone as an important community response to the opioid epidemic. A client commented, *"Since everyone is finding out about Narcan® (naloxone), there have been less deaths."* Another client said, *"There are kids today who know how to use Narcan® … [to prevent] losing their parents to OD (opioid overdose)."* While cycle 3 community professionals observed an increase in access to naloxone from the previous 2 cycles, in focus groups, they continued to report pushback within their communities to the provision of naloxone, citing that some community members believed that too many resources were being consumed by those who "choose" to use opioids and that naloxone provides a safeguard to overdose, thus enabling continued opioid use. For changes in affirmative responses to naloxone survey questions across participant types, see Table 6.

Community Response

When cycle 3 participants were asked in focus groups to rate how well their community was responding to the identified approaches for combating the opioid crisis, clients most often reported 4, while family members and community professionals most often reported 4 to 5 on a scale of 1 (not well at all) to 7 (extremely well); for cycle 2 the most common scores were 3 to 4 and 3, respectively. Moderate response scores reflected the perception that the opioid epidemic, particularly in terms of overdose, had remained consistent throughout the study period. However, par-

Table 5. Participant Identified Community Approaches per Cycle[a]

Community Approaches	Cycle 1	Cycle 2	Cycle 3
12-step programs	+	+	+
Anti-drug coalitions/task forces	+	+	+
Child Protective Services (CPS) interventions	+	–	+
Community awareness campaigns	+	+	+
Counseling	+	+	+
Detoxification	+	+	+
Drug courts	+	+	+
Drug take-back events	+	–	–
Educating medical staff on addiction	–	–	+
Faith-based initiatives	+	+	+
Family drug courts	+	–	+
Family support groups (eg, Al-Anon)	+	+	+
Helplines	+	+	–
Incarceration	+	+	+
Medication-assisted treatment (MAT)	+	+	+
Naloxone	+	+	+
Needle exchange programs	–	+	+
Peer-to-peer supports	+	–	+
Quick response teams (QRTs)	+	+	+
School-based prevention	+	–	+
Sober living/housing	+	+	+
Staffing EDs with peer recovery coaches	–	–	+
Treatment programs	+	+	+
Warm hand-offs	–	+	+
Wraparound services	–	–	+

[a]A '+' indicates an approach discussed by participants in that cycle; a '–' indicates an approach not/infrequently discussed by participants in that cycle.

Table 6. Proportional Change in Naloxone Knowledge and Experience Cycle 1 to Cycle 3

Survey Question	% Yes Response Cycle 1	Cycle 3	% Change
Have you heard of naloxone?			
Clients (*n* = 183; *n* = 172)	85.8	97.1	+11.3[a]
Family (*n* = 54; *n* = 48)	74.1	100.0	+25.9[a]
Professionals (*n* = 97; *n* = 68)	100.0	100.0	0.0
Do you know where to obtain naloxone?			
Clients (*n* = 157; *n* = 166)	72.6	72.9	+0.3
Family (*n* = 40; *n* = 48)	57.5	83.3	+25.8[a]
Professionals (*n* = 97; *n* = 68)	93.8	100.0	+6.2[a]
Have you ever obtained naloxone?			
Clients (*n* = 157; *n* = 167)	41.4	41.9	+0.5
Family (*n* = 40; *n* = 48)	27.5	45.8	+18.3
Professionals (*n* = 97; *n* = 68)	69.1	75.0	+5.9
Do you currently possess naloxone?			
Clients (*n* = 157; *n* = 166)	17.8	20.5	+2.7
Family (*n* = 40; *n* = 48)	15.0	35.4	+20.4[a]
Professionals (*n* = 97; *n* = 68)	56.7	63.2	+6.5
Have you ever used naloxone to save someone from an overdose?			
Clients (*n* = 155; *n* = 166)	14.8	25.9	+11.1[a]
Family (*n* = 40; *n* = 48)	0.0	4.2	+4.2
Professionals (*n* = 97; *n* = 68)	20.6	19.1	-1.5
Has naloxone ever been used on you to reverse an opioid overdose?			
Clients (*n* = 154; *n* = 166)	42.2	34.3	-7.9

[a]Significant change at *p* ≤ 0.05.

ticipants generally acknowledged that community efforts had increased. When participants were asked in focus groups to share observations of community changes that have occurred during the study's time frame, the number of positive observations increased 2.5 times from cycle 1 to cycle 3. Moreover, there were half as many negative observations discussed in cycle 3 compared to cycle 2. For reported observations of community change per cycle, see Table 7.

Treatment Needs

All participant types reported in focus groups that additional services were needed a great deal. Most agreed that demand continued to outpace the availability of services. They spoke of needing more capacity across the treatment spectrum. Clients in rural communities continued to report that a person with OUD typically had no option but to leave their community to receive needed services, often traveling considerable distances from home. Community professionals pointed to continued wait times for services as an indication that more services were needed. Family members emphasized that while there were more treatment options than previously, there were not enough professionals/staff to expand treatment services.

In focus groups throughout cycles, when asked, 'did you receive the kind of services you needed' and 'were the services you received the right approach for helping you,' clients in all commu-

nities overwhelmingly responded 'yes' to both questions. Most clients felt that they had received the services they needed from the program in which they were currently enrolled and that they would recommend the same services to a friend or loved one who needed similar help. When asked, 'is there any type of service that you felt you needed but had not received,' the most frequent response for cycles 2 and 3 was 'no;' 'yes' was the most frequent response given in cycle 1. However, while clients overwhelmingly said that they had received all needed services, they discussed a lack of certain services in their communities. For a list of services needed, as well as a list of barriers to treatment services, see Table 8.

In general, participants throughout cycles reported that it was relatively easy to access treatment services if one were arrested, pregnant, had overdosed, or had insurance. When asked in focus groups how easy or difficult it was for people to access treatment services in the community on a scale from 1 (very difficult/cannot access treatment) to 7 (very easy/no trouble accessing treatment at all), accessibility rating scores varied between communities. Throughout cycles, 1 community consistently reported low accessibility scores of 1 to 3, while 2 communities reported moderate to high scores of 4 to 6, and the other community reported high scores of 6 to 7. Clients in the community reporting low accessibility to treatment assigned their scores based on wait times for inpatient treatment and detox services. Community professionals throughout cycles most often reported accessibility to treatment

Table 7. Observed Changes of Community Approaches per Cycle

Positive observations	Cycle(s)[a]
Naloxone is saving lives	1, 2, 3
Increase in awareness/understanding of opioid addiction (stigma reduction)	1, 2, 3
Increase in number of people seeking help/entering treatment	1, 2, 3
Increase in needle exchanges	1, -, 3
Increase in treatment as an alternative to incarceration	1, 2, 3
Increase in resources/treatment/MAT programs (eg, naltrexone)	1, 2, 3
Increase in people in recovery	1, 2, 3
Increase in younger people entering treatment	-, 2, 3
Decrease in stigma/less shame in seeking treatment	-, 2, 3
Increase in support/support groups	-, 2, 3
Decrease in overdoses	-, 2, 3
Increase in policing (drug interdiction)	-, 2, 3
Increase in coordination among community partners	-, 2, 3
Increase in community involvement/volunteerism	-, 2, 3
Decrease in treatment wait times	-, -, 3
Access/distribution of fentanyl test strips	-, -, 3
Decrease in crime rate	-, -, 3
Quick response teams linking overdose victims to treatment	-, -, 3
Negative observations	
Increase in methamphetamine use	1, 2, 3
Resistance to treatment centers in the community	1, 2, -
Treatment programs only reaching a small proportion of people who need services	1, 2, -
Community pushback/people not caring (compassion fatigue)	1, 2, 3
More attention directed to policing/increased incarceration	1, 2, 3
Lack of coordination among community partners	1, 2, 3
Opioid epidemic is worsening	-, 2, 3
Limited prevention work	-, 2, -
Denial of epidemic/opioid problem	-, 2, -

[a]A '-' in place of a cycle number indicates a theme not/infrequently discussed in that cycle.

as 4 on the above scale, while family members most often reported 4 (cycle 3), 3 (cycle 2), and 1 to 3 (cycle 1). Community professionals discussed programs/agencies not reaching some populations at risk (eg, older adults, LGBTQ+ populations, and people with serious mental illness).

DISCUSSION

This study presented observations of community change as reported by 940 participants from communities particularly hard hit by the opioid epidemic. Study assessment objectives were met. Study findings support the hypotheses that STR grant funding would have a positive effect over time on increasing knowledge of available treatment services in communities and in identifying treatment needs; findings did not support the hypothesis that STR grant funding would have a positive effect over time on reducing stigma.

Participants throughout communities reported misconceptions or general lack of understanding regarding addiction in community messaging. They shared frequently hearing that addiction is a choice and a moral issue. All participant types indicated wanting people in the community to hear and understand that addiction is a disease, and since addiction is a disease and a chronic condition,

it should be treated as other chronic diseases. Education on addiction may be helpful in combating stigma in communities. Training and educational programs targeting counselors/therapists, medical professionals, and police officers have demonstrated effectiveness in reducing stigma-related outcomes.[16,17] Moreover, acknowledging the far-reaching impact of addiction when addressing stigma would raise awareness of the many ways that addiction negatively impacts family members of persons living with OUD as well as entire communities. Other research has found that addressing the effects of drug use on familial relationships and other related social problems is beneficial to long-term recovery.[18] Community members should also be made aware of the many people in recovery who are productive members of society. The sharing of recovery stories with those not in recovery is likely to decrease stigma.[19,20]

Positive messaging pertaining to treatment and recovery would likely aid stigma reduction. Research has found that portraying persons with SUD as successfully treated and in recovery, as well as sharing their personal stories that highlight structural barriers to treatment, are effective strategies for reducing stigma and discrimination and increasing the public's willingness to invest in SUD resources.[19,20] Messages such as change is possible and that

there is hope for persons with OUD to get needed treatment and to recover and that recovery takes time and is a challenging, yet rewarding process, would likely improve community attitudes. In addition, efforts to increase empathy among community members is needed to increase understanding that people with addiction are people like everyone else. Anyone is susceptible to addiction and the opioid crisis is a public health issue. Family members and community professionals agreed that stigmatization is equally as harmful as addiction itself. While consistent PSAS scoring did not indicate a reduction in perceived stigma toward persons living with OUD during the study time frame, participants throughout cycles observed an increasing number of community approaches, such as public awareness campaigns and recovery rallies, to impart knowledge, change attitudes, and reduce stigma.

Participants identified and discussed many approaches employed in their communities to combat the opioid crisis, demonstrating knowledge of available treatment services. When cycle 3 participants were asked to rate their community's response to approaches to combat the opioid crisis, they assigned slightly higher rating scores across the board from cycle 2 to cycle 3, indicating perhaps that communities had become more responsive to addressing OUD. Participants generally acknowledged that community efforts to address the opioid epidemic had increased and that progress had been made. Cycle 3 treatment providers noted that wait times for services had gotten shorter since cycle 1, and family members reported increased service accessibility from cycles 2 and 1. However, most participants spoke of needing more capacity across the treatment spectrum.

Service expansion is needed, both in terms of additional services and a higher volume of existing services. Communities need to address the unmet needs and barriers to treatment identified in this study to combat the opioid epidemic more effectively. For instance, MAT is a critical strategy to assisting those addicted to opioids to recover; however, only approximately half of all clients reported currently receiving MAT. Additional MAT prescribers and more MAT choices are needed. Clients of 1 county behavioral health board area noted needle exchanges (also known as syringe exchanges) operating in their communities when 71.6% of all clients reported past intravenous drug use and 80.3% of these clients reported having shared needles while injecting drugs: 42.1% of all clients reported having tested positive for hepatitis C. Needle exchanges provide more than just clean needles to people who use opioids, oftentimes these programs provide information on available community resources. Further expansion of needle exchanges should be evaluated. In addition, recovery support services are needed. The consensus among clients was that they did not receive all the services they felt they needed from their treatment programs; most often cited as lacking or missing were housing and job placement services and transitional support/aftercare programming when exiting treatment.

Limitations

This study has limitations. Our sampling plan might have created selection bias due to the exclusive recruitment of persons living with OUD from treatment programs. The experiences of persons receiving treatment for OUD might have differed from persons living with OUD who were not in treatment or from those who had never accessed OUD treatment. To minimize this bias, client data were corroborated with data collected from family members of persons living with OUD, many of whom shared experiences of loved ones not in treatment or of loved ones who had never accessed OUD treatment. Also, although study epidemiologists were assigned to 4 geographically different county behavioral health board areas, findings of this study may not be wholly generalizable to all county behavioral health board areas within the state. Moreover, since the proportion of clients who identified as White was considerably higher than the Ohio general population, the limited racial diversity of the sample may not fully capture the experiences, feelings, and beliefs of the state's diverse populations. Lastly, due to the nature of focus groups, it was possible that some participants may have selectively reported attitudes and beliefs that were perceived as socially desirable. To reduce social desirability bias, all participants were assured that all information shared/gathered was strictly confidential. Moreover, during recruitment, and again during the consent process, all potential par-

Table 8. Identified Types of Services Needed and Barriers to OUD Treatment

Services needed
Detox in jail
Detox in the community
Employment services
GED classes
Housing assistance
Inpatient treatment
Life skills training
Medical services
Mental health services
Parenting classes
Transitional housing/sober living
Transitional support/aftercare
Transportation
Trauma-informed care
Wraparound services

Barriers to OUD treatment
Fear of going to jail due to outstanding warrants
Lack of awareness of treatment options
Lack of family support/family enabling drug use
Lack of financial support/insurance
Lack of readiness (person with OUD not ready for treatment/to give up drug use)
Lack of transportation/no public transportation
No detox in the community
Not enough staff to deliver/expand treatment services
Poor attitudes of some providers/past negative experiences with treatment
Shortage of doctors who specialize in addiction/MAT
Stigma
Strict guidelines/cumbersome processes to enrolling in treatment
Strict program rules (no absence policy)
Treatment is time consuming (difficult to manage with work/childcare responsibilities)
Wait lists/too few treatment facilities/beds (no treatment on demand)

ticipants and those who decided to decline participation, as well as participating and nonparticipating programs/agencies/ organizations, were assured that they, as well as the locations where focus groups were conducted, would not be named in any report or publication.

PUBLIC HEALTH IMPLICATIONS

While study findings did not support the hypothesis that STR grant funding would have a positive effect over time in reducing stigma, we support additional research of community efforts to reduce stigma as public health policymakers need to better understand how local and regional efforts should be modified to best provide prevention, treatment, and recovery supports to persons affected by OUD. Specifically, a better understanding of how STR funding has impacted stigma related to OUD could provide evidence that further funds in this area would likely yield additional benefits. This is especially important since states often cited stigma related to MAT as a barrier to spending their STR grant dollars.[13] Furthermore, since all participant types reported that messaging about the opioid epidemic is overwhelmingly negative and often assigns stigmatizing labels to persons living with OUD, public health practitioners should utilize the preferred community messaging discussed in this study to positively influence social norms related to opioid addiction and recovery. Stigma related to SUD has been previously cited as a reason for why there is not more available funding for addiction issues broadly.[21] Therefore, amending messaging about the opioid epidemic to express hope might make it more feasible to either initiate or expand access to the needed services identified in this study.

Conclusion

This targeted response initiative met its objectives of generating data to aid in assessing Ohio's response to the 21st Century Cures Act to address the opioid crisis. Since the disbursement of STR grant dollars to communities to the conclusion of this study, many observations were recorded to indicate that STR grant-funded services had a positive effect. Although a direct causal relationship between STR grant-funded services and improved community responses to the opioid crisis cannot be stated, it can be reasonably inferred from this study's key findings, which were based on the perceptions of several hundred community stakeholders, that these services likely made a positive impact. And, while the duration of this study was perhaps too short to realistically change stigma related to OUD, the data generated through this study have the potential to inform/refine public health strategies to reduce stigma and enhance treatment services.

ACKNOWLEDGMENTS

REFERENCES

1. Winstanley EL, Gay J, Roberts L, et al. Prescription drug abuse as a public health problem in Ohio: A case report. *Public Health Nurs.* 2012;29(6):553-562.
https://doi.org/10.1111/j.1525-1446.2012.01043.x

2. Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in drug and opioid overdose deaths—United States, 2000–2014. *MMWR Morb Mortal Wkly Rep.* 2016;64(50-51):1378-1382.
https://doi.org/10.15585/mmwr.mm6450a3

3. Penm J, MacKinnon NJ, Boone JM, Ciaccia A, McNamee C, Winstanley EL. Strategies and policies to address the opioid epidemic: A case study of Ohio. *J Am Pharm Assoc.* 2017;57(2):S148-S153.
https://doi.org/10.1016/j.japh.2017.01.001

4. Substance Abuse and Mental Health Services Administration. *National Survey on Drug Use and Health, 2018 and 2019.* Rockville, MD: Center for Behavioral Health Statistics and Quality; 2021.
https://www.samhsa.gov/data/nsduh/state-reports-NSDUH-2019

5. Ohio Department of Health. *2019 Ohio Drug Overdose Data: General Findings.* Columbus, OH: Ohio Department of Health; 2020.
https://odh.ohio.gov/wps/wcm/connect/gov/0a7bdcd9-b8d5-4193-a1af-e711 be4ef541/2019_OhioDrugOverdoseReport_Final_11.06.20.pdf?MOD=AJPERES& CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_M1HGGIK0N0JO00QO9 DDDDM3000-0a7bdcd9-b8d5-4193-a1af-e711be4ef541-nmv3qSt

6. US Food and Drug Administration. *21st Century Cures Act.* Silver Spring, MD: US Food and Drug Administration; 2018.
https://www.fda.gov/regulatory-information/selected-amendments-fdc-act/21st-century-cures-act

7. Substance Abuse and Mental Health Services Administration. State Targeted Response to the Opioid Crisis Grants: FOA No. TI-17-014; 2016.
https://www.samhsa.gov/grants/grant-announcements/ti-17-014

8. Siegal HA, Carlson RG, Kenne DR, Starr S, Stephens RC. The Ohio Substance Abuse Monitoring Network: Constructing and operating a statewide epidemiologic intelligence system. *Am J Public Health.* 2000;90 (12):1835–1837.
https://doi.org/10.2105/ajph.90.12.1835

9. US Department of Health and Human Services. *States' Use of Grant Funding for a Targeted Response to the Opioid Crisis.* Washington, DC: US Department of Health and Human Services; 2020.
https://oig.hhs.gov/oei/reports/oei-BL-18-00460.pdf

10. High PM, Marks K, Robbins V et al. State targeted response to the opioid crisis grants (opioid STR) program: Preliminary findings from two case studies and the national cross-site evaluation. *J Subst Abuse Treat.*

2020;108:48-54.
https://doi.org/10.1016/j.jsat.2019.06.008

11. Watson DP, Brucker K, McGuire A, et al. Replication of an emergency department-based recovery coaching intervention and pilot testing of pragmatic trial protocols within the context of Indiana's opioid state targeted response plan. *J Subst Abuse Treat.* 2020;108:88-94.
https://doi.org/10.1016/j.jsat.2019.06.002

12. Ohio Department of Mental Health and Addiction Services. *21st Century Cures Act: Fact Sheet.* Columbus, OH: Ohio Department of Mental Health and Addiction Services; 2017.
https://mha.ohio.gov/static/Portals/0/assets/AboutUs/
GrantsFunding/FederalFunding/CuresAct/Cures-Ohio-Fact-Sheet.pdf

13. Patton M. *Qualitative Evaluation and Research Methods.* Beverly Hills, CA: Sage; 1990.

14. Luoma JB, O'Hair AK, Kohlenberg BS, Hayes SC, Fletcher L. The development and psychometric properties of a new measure of perceived stigma toward substance users. *Subst Use Misuse.* 2010;45(1–2):47–57.
https://doi.org/10.3109/10826080902864712

15. Cho JY, Lee E. Reducing confusion about grounded theory and qualitative content analysis: Similarities and differences. *Qual Rep.* 2014;19(32):1–20.
https://doi.org/10.46743/2160-3715/2014.1028

16. Crapanzano K, Vath RJ, Fisher D. Reducing stigma towards substance users through an educational intervention: harder than it looks. *Acad Psychiatry.* 2014;38(4):420-425.
https://doi.org/10.1007/s40596-014-0067-1

17. Livingston JD, Milne T, Fang ML, Amari E. The effectiveness of interventions for reducing stigma related to substance use disorders: A systematic review. *Addiction.* 2012;107(1):39-50.
https://doi.org/10.1111/j.1360-0443.2011.03601.x

18. Daley DC. Family and social aspects of substance use disorders and treatment. *J Food Drug Anal.* 2013;21(4):S73-S76.
https://doi.org/10.1016/j.jfda.2013.09.038

19. McGinty E, Pescosolido B, Kennedy-Hendricks A, Barry CL. Communication strategies to counter stigma and improve mental illness and substance use disorder policy. *Psychiatr Serv.* 2018;69(2):136-146.
https://doi.org/10.1176/appi.ps.201700076

20. McGinty EE, Goldman HH, Pescosolido B, Barry CL. Portraying mental illness and drug addiction as treatable health conditions: Effects of a randomized experiment on stigma and discrimination. *Soc Sci Med.* 2015;126:73-85.
https://doi.org/10.1016/j.socscimed.2014.12.010

21. Knopf A. What does $8 billion for coronavirus say about opioid funding? *Alcohol Drug Abuse Wkly.* 2020;32(11):5-6.
https://doi.org/10.1002/adaw.32658

ERRATUM

2/1/2023: Corrected text visibility on tables

APPENDIX.

Client Focus Group Questions

Opioid Messaging

1. What is the most consistent message you hear about opioids/heroin?

2. What messaging about opioids/heroin would you want people in your community to hear? (If you were to reframe the messages, what would they say?)

Current Community Approaches

3. What are your community's approaches to combating the opioid crisis?

    a. How well is your community responding to these approaches on a scale from 1 to 7, where 1 is 'not well at all' and 7 is 'extremely well?' Please explain.

    b. What changes have you noticed in your community as a result of these approaches?

Treatment Needs

4. How great do you think the need is for additional treatment services in your community on a scale from 1 to 7, where 1 is 'not needed at all' and 7 is 'needed a great deal?' Please explain.

5. How well do you think current treatment services address the needs of populations at risk on a scale from 1 to 7, where 1 is 'not well at all' and 7 is 'extremely well?' Please explain.

Your Community's Treatment System

6. How satisfied are you with the information that is available on the range of treatment services in your community on a scale from 1 to 7, where 1 is 'completely dissatisfied' and 7 is 'completely satisfied?' Please explain.

7. How did you hear about this program/agency/organization?

8. Who first suggested that you come here?

9. Why did you come to this program/agency/organization as opposed to somewhere else?

10. Are you under any pressure to come to this program/agency/organization, for example, from the courts, your employer, school, or family?

    a. If yes, please identify source(es) of pressure and why you are being pressured?

11. How satisfied were you with the recommendations for treatment services given the options that were presented to you on a scale of 1 to 7, where 1 is 'completely dissatisfied' to 7 'completely satisfied?' Please explain.

12. What is the ease in which people access treatment services on a scale from 1 to 7, where 1 is 'very difficult/felt I could not access treatment' and 7 is 'very easy/I had no trouble accessing treatment at all?' Please explain.

13. In your opinion, what can be done to make accessing treatment services easier?

14. Please describe the way in which you accessed treatment services. What, if any, were the barriers you encountered when trying to access services?

15. Did you receive the kind of services you needed? Please explain.

16. Were the services you received the right approach for helping you? Please explain.

17. Was there any type of service that you felt you needed from the program/agency/ organization but had not received?

    a. If yes, what?

18. If a friend or loved one were in need of similar help, would you recommend the same services? Please explain.

19. Please describe your level of satisfaction with the services/care you have received on a scale from 1 to 7, where 1 is 'completely dissatisfied' and 7 is 'extremely satisfied.' Please explain.

Coordination of Care

20. If you received treatment services from more than one program/agency/organization (eg, assessment at one agency with treatment referral to another agency), how satisfied are you with the way that different programs/agencies/organizations exchanged treatment information about you on a scale of 1 (completely dissatisfied) and 10 (completely satisfied)? Please explain.

If participant received treatment services from more than one program/agency/organization, please ask the following two questions (numbers 21 and 22). If not, skip to number 23.

21. How satisfied are you with the information that each program/agency/organization provided to you about the other's treatment services on a scale of 1 (completely dissatisfied) and 7 (completely satisfied)? Please explain.

22. How satisfied are you with the way the treatment staff of the different programs/agencies/organizations worked together to help you with your problems on a scale of 1 (completely dissatisfied) and 7 (completely satisfied)? Please explain.

23. In your opinion, how well do treatment programs/agencies/organizations in your community work together, on a scale from 1 to 7, where 1 is 'they don't seem to work together at all' and 7 is 'they work together completely?' Please explain.

24. In your opinion, why do some people drop out of treatment?

25. How smoothly do medical services (eg, family doctor, MAT prescriber) and addiction treatment services (eg, this program) work together on a scale from 1 to 7, where 1 is 'they don't seem to work together at all' and 7 is 'they work together completely?' Please explain.

26. What roles do family members play in a person's treatment?

27. What roles have your family members played in your treatment?

Closing Question

28. Are there any other thoughts or ideas that you would like to share?

<div align="center">Family Member Focus Group Questions</div>

Opioid Messaging

1. What is the most consistent message you hear about opioids/heroin?

2. What messaging about opioids/heroin would you want people in your community to hear? (If you were to reframe the messages, what would they say?)

Current Community Approaches

3. What are your community's approaches to combating the opioid crisis?

   a. How well is your community responding to these approaches, on a scale from 1 to 7, where 1 is 'not well at all' and 7' is 'extremely well?' Please explain.

   b. What changes have you noticed in your community as a result of these approaches?

Treatment Needs

4. How great do you think the need is for additional treatment services in your community on a scale from 1 to 7, where 1 is 'not needed at all' and 7 is 'needed a great deal?' Please explain.

5. How well do you think current treatment services address the needs of populations at risk on a scale from 1 to 7, where 1 is 'not well at all' and 7 is 'extremely well?' Please explain.

6. What is the ease in which people access treatment services in your community on a scale from 1 to 7, where 1 is 'very difficult/cannot access treatment' and 7 is 'very easy/no trouble accessing treatment at all?' Please explain.

   a. In your opinion, what can be done to make accessing treatment services easier?

Your Community's Treatment System

7. Did your loved one receive the kind of services you think he/she needed? Please explain.

8. Were the services your loved one received the right approach for helping him/her? Please explain.

9. If a friend or another loved one were in need of similar help, would you recommend the same services? Please explain.

10. Please describe your level of satisfaction with the treatment services your loved one has received on a scale of 1 to 7, where 1 is 'completely dissatisfied' to 7 is 'completely satisfied.' Please explain.

Coordination of Care

11. In your opinion, how well do treatment programs/agencies/organizations in your community work together on a scale from 1 to 7, where 1 is 'they don't seem to work together at all' and 7 is 'they work together completely?' Please explain.

12. What is the relationship between medical services (eg, family doctor, MAT prescriber) and addiction treatment services (eg, this program)?

13. What roles do family members play in a loved one's treatment?

14. What role do you play in your loved one's treatment?

Closing Questions

15. Have you participated in any trainings/classes/conferences related to treating/preventing opioid use disorder?

   a. If yes, what, when and where? Please describe.

16. Are there any other thoughts or ideas that you would like to share?

<div align="center">Community Professional Focus Group Questions</div>

Opiate Messaging

1. What is the most consistent message you hear about opiates/heroin?

2. What messaging about opiates/heroin would you want people in your community to hear? (If you were to reframe the messages, what would they say?)

Current Community Approaches

3. What are your community's approaches to combating the opiate crisis?

   a. How well is your community responding to these approaches on a scale from 1 to 7, where 1 is 'not well at all' and 7 is 'extremely well?' Please explain.

   b. What changes have you noticed in your community as a result of these approaches?

Treatment Needs

4. How great do you think the need is for additional treatment services in your community on a scale from 1 to 7, where 1 is 'not needed at all' and 7 is 'needed a great deal?' Please explain.

5. How well do you think current treatment services address the needs of populations at risk on a scale from 1 to 7, where 1 is 'not well at all' and 7 is 'extremely well?' Please explain.

6. How easy or difficult do you think it is for people to access treatment services in your community on a scale from 1 to 7, where 1 is 'very difficult/cannot access treatment' and 7 is 'very easy/no trouble accessing treatment at all?' Please explain.

   a. In your opinion, what can be done to make accessing treatment services easier?

7. In your opinion, why do some people drop out of treatment?

Your Community's Treatment System

8. Do you view your program/agency/organization as part of a community treatment system?

   a. If yes, how would you describe your program/agency/organization's role in your community's current treatment system?

9.   Please identify other stakeholders and their roles in your community's treatment system.

10. By your estimate, how many treatment programs/agencies/organizations exist in your community?

11. Are there differences in the types of clients seen at each program/agency/organization? Please explain.

12. Are different treatment programs/agencies/organizations aware of one another?

   a.   If yes, please describe the extent of cooperation among participating service providers.

13. In your opinion, how well would you say treatment programs/agencies/organizations in your community work together on a scale from 1 to 7, where 1 is 'they don't seem to work together at all' and 7 is 'they work together completely?' Please explain.

14. How well do you think these stakeholders communicate with each other about clients' needs on a scale from 1 to 7, where 1 is 'not well at all' and 7 is 'extremely well?' Please explain.

15. Is there clarity in boundaries with other health and social services systems? Please explain.

16. How efficiently do you think people move into, through and out of the various help systems, on a scale from 1 to 7, where 1 is 'completely inefficiently' and 7 is 'completely efficiently?' Please explain.

17. Please describe your community treatment system's capacity to respond to change.

18. What are the gaps that you perceive in your community treatment system?

   a.   In your opinion, what could be done to fill these gaps?

Coordination of Care

19. Has your program/agency/organization been successful in linking people with needed treatment services? Please explain answer, describing success(es) and to what/whom do you attribute success(es)?

20. Have you referred clients in the past?

   a.   If yes, why, and where?

   b.   If no, why not?

21. Do you intend to refer clients in the future? Please explain.

22. What criteria are used to determine appropriate client referral?

23. How satisfied are you with the way the treatment staff of different programs/agencies/organizations work together to ensure that persons with opioid use disorder get the help they need on a scale of 1 (completely dissatisfied) and 7 (completely satisfied)? Please explain.

24. How smoothly do medical services (eg, family doctor, MAT prescriber) and addiction treatment services (eg, this program) work together on a scale from 1 to 7, where 1 is 'they don't seem to work together at all' and 7 is 'they work together completely'? Please explain.

25. What roles do family members play in a person's treatment?

Ask questions 26-29 of treatment professionals. Skip to the closing questions for all other community professionals (Question 30).

26. If your program/agency/organization were to close, where would your clients go to receive treatment services?

27. Is your program/agency/organization reaching all those for whom it was intended?

   a. If no, why not?

28. Do the services your program/agency/organization deliver meet the expressed needs of your clients?

   a. If no, why not?

29. In your opinion, are the services offered by your program/agency/organization of good quality? Please explain.

Closing Questions (Ask all professionals)

30. Have you participated in any trainings/classes/conferences related to treating/preventing opioid use disorder?

   a. If yes, what, when and where? Please describe.

31. Are there any other thoughts or ideas that you would like to share?

RESEARCH ARTICLE

Factors Impacting COVID-19 Vaccine Hesitancy and Resistance Among College Students in Northwest Ohio

Mounika Polavarapu[1]; Shipra Singh[1]; Philip J. Welch[2]; Lauren Maziarz[2]; Beanna A. Martinez[1]; Edoseawe Okoduwa[2]; Timothy R. Jordan[1]

[1]School of Population Health, The University of Toledo, Toledo, OH
[2]Department of Public and Allied Health, Bowling Green State University, Bowling Green, OH

Corresponding Author: Mounika Polavarapu, 2801 W. Bancroft Street, Toledo, OH 43606-3390, (419) 530-4958, mounika.polavarapu@utoledo.edu

ABSTRACT

Background: Vaccination is a critical strategy for controlling the transmission of COVID-19 and for returning to normalcy on college campuses; however, vaccine hesitancy and resistance persist as a significant barrier. This study utilized the integrated behavior model (IBM) and the precaution adoption process model (PAPM) to identify factors predictive of COVID-19 vaccine willingness (receptive, hesitant, and resistant) among college students.

Methods: A sample of 1248 students at 2 universities in northwest Ohio were surveyed online in 2021. Stata/SE, version 17 (StataCorp) software was used to conduct stepwise logistic regression to investigate the association of theoretical constructs with vaccine willingness, after controlling for COVID-19 related factors and sociodemographic factors.

Results: Most students (82.5%) were vaccine receptive, 6.9% were vaccine hesitant, and 10.6% were vaccine resistant. Vaccine hesitancy was higher among students aged 18 to 22 years (9.3%), undergraduates (16.5%), and students who identified as Black (13%) or Middle Eastern (14.3%). Lower vaccine hesitance was significantly predicted by IBM constructs of positive attitudes, high self-efficacy, and high salience. Not getting an influenza vaccine in the past 3 years and viewing vaccination as a personal choice were significantly associated with higher vaccine hesitancy. Lower odds of vaccine resistance were predicted by higher subjective norms. Descriptive norms, not getting an influenza vaccine in the past 3 years, agreeing with conspiracies, and viewing vaccination as a personal choice were strongly predictive of higher vaccine resistance.

Conclusion: Identifying the factors that predict vaccine hesitancy and resistance among college students is critical for college administrators, and for those who are designing health communication campaigns, to increase vaccination among this priority population.

Keywords: COVID-19 vaccine; Vaccine hesitancy; Integrated behavior model; College students

INTRODUCTION

Today in the United States (US), there are more COVID-19 vaccines than people willing to receive one.[1] Across the US, mass vaccination sites are closing,[2] a somber acknowledgment that future vaccination efforts will require an individualized and customized approach.[3] As of May 2022, nearly 83% of the total US population had received at least 1 dose of a COVID-19 vaccine.[4] Among adults aged 18 years and over, those in the age range of 18 to 24 years have the lowest vaccination rates with 78.2% receiving at least 1 dose of vaccine, and only 63.6% completing the vaccine series.[4]

Since fall of 2020, the highest incidence of COVID-19 cases are consistently reported among young adults aged 20 to 29 years, accounting for > 20% of all confirmed cases.[4-7] Even though young

adults have a lower risk of developing severe symptoms and complications due to COVID-19, they can be super spreaders to their families and social networks, especially among those who are unvaccinated.[8,9] Almost 20 million students are enrolled in institutions of higher education annually, comprising 40% of the US population aged 18 to 24 years.[10,11] College campuses across the nation reported an increased incidence of COVID-19 infection rates throughout the 2020-2021 academic year.[12] During August 2020, counties with colleges and universities offering remote-instruction reported a 17.9% decline in mean COVID-19 incidence versus those counties with institutions offering in-person instruction, which reported a 56.2% increase in COVID-19 incidence.[13]

Variants of SARS-CoV-2, the virus that causes COVID-19, are expected to continue to emerge, and vaccination is a critical strategy for controlling the transmission of COVID-19.[14] Vaccination is also an important approach for returning to normalcy on college campuses, yet estimates show that 25% to 40% of American adults remain hesitant to get vaccinated or have decided not to do so.[15-18] The World Health Organization (WHO) defines vaccine hesitancy as a "delay in acceptance or refusal of vaccination despite the availability of vaccination services."[19] Reasons for vaccine hesitancy include the novelty of COVID-19, rapid speed of vaccine development and approval that instilled concerns about safety and efficacy, beliefs in conspiracy theories and misconceptions, religious beliefs, and political dogmas.[17,18,20]

Theoretical Framework

We utilized the integrated behavioral model (IBM) and precaution adoption process model (PAPM) as the primary framework for our study. The IBM draws on the concepts from several pertinent theories, which have been combined in the literature to obtain a holistic perspective about beliefs and intentions of individuals toward a health behavior, including COVID-19 vaccine hesitancy.[21-24]

According to the IBM, a person's behavioral intention to perform a specific behavior is the primary determinant of behavior.[25] Behavioral intention is shaped by 3 main construct categories: attitude (experiential and instrumental), perceived norm (subjective and descriptive), and personal agency (perceived behavioral control and self-efficacy). There are also 4 factors outside the model that influence behavior directly: knowledge and skills to perform the behavior, salience of the behavior, environmental constraints, and habit.

The PAPM explains how people decide to take preventive action.[26,27] The PAPM identifies 7 stages of readiness to adopt a new preventive or precautionary behavior: (1) being unaware of the issue, (2) unengaged by the issue, (3) undecided, (4) thought about it and decided not to act, (5) decided to act, (6) acting, and (7) maintenance.[28] These stages were used to assess the primary construct of "behavioral intention" within the IBM model. The PAPM model has been used in the literature to understand vaccine intentions, specifically human papillomavirus (HPV) vaccines.[29,30]

The aim of the current study was to assess the role of theoretical constructs and other relevant factors that best predicted college students' decision-making regarding receiving COVID-19 vaccination.

METHODS

Study Design, Participants, and Sampling

During the spring semester of 2021, a nonexperimental, cross-sectional study was conducted among college students aged 18 years and over who were enrolled at 2 relatively similar sized public universities in northwest Ohio. Sample size estimates were calculated separately for each institution for adequate external validity (95% confidence interval, 5% margin of error, 50% response distribution, and projected response rate of 20%); N = 7190. Despite the random selection of 7190 students, the low expected and actual response rates reflected a convenience sample included in the study.

Survey Instrument and Pilot Testing

A newer survey instrument (Appendix) was developed because, at the time of data collection, there was a paucity of IBM-based validated tools that elucidated the decision-making process of college students regarding COVID-19 vaccination. Furthermore, the existing tools did not capture the additional COVID-19 related variables which appear in our instrument. The survey instrument was built using Qualtrics online survey software. Face validity of the instrument was established via a comprehensive review of the published literature, and content validity was established by having the survey reviewed by 4 external experts. To establish stability reliability, the survey instrument was pilot-tested prior to its launch with a convenience sample of 11 matched-pair responses, each survey taken 10 days apart. The intraclass correlation coefficients ranged from .57-.92 for all scales. Using the final results of the survey, the Cronbach α values ranged from .49-.92 for the scales. Construct validity of the theoretical subscales was assessed by conducting post hoc exploratory factor analysis using a maximum likelihood estimation method with a varimax rotation.

Measures

The survey instrument included variables based on the IBM constructs, PAPM stages of readiness, COVID-19 related variables, and sociodemographic factors.

Dependent Variable

The dependent variable was "vaccination willingness." We used the responses of the PAPM item to create this categorical variable with 3 groups: (1) Vaccine receptive—those who already got the vaccine, decided to get the vaccine as soon as it was available to them, or were in the process of making their vaccination appointment. (2) Vaccine hesitant—those who were undecided about getting the vaccine. (3) Vaccine resistant—those who had decided not to get the COVID-19 vaccine. At the time of data collection,

vaccines were made available free of cost to all adults above 18 years of age, and no vaccine mandates were in place. Hence, the likelihood of respondents who obtained vaccines due to workplace or school mandates was very unlikely, thereby minimizing the chances of misclassification bias.

Integrated Behavior Model Independent Variables

Attitudes

Seven items assessed how favorable or unfavorable students' instrumental and experiential attitudes were toward the COVID-19 vaccine. The responses ranged on a 5-point Likert scale from "least favorable" to "most favorable."

Perceived Social Norms

Descriptive norms were assessed in 2 ways. First, a single item measured if most people would approve/disapprove of the respondent getting vaccinated. Responses ranged on a 5-point Likert scale from "strongly agree" to "strongly disagree." Second, an 8-item scale measured the likelihood of individuals in the student's social network getting the COVID-19 vaccine. The responses ranged on a 5-point Likert scale from "very unlikely" to "very likely," in addition to "not applicable." Subjective norm was measured with an 8-item scale that assessed the perceived influence of others regarding obtaining the vaccine. The 4-point Likert scale ranged from "not influential at all" to "very influential," in addition to "not applicable."

Personal Agency

This 8-item scale assessed students' level of confidence to perform actions related to getting a COVID-19 vaccine. Responses ranged on a 4-point Likert scale from "not confident at all" to "very confident." Perceived behavioral control was a single item that assessed students' perceived control of getting a COVID-19 vaccine. The 5-point Likert scale ranged from "not under my control" to "completely under my control."

Independent Variables Outside the Integrated Behavioral Model

Salience

Three items measured students' perceived importance of getting the COVID-19 vaccine with a 4-point Likert scale ranging from "not important at all" to "very important."

Knowledge

Three items assessed knowledge related to COVID-19 infection. Five items assessed knowledge pertaining to COVID-19 vaccines. Items were marked as true/false.

Environmental Constraints

Twelve items measured potential environmental conditions that made it easier or more difficult to getting vaccinated. Responses ranged on a 5-point Likert scale from "very easy" to "very difficult."

Habit of Getting Influenza Vaccine

This item assessed influenza vaccination in the past 3 years with response options as "once every year," "2 times in the past 3 years," "1 time in the past 3 years," "did not get the influenza vaccine at all in the past 3 years," and "unsure."

Other Independent Variables

COVID-19 Related Variables

These items included COVID-19 infection history (history of testing positive, getting hospitalized, or know someone who died); COVID-19 related health behaviors (6 items assessing adherence to Centers for Disease Control and Prevention [CDC] recommendations); conspiracy thinking (9 items such as media is creating unnecessary fear, the US government is trying to control the population, pharmaceutical companies hid information about vaccines, etc); political affiliation (political leaning as "Republican," "Democrat," "Independent," "don't know," or "no preference"); perceptions about COVID-19 pandemic (worst of the pandemic was "behind us," "happening currently," or "still to come"); and perceptions about COVID-19 vaccination (it is "a personal choice," "everyone's responsibility," "both," "neither," or "unsure").

Sociodemographic Factors and Health Status

These items included age, gender, race, ethnicity, rank in college, international student status (domestic versus international), living arrangements (residing alone versus with others), physical and mental health, (ranging on a 5-point Likert scale from "excellent" to "very poor") and health care utilization in the past 12 months (response options were yes/no/unsure).

Data Collection

Following institutional review board approval of a reciprocal application (#300897) between the 2 institutions, data collection was completed between March and April 2021 using an anonymous Qualtrics survey link sent to student emails. Electronic informed consent was obtained from students prior to accessing the survey. At the end of the survey, students were offered an opportunity to enter a random drawing for 1 of 50 Amazon gift cards.

Data Analysis

Data analyses were performed using Stata/SE, version 17 (StataCorp). Descriptive statistics were used to characterize the survey respondents using frequencies and percentages for categorical variables. Chi-square tests were used to determine if there were statistically significant differences in the proportions of respondents in the 3 outcome groups (vaccine resistant, vaccine hesitant, and vaccine receptive) across the independent variables.

First, we used a multivariable, logistic regression model to identify the factors predictive of vaccine hesitancy compared to those who were vaccine receptive. The initial step of developing this model included a stepwise logistic regression model using the theoretical

constructs, with a cutoff p value of < .05 for retention. The retained variables were included in the final multivariable logistic regression model that compared vaccine hesitant to vaccine receptive students while controlling for variables related to conspiracy type thinking, influenza vaccination habit, political party, COVID-19 health behaviors, and perceptions about the COVID-19 pandemic and vaccination. Finally, using the same method, we developed another multivariable logistic regression model to identify the factors predictive of vaccine resistance compared to students in the other 2 groups (ie, vaccine hesitant and vaccine receptive).

RESULTS

A total of 7190 students were invited to complete the survey, resulting in 1471 responses. Survey responses were eliminated when they were partially complete (n = 211), from students medically ineligible to receive the COVID-19 vaccine (n = 10), and from students less than 18 years of age (n = 2). The final data set consisted of 1248 completed surveys and a final response rate of 18%.

Participants were predominantly non-Hispanic (95.4%), White (82.4%), and female (69.0%). Table 1 displays additional demographic characteristics broken down by the 3 levels of willingness to obtain the COVID-19 vaccine (ie, resistant, hesitant, or recep-

tive). In our sample, 10.6% of respondents were classified as vaccine resistant, 6.9% as vaccine hesitant, and 82.5% as vaccine receptive. Students aged 18 to 22 years were statistically significantly more vaccine resistant and vaccine hesitant than other students. Undergraduate students reported more than twice as much vaccine resistance (16.5% versus 5.9%) and vaccine hesitancy (9.6% versus 4.8%) than graduate students. Among all racial groups, Black (13%) and Middle Eastern (14.3%) students reported higher vaccine hesitancy. Vaccine resistance was almost twice as high among those living with others when compared with students living alone (11.6% versus 6.4%).

The proportion of vaccine receptive students was reported to be higher among those who had COVID-19 infection (73.7%), knew someone who tested positive (83.9%), and knew someone who was hospitalized (84.6%). Moreover, 1 in 5 students reported knowing someone who had died of COVID-19, and those who did not know someone who died of COVID-19 were almost 2 times more likely to be vaccine resistant than those students who did (11.4% versus 6.9%).

Students who received at least 1 influenza vaccine in the past 3 years were significantly more vaccine receptive than those who reported not getting an influenza vaccine in the past 3 years (87.8% versus 63.8%; $\chi^2 = 140.07$, $df = 8$, p < .01). In addition,

Table 1. Participant Demographic Characteristics by COVID-19 Vaccination Willingness

Characteristic		COVID-19 Vaccination Willingness			
		Resistant *n* (%)	Hesitant *n* (%)	Receptive *n* (%)	Total *n* (%)
Sex					
	Female	87 (10.1)	54 (6.3)	717 (83.6)	858 (69.0)
	Male	44 (11.5)	32 (8.3)	308 (80.2)	384 (31.0)
Race**					
	White	118 (11.5)	67 (6.5)	843 (82.0)	1028 (82.4)
	Asian	3 (2.9)	8 (7.6)	94 (89.5)	105 (8.4)
	Black	2 (4.4)	6 (13.0)	38 (82.6)	46 (3.7)
	Multiracial	3 (10.0)	1 (3.3)	26 (86.7)	30 (2.4)
	Middle Eastern/North African	0 (0.0)	3 (14.3)	18 (85.7)	21 (1.7)
	Other	6 (33.3)	1 (5.6)	11 (61.1)	18 (1.4)
Ethnicity					
	Non-Hispanic	125 (10.5)	83 (7.0)	983 (82.5)	1191 (95.4)
	Hispanic	7 (12.3)	3 (5.3)	47 (82.5)	57 (4.6)
Age in years***					
	18-22	79 (15.0)	49 (9.3)	400 (75.8)	528 (44.9)
	23-27	19 (5.4)	24 (6.8)	308 (87.8)	351 (29.2)
	28+	29 (9.0)	12 (3.7)	283 (87.4)	324 (26.9)
College level***					
	Undergraduate	91 (16.5)	53 (9.6)	408 (73.9)	552 (44.7)
	Graduate	40 (5.9)	33 (4.8)	611 (89.3)	684 (55.3)
International student status**					
	Domestic	130 (11.5)	76 (6.7)	929 (81.9)	1135 (90.9)
	International	2 (1.8)	10 (8.6)	101 (89.4)	113 (9.1)
Living arrangement*					
	Living with others	116 (11.6)	73 (7.3)	809 (81.1)	998 (80.0)
	Living alone	16 (6.4)	13 (5.2)	221 (88.4)	250 (20.0)

Values may not equal 100% due to rounding or missing responses.
χ^2 tests were not run on any cells with 0 as frequencies or if less than 80% of cells had frequencies > 5.
*p < .05, **p < .01, ***p < .001

students who followed CDC recommended COVID-19 guidelines such as avoiding contact with COVID-19 positive people ($\chi^2 = 152.17$, $df = 8$, p < .01), avoiding indoor shared spaces ($\chi^2 = 225.65$, $df = 8$, p < .01), and utilizing frequent hand washing/hand sanitizers ($\chi^2 = 44.41$, $df = 8$, p < .01) reported statistically significantly greater vaccine receptiveness than those who did not.

Table 2 reports political affiliation, perceptions about the COVID-19 pandemic and vaccination, and conspiracy-type thinking across the 3 levels of willingness (ie, resistant, hesitant, or receptive). Students who self-identified politically as Democrats were more likely to be receptive to vaccination (96.3%) compared with Republicans (53.4%) and Independents (78.7%). Vaccine resistance was markedly higher among students who identified as

Table 2. Political Affiliation, Perception about COVID-19 Pandemic and Vaccination, Conspiracy Thinking by COVID-19 Vaccination Willingness

	COVID-19 Vaccination Willingness		
	Resistant n (%)	Hesitant n (%)	Receptive n (%)
Political affiliation***			
Republican	65 (31.9)	30 (14.7)	109 (53.4)
Democrat	10 (1.6)	13 (2.1)	591 (96.3)
Independent	24 (13.8)	13 (7.5)	137 (78.7)
Don't know	33 (12.9)	30 (11.7)	193 (75.4)
Perception about COVID-19 pandemic***			
Behind us	93 (13.7)	48 (7.1)	539 (79.3)
Happening currently	15 (4.5)	18 (5.4)	302 (90.2)
Still to come	24 (10.3)	20 (8.6)	189 (81.1)
Perception about COVID-19 vaccination***			
Personal choice	120 (39.3)	53 (17.4)	132 (43.3)
Everyone's responsibility	2 (0.4)	4 (0.8)	520 (98.9)
Both	5 (1.3)	24 (6.1)	362 (92.6)
Neither	3 (60.0)	1 (20.0)	1 (20.0)
Conspiracy thinking about COVID-19			
Media created fear ***			
Disagree	11 (2.8)	10 (2.6)	366 (93.4)
Neither disagree nor agree	16 (5.8)	23 (8.3)	239 (86.0)
Agree	105 (18.2)	53 (9.2)	420 (72.7)
Almost all people who get the disease recover from it***			
Disagree	46 (4.4)	46 (4.4)	943 (91.1)
Neither disagree nor agree	43 (32.6)	27 (20.5)	62 (47.0)
Agree	43 (53.1)	13 (16.0)	25 (30.9)
Harm from the disease has been exaggerated***			
Disagree	27 (3.3)	25 (3.0)	776 (93.7)
Neither disagree nor agree	19 (9.7)	32 (16.4)	144 (73.9)
Agree	86 (38.2)	29 (12.9)	110 (48.9)
More people die from influenza than from COVID-19***			
Disagree	33 (5.2)	21 (3.3)	575 (91.4)
Neither disagree nor agree	33 (8.8)	40 (10.6)	304 (80.6)
Agree	66 (27.5)	25 (10.4)	151 (62.9)
Vaccine is more dangerous than getting the disease			
Disagree	37 (3.6)	50 (4.8)	945 (91.6)
Neither disagree nor agree	62 (39.7)	32 (20.5)	62 (39.7)
Agree	33 (55.0)	4 (6.7)	23 (38.3)
Pharmaceutical companies withheld information on vaccine side effects***			
Disagree	27 (3.0)	29 (3.3)	834 (93.7)
Neither disagree nor agree	57 (21.9)	40 (15.4)	163 (62.7)
Agree	48 (49.0)	17 (17.3)	33 (33.7)
Higher power determines my health outcomes***			
Disagree	52 (5.0)	51 (4.9)	944 (90.2)
Neither disagree nor agree	31 (27.2)	26 (22.8)	57 (50.0)
Agree	49 (56.3)	9 (10.3)	29 (33.3)
Vaccination is an attempt to take away my personal freedom***			
Disagree	36 (3.5)	49 (4.8)	940 (91.7)
Neither disagree nor agree	25 (22.9)	29 (26.6)	55 (50.5)
Agree	71 (62.3)	8 (7.0)	35 (30.7)
Government will control the population through vaccination***			
Disagree	34 (3.4)	41 (4.1)	921 (92.5)
Neither disagree nor agree	26 (21.0)	31 (25.0)	67 (54.0)
Agree	72 (56.3)	14 (10.9)	42 (32.8)

*p < .05, **p < .01, ***p < .001

Republican (31.9%) than as Democrat (1.6%) or Independent (13.8%). Students who believed that the worst of the pandemic was behind us were more resistant to vaccination (13.7%) than those who believed the worst of the pandemic is happening currently (4.5%). Those students who believed that getting vaccinated is a social responsibility to others were more than twice as receptive to vaccination (98.9%) than students who believed getting vaccinated is a personal choice (43.3%). Approximately 40% of students who viewed COVID-19 vaccination as a personal choice were vaccine resistant.

Vaccine resistance was also more common among those who believed in misinformation and conspiracy theories. Those who agreed that the potential health risks of COVID-19 had been greatly exaggerated by the media were more likely to be vaccine resistant than students who disagreed with that sentiment (18.2% versus 2.8%). Furthermore, students who believed that the pharmaceutical companies that manufactured the vaccines hid information from the public's view were more likely to be vaccine hesitant than those who disagreed (17.3% versus 3.3%). Students who agreed that the government telling everyone to get vaccinated is a method to control the population were significantly more resistant to vaccination than those who disagreed with that belief (56.3% versus 3.4%). Vaccine resistance was significantly higher among students who agreed that the vaccine is an attempt to take away personal freedom (62.3% versus 3.5%).

Table 3 reports 2 logistic regression models that were conducted to identify and assess independent variables that were predictive of vaccine hesitance and vaccine resistance. Model 1 identified factors that were significantly associated with vaccine hesitancy versus vaccine receptiveness, while adjusting for covariates. As per the IBM, positive instrumental and experiential attitudes (OR 0.79; 95% CI, 0.72-0.86), high self-efficacy to get vaccinated (OR 0.90; 95% CI, 0.84-0.96), and high salience (OR 0.80; 95% CI, 0.68-0.94) predicted lower odds of vaccine hesitancy. Not receiving the influenza vaccine within the past 3 years (OR 4.0; 95% CI, 1.75-9.13) or being unsure (OR 5.22; 95% CI, 1.40-19.43) about receiving it significantly predicted increased COVID-19 vaccine hesitance compared to those who got yearly influenza vaccination. Viewing the COVID-19 vaccine as a personal choice compared to those who saw it as a social responsibility (OR 6.50; 95% CI, 1.81-23.22) was significantly associated with vaccine hesitance. Model 1 discriminated well between vaccine hesitance and vaccine receptiveness with a C statistic of 0.96.

Model 2 predicted factors associated with vaccine resistance versus all other vaccine willingness categories, while adjusting for covariates. As per IBM, subjective norms were significantly predictive of resistance to getting the COVID-19 vaccine. Students who were not influenced by people in their social network regarding the decision to get the COVID-19 vaccine had significantly higher odds of vaccine resistance (OR 0.91; 95% CI, 0.86-0.95). Descriptive norms were also significantly predictive of resistance to get-

ting the COVID-19 vaccine. Students who strongly disagreed with the idea that most people they know approve of them getting a COVID-19 vaccine were almost 5 times as resistant compared with students who strongly agreed with that sentiment (OR 4.69; 95% CI, 1.12-19.74). Students who disagreed or were ambivalent (neither disagree nor agree) that most people approve of them getting a COVID-19 vaccine were 4 times as resistant compared with students who strongly agreed with that view (OR 4.18; 95% CI, 1.40-12.43 and OR 4.52; 95% CI, 1.95-10.50, respectively).

Not obtaining the influenza vaccine for the past 3 years also increased vaccine resistance when compared to those who got yearly influenza vaccination (OR 3.44; 95% CI, 1.67-7.11). Higher conspiracy-type thinking predicted increased resistance to vaccination (OR 1.09; 95% CI, 1.04-1.14). Believing that COVID-19 vaccination is a personal choice and not a social responsibility to others strongly predicted increased resistance to the vaccine (OR 16.12; 95% CI, 3.53-73.57). Overall, model 2 was highly predictive of vaccine resistance with a C statistic of 0.97.

DISCUSSION

Nearly 83% of students in the current study were vaccine receptive, meaning that they had already received the vaccine, were in the process of making an appointment to get it, or were planning to get it as soon as it was available. Only 6.9% were vaccine hesitant and 10.6% were vaccine resistant. Our results were similar to a spring 2021 survey of 1032 college students across the US conducted by College Finance which reported that 87.6% of college students were planning on getting the vaccine, 8.4% were unsure, and 4% were not planning to get it.[31]

As we hypothesized, the IBM constructs of instrumental and experiential attitudes and self-efficacy predicted lower odds of vaccine hesitancy. Conversely, perceived social norms were highly predictive of vaccine resistance. According to IBM instrumental attitudes (cognitive beliefs about the outcomes of getting vaccinated) and experiential attitudes (emotional responses to the thought of getting vaccinated) play a significant role in behavioral intentions.[32] In this situation, students who did not believe in beneficial outcomes of getting vaccinated and/or those who had strong negative, emotional responses to the idea of getting vaccinated (eg, fear of needles or side effects) were more vaccine hesitant and resistant. Prochaska[33] recommends that for a person to move toward action, the advantages of changing must *increase* about twice as much as the disadvantages/cons *decrease*. Therefore, those who design health communication campaigns for the vaccine hesitant should put twice as much emphasis on the benefits of getting vaccinated as on reducing the disadvantages or barriers.

We also found that higher levels of self-efficacy predicted lower vaccine hesitancy. Students with a strong sense of efficacy are more likely to be intrinsically motivated and will exert a high degree of effort to accomplish a goal, even in the midst of resistance or barriers. According to Bandura,[34] all 4 sources of self-efficacy

Table 3. Integrated Behavior Model Constructs and other Key Variables that Predict COVID-19 Vaccine Hesitance and Resistance

Model 1: Vaccine Hesitance[b]	OR (95% CI)
IBM constructs	
Instrumental and experiential attitudes	.79*** (.72-.86)
Personal agency—self-efficacy	.90*** (.84-.96)
Key independent constructs	
Salience	.80** (.68-.94)
Habit of getting influenza vaccine in the last 3 years	
Once every year	Reference
1 time	.89 (.27–2.94)
2 times	1.72 (.55–5.36)
Did not get it	4** (1.74–9.13)
Unsure	5.22* (1.40–19.43)
Other constructs	
COVID-19 related health behaviors	1.12 (1–1.26)
Conspiracy thinking	.97 (.91-1.04)
Perceptions about COVID-19 pandemic	
Behind us	Reference
Happening currently	.73 (.32-1.66)
Still to come	.83 (.36-1.89)
Perceptions about COVID-19 vaccination	
Everyone's responsibility	Reference
Personal choice	6.50** (1.81–23.22)
Both	3.06 (.91–10.26)
Neither	.96 (.00–187.90)
Unsure	2.82 (.43–18.30)
Political affiliation	
Democrat	Reference
Republican	2.87 (.95–8.69)
Independent	1.62 (.56–4.68)
No preference	1.53 (.55–4.24)
Don't know	2.60 (.82-8.28)
Model 2 –Vaccine Resistance[b]	OR (95% CI)
IBM constructs	
Perceived norms—subjective	.91*** (.86-.95)
Perceived norms—descriptive	
Strongly agree	Reference
Agree	1.23 (.53–2.88)
Neither agree nor disagree	4.52*** (1.95–10.50)
Disagree	4.18** (1.40–12.43)
Strongly disagree	4.69* (1.12–19.74)
Key independent constructs	
Knowledge	
Regarding COVID-19 infection	.79 (.56–1.14)
Regarding COVID-19 vaccine	.77 (.59-1.01)
Habit of getting influenza vaccine in the last 3 years	
Once every year	Reference
1 time	2.05 (.81–5.21)
2 times	.44 (.09–2.06)
Did not get it	3.44** (1.67–7.11)
Unsure	1.87 (.53–6.58)
Other constructs	
COVID-19 related health behaviors	.96 (.89–1.04)
Conspiracy thinking	1.09** (1.04–1.14)
Perceptions about COVID-19 pandemic	
Behind us	Reference
Happening currently	.91 (.40–2.07)
Still to come	.86 (.41–1.80)
Perceptions about COVID-19 vaccine responsibility	
Everyone's responsibility	Reference
Personal choice	16.13*** (3.53–73.57)
Both	1.15 (.20–6.75)
Neither	5.88 (.35–99.97)
Unsure	3.80 (.44–32.78)
Political affiliation	
Democrat	Reference
Republican	1.40 (.49–4)
Independent	1.31 (.43–3.97)
No preference	1.57 (.57–4.36)
Don't know	.96 (.25–3.73)

OR = Odds Ratio, CI = confidence interval *p < .05, **p < .01, ***p < .001
[a]Model 1 compares vaccine hesitant students with vaccine resistant students, number of observations = 1073, df = 19, log likelihood = -140.40, R^2=0.50.
[b]Model 2 compares vaccine resistant students with all other students, number of observations = 1243, df = 23, log likelihood = -169.37, R^2=0.59.

should be considered when designing an intervention: (1) mastery experiences (give many opportunities to achieve success), (2) vicarious experience (see peers and hear from peers who were vaccinated), (3) verbal persuasion (give credible, valid information and positive feedback to guide them through the behavior and/or to motivate them to make their best effort), and (4) emotional state (alleviate their fears and reduce anxiety surrounding vaccination).[35]

Considering that we surveyed young adults, who are more typically concerned than older adults about what others think about them, the influence of perceived social norms was not surprising. Students who believed that most people they know would not approve or be ambivalent of them getting a vaccine were much more resistant to getting vaccinated than students with the opposite perceptions of the social norm. In general, people have a greater tendency to behave in accordance with their attitudes when their attitudes are supported by in-group norms.[36] Such results point to the importance of connecting the vaccine hesitant with others who are familiar, well-respected, and who recommend obtaining the vaccine (eg, their primary care providers.) For example, 67% of participants in a recent study reported they would accept a COVID-19 vaccine if it is recommended for them.[37]

Our findings regarding political party affiliation corroborate our results that students are influenced by perceived social norms. For example, students who self-identified as Democrat were much more likely to be receptive to getting vaccinated than Republicans or Independents. Likewise, vaccine resistance was much higher among Republican students than students who identified as Democrat or Independent. Our findings regarding the deep partisan divide in vaccine receptivity are supported by multiple studies. A Monmouth University poll of American adults in April 2021 reported that only 36% of Republicans had received at least 1 shot of the vaccine compared with 67% of Democrats and 47% of Independents. In that same study, 43% of Republicans said they would likely never get the vaccine.[38]

Similar partisan divide exists for vaccine mandates. As of August 2021, a total of 572 colleges and universities required a COVID-19 vaccine of at least some students and/or employees.[39] In a survey of 2000 college students conducted by Inside Higher Ed and College Pulse, 90% of students who self-identified as Democrat supported a vaccine mandate for colleges versus only 37% of students who self-identified as Republican.[40]

Furthermore, students who believed in conspiracies and misinformation and that getting a vaccination is a personal choice instead of a social responsibility to others were more likely to be vaccine hesitant and resistant. Given the widespread exposure to conspiracy theories via social media and the internet, it is an emerging research domain within social psychology.[41] There is a growing need to better understand these beliefs through research, cautiously mitigating the unintended risk of exposure to conspiracy

theories translating into beliefs for a small group of research participants.[42]

The results of our study should be interpreted with potential limitations in mind. First, we tested the stability-reliability of the survey with undergraduate college students in a health-related class. This may have biased our pilot-test results due to the shared career interests of the cohort. Second, our return rate was 18%, that has resulted in a convenience sample, diluting the effect of randomization. The extent to which the return rate is less than 100% threatens the external validity of our findings, limiting the ability to make generalizations beyond the responding students. Third, students were from only 2 public universities in northern Ohio. Thus, the generalizability of our results to all US college students may be limited. Fourth, due to the cross-sectional nature of our study, we cannot infer any causality and we lack the ability to determine whether those who intended to get a vaccine actually received it. Fifth, social desirability bias may have influenced some of the respondents' answers. If that is the case, the percentage of those who are vaccine receptive may have been overstated. However, the strength of our study is the utilization of well-accepted theoretical models as the framework of our research to increase its validity.[25] Lastly, the classification of vaccine willingness is much more complex today than that used in our study because of vaccines mandates and multiple boosters. However, it is a strength of this study that our vaccine willingness groups remained unbiased by these factors, thereby enabling fair prediction of receptiveness, hesitancy, and resistance.

PUBLIC HEALTH IMPLICATIONS

Vaccine hesitancy is an ongoing and constantly evolving concern. Our data were collected before the outbreak of the Delta and Omicron variant, full US Food and Drug Administration (FDA) approval of Pfizer vaccine, and conversations pertaining to booster doses. The methodology described in our study, identifying the key theoretical constructs predictive of vaccine hesitancy, could inform valuable lessons for anticipated emerging and re-emerging infectious diseases. Approaches to prioritize and target such constructs could inform timely interventions to protect campus communities against them.

As college students return to campus, the emergence of the newer COVID-19 variants has become a great concern to college administrators. Continued campaigns on college campuses are necessary to communicate the doubled risk of hospitalization and attendance to emergency care due to the emerging variants among unvaccinated individuals.[43] Emphasis should be placed on vaccination as one of the best methods that protect against existing variants and slows the emergence of newer variants by reducing the spread of infection.[14] The Pfizer vaccine was approved by the FDA on August 23, 2021, and contributed to decreasing vaccine hesitancy as well as improving vaccination rates.[44] According to a survey published in June 2021 by the Kaiser Family Foundation,

30% of the unvaccinated respondents expressed willingness to get the COVID-19 vaccine after it received full FDA approval.[20] However, a subsequent study in 2022 has shown that the increase was moderate and very short-term post approval.[45] This observation has been potentially attributed to the fact that those awaiting approval may have provided a socially desirable response and did not act on their intentions after FDA approval. On the other hand, subsequent multiple vaccine approvals by the FDA resulted in educational and worksite vaccine mandates, even though opposition among the unvaccinated persists, with 92% of them opposed to such mandates.[46] Furthermore, conflicting and uncoordinated announcements from the US White House COVID-19 Response Team, CDC, and WHO before the FDA's approval of the booster doses generated confusion and doubt regarding the benefits and effectiveness of the primary and booster vaccines for COVID-19.[47] Thus, future studies should continually re-examine vaccine hesitancy among college students with the changing scope of the COVID-19 pandemic, vaccine mandates at educational institutions, and the evidence pertaining to long-term efficacy and safety of vaccines.

ACKNOWLEDGMENTS

REFERENCES

1. Mundt D. More vaccine than arms to put it in. *Denison Bulletin & Review*. Published April 13, 2021. Accessed September 7, 2021.
https://dbrnews.com/news/more-vaccine-than-arms-to-put-it-in/article_2f493244-9ca5-11eb-b90b-8ff33f358930.html

2. Stolberg SG. With mass vaccination sites winding down, it's all about the "ground game." *The New York Times*. Published June 22, 2021. Accessed July 7, 2021.
https://www.nytimes.com/2021/06/22/us/politics/mass-vaccination-sites-coronavirus.html

3. Goldstein J. How do you persuade New Yorkers to be vaccinated? Knock on their doors. *The New York Times*. Published May 20, 2021. Accessed May 20, 2021.
https://www.nytimes.com/2021/05/20/nyregion/vaccine-hesitancy-outreach.html

4. Centers for Disease Control and Prevention. COVID data tracker. United States Department of Health & Human Services. Updated May 17, 2022. Accessed May 31, 2022.
https://covid.cdc.gov/covid-data-tracker/#vaccination-trends

5. Boehmer TK, DeVies J, Caruso E, et al. Changing age distribution of the COVID-19 pandemic—United States, May–August 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(39).
https://doi.org/10.15585/mmwr.mm6939e1

6. Lieber D. Delta variant outbreak in Israel infects some vaccinated adults. *Wall Street Journal*. Published June 25, 2021. Accessed September 7, 2021.
https://www.wsj.com/articles/vaccinated-people-account-for-half-of-new-covid-19-delta-cases-in-israeli-outbreak-11624624326

7. Riley S, Wang H, Eales O, et al. REACT-1 round 12 report: resurgence of SARS-CoV-2 infections in England associated with increased frequency of the Delta variant. Imperial College of London. Published June 17, 2021. Accessed August 31, 2020.
https://spiral.imperial.ac.uk/handle/10044/1/89629

8. Kecojevic A, Basch CH, Sullivan M, Chen Y-T, Davi NK. COVID-19 vaccination and intention to vaccinate among a sample of college students in New Jersey. *J Community Health*. 2021;46:1059-1068.
https://doi.org/10.1007/s10900-021-00992-3

9. Bendix A. Young adults are more likely to be COVID-19 superspreaders, new research shows — probably because they aren't staying home. *Business Insider*. Published August 25, 2020. Accessed September 7, 2021.
https://www.businessinsider.com/young-people-coronavirus-superspreaders-outbreaks-college-bars-2020-8

10. Hussar B, Zhang J, Hein S, et al. The condition of education 2020 (NCES 2020-144). Washington, DC: National Center for Education Statistics. Published May 1, 2020. Accessed September 7, 2021.
https://nces.ed.gov/pubs2020/2020144.pdf

11. Lederer AM, Hoban MT, Lipson SK, Zhou S, Eisenberg D. More than inconvenienced: the unique needs of U.S. college students during the COVID-19 pandemic. *Health Educ Behav*. 2020;48(1):14-19.
https://doi.org/10.1177/1090198120969372

12. Lu H, Weintz C, Pace J, Indana D, Linka K, Kuhl E. Are college campuses superspreaders? A data-driven modeling study. *Comput Methods Biomech Biomed Engin*. 2021;24(10):1-11.
https://doi.org/10.1080/10255842.2020.1869221

13. Leidner AJ, Barry V, Bowen VB, et al. Opening of large institutions of higher education and county-level COVID-19 incidence — United States, July 6–September 17, 2020. *MMWR Morb Mortal Wkly Rep*. 2021;70(1):14-19.
https://doi.org/10.15585/mmwr.mm7001a4

14. Centers for Disease Control and Prevention. Coronavirus disease 2019 (COVID-19). National Center for Immunization and Respiratory Diseases. Variants of the virus. Updated August 11, 2021. Accessed September 1, 2021.
https://www.cdc.gov/coronavirus/2019-ncov/variants/

15. Callaghan T, Moghtaderi A, Lueck JA, et al. Correlates and disparities of intention to vaccinate against COVID-19. *Soc Sci Med*. 2021;272 (1982):113-638.
https://doi.org/10.1016/j.socscimed.2020.113638

16. Hamel L, Kearney A, Kirzinger A, Lopes L, Muñana C, Brodie M. KFF health tracking poll – September 2020: Top issues in 2020 election, the role of misinformation, and views on a potential coronavirus vaccine. Kaiser Family Foundation. Published September 10, 2020. Accessed September 7, 2021.
https://www.kff.org/coronavirus-covid-19/report/kff-health-tracking-poll-september-2020/

17. Tyson A, Johnson C, Funk C. U.S. public now divided over whether to get COVID-19 vaccine. Pew Research Center Science & Society. Published September 17, 2020. Accessed July 30, 2021.
https://www.pewresearch.org/science/2020/09/17/u-s-public-now-divided-over-whether-to-get-covid-19-vaccine/

18. Khubchandani J, Sharma S, Price JH, Wiblishauser MJ, Sharma M, Webb FJ. COVID-19 vaccination hesitancy in the United States: a rapid national assessment. *J Community Health*. 2021;46(2):1-8. https://doi.org/10.1007/s10900-020-00958-x

19. MacDonald NE. Vaccine hesitancy: definition, scope and determinants. *Vaccine*. 2015;33(34):4161-4164. https://doi.org/10.1016/j.vaccine.2015.04.036

20. Muñana C, Hamel L, Kirzinger A, Brodie M. KFF COVID-19 vaccine monitor: December 2020. Kaiser Family Foundation. Published December 15, 2020. Accessed September 7, 2021. https://www.kff.org/coronavirus-covid-19/report/kff-covid-19-vaccine-monitor-december-2020

21. Guidry JPD, Laestadius LI, Vraga EK, et al. Willingness to get the COVID-19 vaccine with and without emergency use authorization. *Am J Infect Control*. 2021;49(2):137-142. https://doi.org/10.1016/j.ajic.2020.11.018

22. Shmueli L. Predicting intention to receive COVID-19 vaccine among the general population using the health belief model and the theory of planned behavior model. *BMC Public Health*. 2021;21(1):804. https://doi.org/10.1186/s12889-021-10816-7

23. Koesnoe S, Siddiq TH, Pelupessy DC, et al. Using integrative behavior model to predict COVID-19 vaccination intention among health care workers in Indonesia: a nationwide survey. *Vaccines (Basel)*. 2022;10(5):719. https://doi.org/10.3390/vaccines10050719

24. Romate J, Rajkumar E, Greeshma R. Using the integrative model of behavioural prediction to understand COVID-19 vaccine hesitancy behaviour. *Sci Rep*. 2022;12(1):9344. https://doi.org/10.1038/s41598-022-12466-0

25. Montano, DE, Kasprzyk D. Theory of Reasonsed Action, Theory of Planned Behavior, and the Integrated Behavior Model. In: Glanz K, Rimer B, Viswanath K. Eds. *Health Behavior: Theory, Research, and Practice*. 5th ed. New York, NY: John Wiley & Sons; 2015.

26. Weinstein ND. The precaution adoption process. *Health Psychol*. 1988;7(4):355-386. https://doi.org/10.1037/0278-6133.7.4.355

27. Weinstein ND, Sandman PM, Blalock SJ. The Precaution Adoption Process Model. In: Sweeny K, Robbins ML, Cohen LM. Eds. *The Wiley Encyclopedia of Health Psychology*. Published online September 2, 2020:495-506. https://doi.org/10.1002/9781119057840.ch100

28. Weinstein ND, Sandman PM. A model of the precaution adoption process: evidence from home radon testing. *Health Psychol*. 1992;11(3):170-180. https://doi.org/10.1037/0278-6133.11.3.170

29. Tatar O, Shapiro GK, Perez S, Wade K, Rosberger Z. Using the precaution adoption process model to clarify human papillomavirus vaccine hesitancy in Canadian parents of girls and parents of boys. *Hum Vaccin Immunother*. 2019;15(7-8):1803-1814. https://doi.org/10.1080/21645515.2019.1575711

30. Barnard M, George P, Perryman ML, Wolff LA. Human papillomavirus (HPV) vaccine knowledge, attitudes, and uptake in college students: implications from the Precaution Adoption Process Model. *PLoS One*. 2017;12(8):e0182266. https://doi.org/10.1371/journal.pone.0182266

31. Pilgrim K. College students on the COVID-19 vaccines. *College Finance*. Published April 21, 2021. Accessed August 31, 2021. https://collegefinance.com/covid-19/college-students-on-the-covid-19-vaccine

32. Ajzen I, Fishbein M. The influence of attitudes on behavior. In: Albarracin D, Johnson BT, Zanna MP, eds. *The Handbook of Attitudes*. Mahwah, NJ: Lawrence Erlbaum Associates; 2005:173-221.

33. Prochaska JO. Decision making in the transtheoretical model of behavior hange. *Med Decis Making*. 2008;28(6):845-849. https://doi.org/10.1177/0272989X08327068

34. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev*. 1977;84(2):191-215. https://doi.org/10.1037/0033-295x.84.2.191

35. Margolis H, Mccabe PP. Improving self-efficacy and motivation. *Interv Sch Clin*. 2006;41(4):218-227. https://doi.org/10.1177/10534512060410040401

36. Park HS, Smith SW. Distinctiveness and influence of subjective norms, personal descriptive and injunctive norms, and societal descriptive and injunctive norms on behavioral intent: a case of two behaviors critical to organ donation. *Hum Commun Res*. 2007;33(2):194-218. https://doi.org/10.1111/j.1468-2958.2007.00296.x

37. Malik AA, McFadden SM, Elharake J, Omer SB. Determinants of COVID-19 vaccine acceptance in the US. *EClinicalMedicine*. 2020;26:100495. https://doi.org/10.1016/j.eclinm.2020.100495

38. Monmouth University Polling Institute. One in five still shun vaccine. Monmouth University. Published April 14, 2021. Accessed August 1, 2021. https://www.monmouth.edu/polling-institute/reports/monmouthpoll_US_041421/

39. Thomason A, O'Leary B. Here's a list of colleges that require students or employees to be vaccinated against Covid-19. The Chronicle of Higher Education. Published September 7, 2021. Accessed September 7, 2021. https://www.chronicle.com/blogs/live-coronavirus-updates/heres-a-list-of-colleges-that-will-require-students-to-be-vaccinated-against-covid-19

40. Schaffer R. Most college students support vaccine mandate for a return to campus, but a strong partisan divide exists. *Businesswire*. Published June 8, 2021. Accessed September 7, 2021. https://www.businesswire.com/news/hk-en/20210608005441/en/Survey-Most-College-Students-Support-Vaccine-Mandate-for-a-Return-to-Campus-but-a-Strong-Partisan-Divide-Exists

41. van Prooijen JW, Douglas KM. Belief in conspiracy theories: Basic principles of an emerging research domain. *Eur J Soc Psychol*. 2018;48(7):897-908. https://doi.org/10.1002/ejsp.2530

42. Balafoutas L, Libman A, Selamis V, Vollan B. Exposure to conspiracy theories in the lab. *Econ Polit Stud*. 2021;9(1):90-112. https://doi.org/10.1080/20954816.2020.1818930

43. Twohig KA, Nyberg T, Zaidi A, et al. Hospital admission and emergency care attendance risk for SARS-CoV-2 delta (B.1.617.2) compared with alpha (B.1.1.7) variants of concern: a cohort study. *Lancet Infect Dis*. 2020;22(1): P35-42. https://doi.org/10.1016/S1473-3099(21)00475-8

44. Gravely, A. FDA Paves Way for College Vaccine Mandates. Published August 24, 2021. Accessed September 7, 2021.

https://www.insidehighered.com/news/2021/08/24/more-colleges-expected-mandate-vaccines-following-pfizer-fda-approval

45. Scherer AM, Parker AM, Gidengil CA, et al. COVID-19 Vaccine uptake and intentions following US Food and Drug Administration approval of the Pfizer-BioNTech COVID-19 vaccine. *JAMA Intern Med*. 2022;182 (6):678-680.
https://doi.org/10.1001/jamainternmed.2022.0761

46. Nadworny E, Dey S. Full FDA approval triggers more universities to require the COVID-19 vaccine. Oklahoma State University. Published September 1, 2021. Accessed September 7, 2021.
https://www.kosu.org/education/2021-09-01/full-fda-approval-triggers-more-universities-to-require-the-covid-19-vaccine

47. Centers for Disease Control and Prevention. Rapid COVID-19 state of vaccine confidence insights report. Coronavirus disease 2019 (COVID-19). Published August 25, 2021. Accessed September 7, 2021. National Center for Immunization and Respiratory Diseases.
https://www.cdc.gov/vaccines/covid-19/downloads/SoVC-boosters-8-26-21.pdf

ERRATUM

3/17/2023: Corrected co-author's name to Edoseawe Okoduwa.

APPENDIX.

The College Student COVID-19 Vaccination Survey

The Rocket Student Pandemic Health Survey
The University of Toledo

- Thank you for participating in the pilot test for this important health study.
- The survey will only require about <u>10-12 minutes</u> of your time.
- No one can connect your answers to your identity.
- Your answers to this survey are <u>confidential</u>.

Please read carefully: By clicking "I agree" below, you are indicating that you:

- Are at least 18 years old.
- Have read the informed consent letter that was attached to the email invitation.
- Have had all your questions answered.
- Have decided to take part in this research.

I AGREE

Section A: Your Status, Intentions and History [Behavioral Intentions]

Instructions: For each item below, please select the answer that best describes your history and views.

1. Which of the following statements best describes your <u>current status</u> regarding getting the COVID-19 vaccine? *(Please select only one response) (PAPM)*
   a. I have not heard much about a COVID-19 vaccine.
   b. I have not thought much about getting vaccinated with the COVID-19 vaccine.
   c. I am undecided about getting the COVID-19 vaccine.
   d. I thought about it and decided <u>not</u> to get the COVID-19 vaccine. (skip to question #3 below)
   e. I have decided to get the COVID-19 vaccine as soon as it is available to me.
   f. I am in the process of making an appointment to get vaccinated with a COVID-19 vaccine.
   g. I was advised by a medical provider not to receive it. (End of Survey)
   h. I have already received the vaccine. (skip to question #3 below)

2. When the COVID-19 vaccine is available to you, which of the following best describes your <u>intentions</u>? [Behavioral Intentions]
   a. I will get the vaccine as soon as I am able.
   b. I will wait a while and see how the vaccine is working for others who received it.
   c. I will get the vaccine but only if it is required of me to work or do other activities that I want to do.
   d. I am not sure what I am going to do.
   e. I will not be getting the vaccine.

3. Thinking about the impact COVID-19 is having on the US, I would say that the worst of the problems are:
   a. Behind us (in the past)
   b. Happening currently
   c. Still to come (in the future)

4. Which statement below best describes your view regarding getting vaccinated against COVID-19?
   a. Getting vaccinated is a personal choice.
   b. Getting vaccinated is part of everyone's responsibility to protect the health of others.
   c. Both
   d. Neither
   e. Unsure/Don't know

5. For each question below, please select the answer that applies to you.

Question	Yes	No	Don't know
a. Have you had a COVID-19 infection?			
b. Have you been tested for COVID-19?		Skip to 6	Skip to 6

5a. Was the test positive for having COVID-19?
   a. Yes
   b. No (Skip to 6)
   c. Don't know (Skip to 6)

5b. Were you hospitalized due to your illness?
   a. Yes
   b. No

6.

Do you know someone in your social circle (example: friends, family, neighbors, co-worker, classmates) who	Yes	No	Don't know
a. tested positive for COVID-19?			
b. were hospitalized due to COVID-19?			
c. died from COVID-19?			

Factors Contributing to vaccination decision
Display: Only for those who decided to NOT get the vaccine

1. Decision about not getting the COVID-19 vaccine is . . .

Not under my control				Completely under my control
1	2	3	4	5

2. For each item below, please rate their impact on your decision not to take the COVID-19 vaccine.

	Significant Impact	Moderate Impact	A Little Impact	No Impact
a. Not knowing exactly where to get the vaccine.				
b. Not being able to drive somewhere within 10-15 minutes to get the vaccine.				
c. Having to wait more than a week to get an appointment to get the vaccine.				
d. Not being given time off from school or work without penalty to get the vaccine.				
e. Having a bad experience/bad reaction to vaccines in the past.				
f. Not getting a recommendation to get the vaccine from a health care provider.				
g. Not trusting the healthcare system.				
h. Not trusting the vaccine is safe.				
i. Not trusting in the US government				
j. Having to pay for part or all the cost of getting the vaccine.				
k. Observing others have negative side effects from the vaccine.				
l. Hearing from or reading the writings of others who are discouraging others from getting the vaccine.				

3. Please specify if you have any other factor(s) (not mentioned above) that has impacted your decision not to get the COVID-19 vaccine.

Section B: Your Thoughts

SKIP: for those who decided to NOT get the vaccine

1. How <u>important is /was each of the following</u> to you regarding getting the COVID-19 vaccine? Select the answer that best matches your views [Salience]

How important is/was it to you to . . .?	Not Important at all	Somewhat Important	Important	Very Important
a. Get the COVID-19 vaccine.				
b. Decrease your odds of having serious health effects from COVID-19.				
c. Decrease your odds of dying from COVID-19.				

2. Which of the words below best describes your feelings and thoughts as you think about getting a COVID-19 vaccine in the future OR describe your past feelings or thoughts prior to when you went to get a COVID-19 vaccine?

   Select the placement on the line that best describes your feelings/thoughts.
   [Instrumental and Experiential Attitude]

   For me, getting the COVID-19 vaccine would be/was . . .

Scary				Comforting
1	2	3	4	5

Painful				No Pain
1	2	3	4	5

Difficult				Easy
1	2	3	4	5

Opposed to my views				In agreement with my views
1	2	3	4	5

Ineffective at reducing serious illness				Effective at reducing serious illness
1	2	3	4	5

Unsafe				Safe
1	2	3	4	5

Harmful				Beneficial
1	2	3	4	5

3. For each statement below select "True" if the statement is true and "False" if the statement is false. [Knowledge]

Please mark "True" or "False" for each item below.	True	False
a. The vaccines available to Americans are less than 50% effective at preventing serious illness and/or death from COVID-19.		
b. The absolute best way to avoid getting COVID-19 is to not breathe the same air as other people who live outside your household.		

c. Most COVID-19 infection occurs when people touch a contaminated surface and then touch their eyes, nose, or mouth.		
d. Almost all people who spread the virus to others have a fever and other symptoms (eg, cough).		
e. The companies that developed the vaccines did not test the safety of their vaccines.		
f. The Pfizer and Moderna vaccines use a new technology that changes the DNA of your cells.		
g. The technique used by Johnson and Johnson to develop their vaccine is much safer than the techniques used by Pfizer and Moderna.		
h. In the US, the Pfizer and Moderna vaccines have caused serious side effects in more than 50% who have received it.		

Section C: Your Perceptions

1. Please indicate your level of agreement or disagreement with the following statements.
[EPPM: Perceived Susceptibility, Severity, response efficacy, response costs]

Agree or Disagree?	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
a. My chances are high of getting severe health outcomes from COVID-19.					
b. If I were to get a COVID-19 infection or a reinfection, the health outcomes would be very serious.					
c. It would be/was a real hassle for me to get a COVID-19 vaccine.					
d. The COVID-19 vaccine that will be/was available to me is effective at reducing my risks of severe disease from COVID-19.					

2. Please rate your level of confidence to do each action below? [Self-Efficacy]
   SKIP: for those who decided to NOT get the vaccine

How confident are / were you regarding COVID-19 vaccine to …	Not Confident at all	Somewhat Confident	Confident	Very Confident
a. Find an easily accessible location that provides/provided the vaccine to you.				
b. Make an appointment to get the vaccine.				
c. Get to a location that provides/provided the vaccine.				
d. Pay the cost of the vaccination.				
e. Get one or more vaccine shots as recommended by health professionals.				
f. Fill out and complete all the paperwork that is associated with getting the vaccine.				
g. Handle fear of needles that you may have.				
h. Handle any side effects of the vaccine.				

Section E: Your Views of Others
[Subjective Norm and Descriptive Norm]

Instructions: For the statement below, please select the answer that best describes your views

	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
1. Most people that I know would approve of me getting a COVID-19 vaccine. [Descriptive Norm]	SD	D	Neither	A	SA

Instructions: For each question below, please select the answer that best describes your views. Select "Not Applicable" if those specific people are not in your life.

2. How likely is it that the individuals listed below have already received or will get the COVID-19 vaccine, when available? Select "Not Applicable" if those specific people are not in your life.

	Very Unlikely	Somewhat Unlikely	Likely	Very Likely	Not Applicable
a. Health care providers	VU	SU	L	VL	NA
b. Immediate family (parents/ siblings)	VU	SU	L	VL	NA
c. Other family members	VU	SU	L	VL	NA
d. Spouse/Partners/Significant others	VU	SU	L	VL	NA
e. Friends	VU	SU	L	VL	NA
f. Roommates	VU	SU	L	VL	NA
g. Professors/ Academic advisors	VU	SU	L	VL	NA
h. Your boss	VU	SU	L	VL	NA

3. How influential are the opinions of the people listed below regarding your decision to get the COVID-19 vaccine? [Subjective Norm]

	Not Influential at All	Somewhat Influential	Influential	Very Influential	Not Applicable
a. Health care providers	Not at all	Somewhat	Influential	Very Influential	NA
b. Immediate family (parents/ siblings)	Not at all	Somewhat	Influential	Very Influential	NA
c. Other family members	Not at all	Somewhat	Influential	Very Influential	NA
d. Spouse/Partners/ Significant others	Not at all	Somewhat	Influential	Very Influential	NA
e. Friends	Not at all	Somewhat	Influential	Very Influential	NA
f. Roommates	Not at all	Somewhat	Influential	Very Influential	NA

Section D: Factors contributing to your decision regarding vaccine
[Environmental Constraints, Perceived Control, Response Efficacy & Response Costs]

SKIP: for those who decided to NOT get the vaccine

Instructions: For each item below, please select the answer that best describes your thoughts.

1. Decision about getting or not getting the COVID-19 vaccine would be/was …

Not Under My Control			Completely Under My Control	
1	2	3	4	5

2. Please rate whether each factor listed below would/did make it DIFFICULT or EASY for you to obtain the vaccine.

	Very difficult	Somewhat difficult	Neither	Somewhat easy	Very easy
a. Knowing exactly where to get the vaccine.					
b. Be able to drive somewhere within 30 minutes to get the vaccine.					
c. Having to wait more than a week to get an appointment to get the vaccine.					
d. Having to pay more than $20 for the vaccine.					
e. Being given time off from school or work without penalty to get the vaccine.					
f. Having a bad experience/bad reaction to vaccines in the past.					
g. Obtaining a recommendation to get the vaccine from a health care provider.					
h. Trusting the vaccine is safe.					
i. Not trusting in the US government.					
j. Receiving a free vaccine (no cost to you).					
k. Seeing others get the vaccine and not having any health problems from the vaccine.					
l. Hearing/reading things from others that discourage people from getting the vaccine.					

3. Please specify if you have any other factor(s) (not mentioned above) that would make/made it DIFFICULT for you to get the COVID-19 vaccine.

4. Please specify if you have any other factor(s) (not mentioned above) that would make/made it EASIER for you to get the COVID-19 vaccine.

	Not at all	Somewhat	Influential	Very Influential	NA
g. Professors/Academic advisors	Not at all	Somewhat	Influential	Very Influential	NA
h. Your boss	Not at all	Somewhat	Influential	Very Influential	NA

Section F: Your Opinions

1. How much do you agree or disagree with the following statements?
[Conspiracy Type Thinking]

Rate your level of disagreement/agreement with each statement below.	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
a. The mainstream media has been creating unnecessary fear by constantly talking and writing about COVID-19.	SD	D	Neither	A	SA
b. A COVID-19 vaccine is not needed since almost all people who get the disease recover from it.	SD	D	Neither	A	SA
c. The potential harm of being infected by COVID-19 has been greatly exaggerated.	SD	D	Neither	A	SA
d. In the US, millions more per year die from the flu than from COVID-19.	SD	D	Neither	A	SA
e. The vaccine for COVID-19 is more dangerous than getting the disease itself.	SD	D	Neither	A	SA
f. Pharmaceutical companies who made the vaccines have hidden information from the public that these vaccines cause bad health conditions.	SD	D	Neither	A	SA
g. It really makes no sense for me to get the COVID-19 vaccine since a higher power determines my health outcomes anyway.	SD	D	Neither	A	SA
h. The COVID-19 vaccine is an attempt to take away my personal freedom.	SD	D	Neither	A	SA
i. The government telling everyone to get vaccinated is a method to control the population.	SD	D	Neither	A	SA

Section G: About You

1. Where do you get most of your information about COVID-19 topics? (select all that apply below).
   - a. Friends
   - b. Family
   - c. Health care providers
   - d. Religious leaders
   - e. Social media (eg, Facebook, Instagram, Tik Tok)
   - f. YouTube
   - g. Television
   - h. Government websites (eg, CDC)
   - i. Medical related websites (eg, Mayo Clinic)
   - j. Peer reviewed research papers in medical/scientific journals (eg, New England Journal of Medicine)
   - k. My professors
   - l. Other (please specify) _____

2. **How many times in the past three years did you get the <u>flu vaccine</u>? [Habit]**
   a. Once every year (3 times)
   b. 2 times
   c. 1 time
   d. Did not get the flu vaccine at all in the past 3 years
   e. Unsure/ do not remember

3. **In the past month, how often did you do each of the following? (Health behavior)**

In the past 30 days how often did you . . .?	Never	Hardly Ever	Some of the Time	All or Most the Time	Do Not Remember
a. Wear a face covering/mask when in contact with others who live outside your household.					
b. Maintain at least 6ft distance between yourself and those who live outside your household.					
c. Wash your hands thoroughly with soap and water or hand sanitizer after touching objects frequently touched by others.					
d. Avoid indoor spaces where you would be breathing the same air as others who live outside your household.					
e. Avoid close contact with people who tested positive for COVID-19.					
f. Intentionally not go somewhere because of increased risk of COVID-19 infection.					

4. **Currently, which political party do you lean more towards?**
   a. Republican
   b. Democrat
   c. Independent
   d. None/No preference
   e. Don't know

5. **Select the answer below that best describes your current overall health status in each area.**

Health Areas	Excellent	Good	Fair	Poor	Very Poor
a. Physical health?					
b. Mental health?					

6. **For each of the health areas listed below, have you seen a healthcare provider (in person or using telehealth) in the past 12 months? (Note: A healthcare provider means a physician, physician assistant, nurse practitioner, or a psychiatrist).**

Health Areas	Yes	No	Unsure
a. For your physical health needs?			
b. For your mental health needs?			

7. **What is your current age (in years)? (dropdown menu)**

Less than 18	24
18	25
19	26
20	27
21	28
22	29
23	30 years old or more

8. **What is your rank in college?** *(Select only one below)*
   a. Freshman
   b. Sophomore
   c. Junior
   d. Senior
   e. Graduate Student
   f. Unclassified
   g. Other (please specify): _____

9. **Which of the following best describes the college in which your current academic major is housed?** *(Select only one below)*
   a. College of Arts and Letters
   b. College of Business
   c. College of Education
   d. College of Engineering
   e. Health and Human Services
   f. College of Law
   g. College of Medicine
   h. College of Music
   i. Other (please specify): _____

10. **Which of the following best describes <u>who</u> you are currently living with?**
   a. I live alone (skip to question 13)
   b. I live with other people

11. **In which age categorie(s) are those with whom you live? (Select all that apply to capture everyone)**
   a. 0-12
   b. 13-18
   c. 19-40
   d. 41-65
   e. 66 years and older

12. **Do any of the people that you live with have a medical condition that puts them at risk of having serious health outcomes from a COVID-19 infection?**
   a. Yes
   b. No
   c. Unsure

13. **Are you an international student at UT?**
   a. Yes
   b. No

14. **What is your gender?** *(Select only one below)*
   a. Male
   b. Female
   c. Other, please specify_____

15. **Do you identify as Hispanic or Latino?**
   a. Yes
   b. No

16. **What is your race?** *(Select all that apply below)*
   a. White
   b. Black
   c. Asian
   d. American Indian or Alaskan Native
   e. Native Hawaiian/Pacific Islander
   f. Middle Eastern or North African
   g. Other/Multiracial (please specify) _____

17. **Is there anything else that you would like to say about the topic of COVID-19, and COVID-19 vaccines? Any final thoughts?**

Thank you for completing the survey!

RESEARCH ARTICLE

Impact of COVID-19 on Jobs in Ohio's Health Care Sector

Saannidhya Rawat[1]

[1]Department of Economics, Carl H. Lindner College of Business, University of Cincinnati , Cincinnati, OH

Corresponding Author: Saannidhya Rawat, 2906 Woodside Drive, Cincinnati, OH 45221, rawatsa@mail.uc.edu

ABSTRACT

Background: This study seeks to measure the impact of COVID-19 on health care jobs in Ohio. We examine whether health care sector workers were similarly affected compared to workers in other industries in Ohio and if there were any significant differences in job categories within the health care sector.

Methods: Using a rich dataset provided by the Ohio Department of Job and Family Services (ODJFS), we study the employment levels for different health care subsectors in Ohio by calculating job creation, destruction, and reallocation rates and analyze the disruption in labor markets caused by COVID-19.

Results: Certain health care subsectors such as ambulatory health care services and hospitals recovered almost immediately after the lockdown but are still below their pre-COVID-19 employment levels. The social assistance subsector eventually recovered but also has not reached its pre-COVID-19 employment level. The nursing and residential care subsector has experienced a continuous decline in jobs. Although both job creation and destruction rates reached their relative peaks for all health care subcategories, the gap between pre-COVID-19 and post-COVID-19 levels was higher for job destruction rate.

Conclusion: Ohio's health care sector has not yet fully recovered from the COVID-19 lockdown imposed in 2020.

Keywords: COVID-19; Health care; Labor economics; Secondary analysis

INTRODUCTION

The Centers for Disease Control and Prevention (CDC) confirmed the first case of coronavirus disease 2019 (COVID-19) on January 28, 2020.[1] Since then, there have been more than 82 million cases and 995 000 deaths in the United States (US) due to COVID-19 as of May 2022.[2] To contain the deadly virus in the US, states implemented various safety measures such as stay-at-home orders and mask mandates. These events led to a nationwide shock as people struggled to accept this new reality.

Along with being a global health crisis, COVID-19 has also been an economic crisis.[3] The US gross domestic product (GDP) declined by a record 32.9% in the second quarter of 2020[4] and unemployment rate reached 15%.[5] The federal government passed the CARES Act with an aim to provide economic support to US citizens.

On March 22, 2020, Governor DeWine issued a stay-at-home order for all Ohioans. This required closure of all nonessential businesses and ensured a statewide lockdown to curb the spread of the virus.[6] Health care workers were uniquely affected by the COVID-19 lockdown as it comprised of services that provided essential care (ie, the sector was not under complete lockdown). Because health care workers form 14% of the total workforce in Ohio,[7] which is one of the highest in the nation, it is important to identify the overall effect of the COVID-19 lockdown on people employed by this sector.

Furthermore, even within the health care sector, the impact may be quite different for different groups. For instance, clinics providing outpatient services such as general practitioners, optometrists, and dentists may experience a more sudden decrease when it comes to in-person interaction as compared to hospitals, which contrastingly may experience a surge in patients admitted due to

coronavirus. In this paper, we analyze the rich dataset provided by the Ohio Department of Job and Family Services (ODJFS) to study the dynamics of such labor markets. A complete definition of locations covered and the associated health care sector and its subsectors is shown in the Methods section.

The COVID-19 recession in this study starts at the time when the lockdown was announced in Ohio. The Great Recession (also known as the Financial Crisis), as defined by National Bureau of Economic Research (NBER), was from the last quarter of 2007 to the second quarter of 2009.[8] There were significant differences between the health care sector and the rest of the sectors (referred as non-health care) in Ohio during the Great Recession. However, these differences were not evident during the economic recession caused by COVID-19. These results are consistent with rest of the country.[9]

Figure 1 shows year-over-year percentage change in the number of employed workers in health care and non-health care sectors in Ohio. The health care sector employment levels did not fall greatly during the Great Recession, even though other sectors saw a significant reduction in job levels. Contrastingly, COVID-19 recession led to a sharp reduction in health care workforce and this decline mimicked the reduction in non-health care sectors, although the decline in health care was not as steep.

The unit-level data in this study allows us to look further than just observing aggregate employment patterns and observe more deeply how people may be affected by the changing state of the economy. Whenever a representative unit hires a new person and adds them to their payroll, a new job is created and whenever a person is removed from the payroll, a job is destroyed. Even within Ohio, thousands of jobs are added and destroyed every day. These new jobs can either be created by existing firms which are expanding their workforce or by new firms entering the market. Analyzing the number of jobs created by new and existing firms in Ohio can tell us how likely is a person to get a job. Similarly, when firms downsize their workforce or exit the market, they destroy jobs. Analyzing the number of jobs destroyed by surviving and exiting firms in Ohio can tell us how likely a person is to lose a job. Together, these variables can tell us about the ongoing shifts in the labor markets.

METHODS

Data

The data for this study comes from the ODJFS and range from January 2006 to June 2021. Ohio Revised Code (ORC) Section 4141.13 (G) requires the ODJFS to collect information from all Ohio employers to determine if they are subject to the state's unemployment insurance laws. According to the ODJFS website, unemployment benefits are financed by taxes paid by employers to the federal and state governments.[10] The federal taxes cover most of the program's administrative costs, and the state taxes fund the actual benefits. Unemployment benefits provide short-term income to workers who lose their jobs through no fault of their own and who are actively seeking work. The ODJFS collects
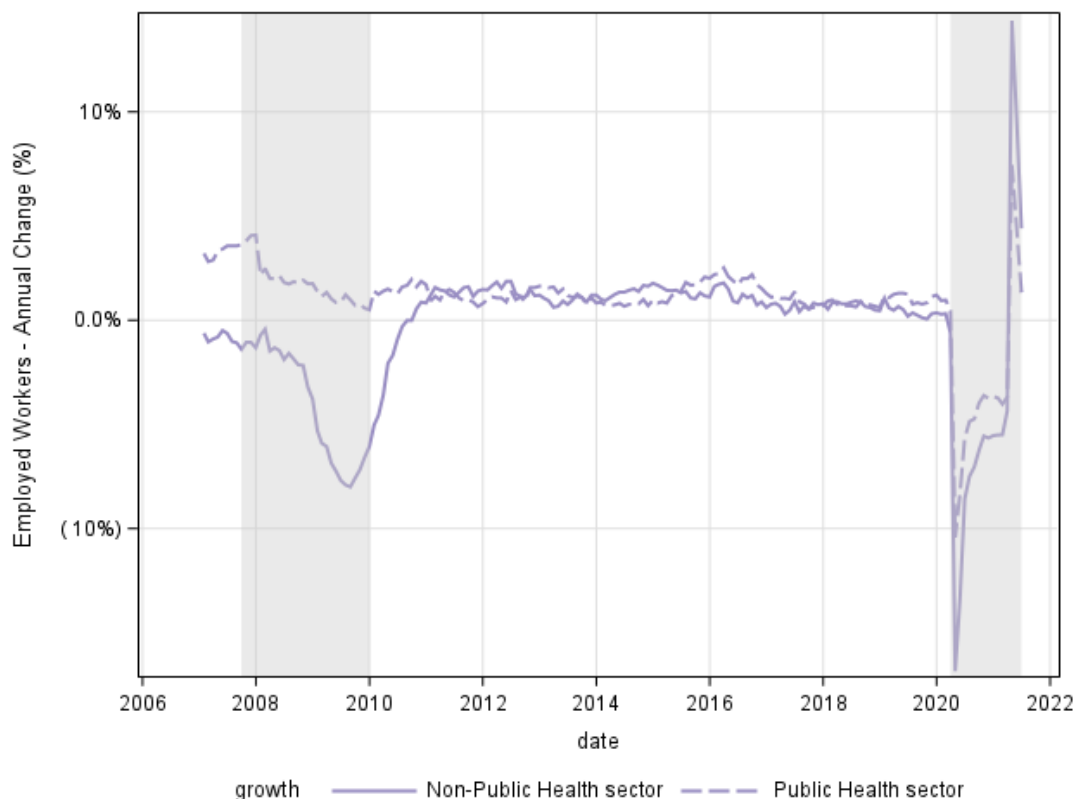

Figure 1. Health Care Versus Non-Health Care Sectors in Ohio

this data via their State of Ohio Unemployment Resource for Claimants and Employers (SOURCE) application. The employers report to ODJFS the number of employees on their payroll and the wages paid to these employees. Each employer has a unique employer identification number (EIN) and is classified as per North American Industry Classification System (NAICS). Data on the number of employees are available at a monthly level, and data on wages is available at a quarterly level. For this study, we use data on number of employees.

We define the NAICS category and major health care subcategories considered for this study. The NAICS records category 62 as health care and social assistance.[11] One important thing to note is that NAICS does not distinguish between health care and social assistance services, citing difficulties in identifying the boundaries of these activities. We follow the same delineation and consider the 4 highest categories under this sector: ambulatory health care (621), hospitals (622), nursing and residential care (623), and social assistance (624).

Ambulatory health care subsector serves patients who do not require inpatient services and are generally associated with outpatient services (ie, they do not require the patient to be admitted overnight). Offices of physicians, dentists, optometrists, mental health practitioners, occupational and speech therapists, and outpatient care centers fall under this category.

Hospitals form the majority of the health care sector and mainly provide medical, diagnostic, and treatment services to inpatients but can also have small-scale outpatient services. These health care institutions are generally much larger in size than units under other sectors and provide specialized facilities that are essential for the region.

The nursing and residential care subsector provides nursing, supervisory, residential, or any other type of care required by its patients, who are sometimes referred as residents. The social assistance subsector provides a wide variety of social assistance services directly to their clients which include, but are not limited to, individual and family services, childcare services, community food services, and temporary shelters and housing services.

Variables

1. Number of employed persons is the variable of interest and is defined as the number of workers that were reported to ODJFS by a unit and were part of its payroll.

2. The NAICS code variable identifies the specific industrial category of a unit as per NAICS.

3. Subcategories variable uses NAICS code and separates sectors into health care and non-health care.

4. Unique location identifier, known as "unit" throughout this paper, was used to identify a particular location or address related to health care sector.

Measures

In order to truly understand the jobs related to Ohio's health care sector, we need to study the dynamics of Ohio's health care labor market. In this paper, we do this by analyzing job flows, that is, the creation and destruction of jobs within the health care sector and its subsectors. Job creation rate represents the sum of job gains measured at a unit over 1 month due to either opening of new units or expansion of jobs within an existing unit. Job destruction rate represents the sum of job losses resulting from either closing of a production unit or contraction in the number of jobs by an existing unit. Job reallocation rate is equal to the sum of job creation rate and job destruction rate. Net employment rate is equal to the difference between job creation rate and job destruction rate. All the rates were based on monthly data and were calculated on an annual or year-over-year basis. Below, we mathematically define each of these measures.

Let E_{it} be defined as the number of people on i^{th} company's payroll during t^{th} time period, where $i \in \{1,2, \dots , N\}$ for some $N \in \mathbb{N}$ and $t \in \{1,2, \dots , T\}$ for some $T \in \mathbb{N}$, where $\mathbb{N}$ is the set of natural numbers.

Then,

Let monthly job creation be $JC_t = \frac{1}{N} \sum_{i=1}^{N} JC_{it}$, where

$$JC_{it} = \begin{cases} E_{it} - E_{it-1} , & if \ E_{it} - E_{it-1} \geq 0 \\ 0 , & if \ E_{it} - E_{it-1} < 0 \end{cases}$$

Let monthly job destruction be $JD_t = \frac{1}{N} \sum_{i=1}^{N} JD_{it}$, where

$$JD_{it} = \begin{cases} 0 , & if \ E_{it} - E_{it-1} \geq 0 \\ -(E_{it} - E_{it-1}) , & if \ E_{it} - E_{it-1} < 0 \end{cases}$$

Let annual job creation rate be $JCR_t = \frac{JC_t}{\sum_{i=1}^{N} E_{it}} - \frac{JC_{t-12}}{\sum_{i=1}^{N} E_{it-12}}$

Let annual job destruction rate be $JDR_t = \frac{JD_t}{\sum_{i=1}^{N} E_{it}} - \frac{JD_{t-12}}{\sum_{i=1}^{N} E_{it-12}}$

Let reallocation rate be $RR_t = JCR_t + JDR_t$

Let net employment rate be $NER_t = JCR_t - JDR_t$

Further, let $\tilde{T}$ be the period when lockdown was announced in Ohio.

Let average job creation rate before and after COVID-19 be $\overline{JCR_0}$ and $\overline{JCR_1}$ where $\overline{JCR_0} = \frac{\sum_{t=1}^{\tilde{T}-1} JCR_t}{\tilde{T}-1}$ and $\overline{JCR_1} = \frac{\sum_{t=\tilde{T}}^{T} JCR_t}{T-\tilde{T}+1}$

Similarly, let average job destruction rate before and after COVID-19 be $\overline{JDR_0}$ and $\overline{JDR_1}$, where $\overline{JDR_0} = \frac{\sum_{t=1}^{\tilde{T}-1} JDR_t}{\tilde{T}-1}$ and $\overline{JDR_1} = \frac{\sum_{t=\tilde{T}}^{T} JDR_t}{T-\tilde{T}+1}$

Then, our job loss measure (JL) is defined as

$$JL = (\overline{JDR_1} - \overline{JDR_0}) - (\overline{JCR_1} - \overline{JCR_0})$$

RESULTS

We first share the results related to jobs generated by each subsector within health care before and after COVID-19. Post-COVID-19 period begins April 2020, after the announcement of the stay-at-home order by the Ohio Department of Health (ODH).

Figure 2 shows monthly number of employed persons within Ohio by each major NAICS subsector under health care. All subsectors experienced a decline due to lockdown imposed by COVID-19, but the sharpest decline was experienced by ambulatory health care services and social assistance sectors. Both these sectors recovered after the shock but have, so far, failed to reach the pre-COVID-19 levels. Hospitals experienced a temporary decline but also recovered promptly. The nursing subsector has experienced a constant decline since the advent of the COVID-19 crisis.

Table 1 shows average pre-COVID-19 and post-COVID-19 lockdown levels for job creation, destruction, reallocation, and net employment rates for health care and its subsectors. Pre-COVID-19 period is up to March 2020 and post-COVID-19 period begins April 2020 (ie, once the stay-at-home order was announced). Each subsector had a positive net employment rate before COVID-19 but had a negative net employment rate after COVID-19. For example, the ambulatory health care subsector had a net employment rate of 0.15% before COVID-19 but had a net employment rate of −0.27% after COVID-19.

All sectors had a higher job creation rate post-COVID-19 than pre-COVID-19. Similarly, all sectors had a higher job destruction rate post-COVID-19 than pre-COVID-19. However, the difference between job destruction rate before and after COVID-19 was much higher than the difference between job creation rate before and after COVID-19. For instance, the social assistance subsector had a pre-COVID-19 job creation rate of 3.45% and a post-COVID-19 job creation rate of 4.19% which led to an increase of 0.74 percentage points (pp). Similarly, it had a pre-COVID-19 job destruction rate of 3.17% and a post-COVID-19 job destruction rate of 4.84% resulting in an increase of 1.67 pp. Note that job destruction rate between the 2 periods is more than double the job creation rate. In other words, the difference between 1.67 pp and 0.74 pp is 0.93, and this number is our measure of jobs lost in Social Assistance subsector between the pre-COVID-19 and post-COVID-19 periods. This difference measure reveals that newer jobs created after the advent of COVID-19-imposed restrictions were not able to fully compensate for the jobs destroyed by these restrictions. In this way, when we compute difference measures for all the health care subsectors provided in Table 1, we find that none of the sectors have been able to recover from the high job destruction rates during the post-COVID-19 period.

All sectors also had a higher job reallocation rate post-COVID-19 than pre-COVID-19, which suggests that health care workers were more likely to switch their jobs after Ohio declared a state of emergency in late March 2020.
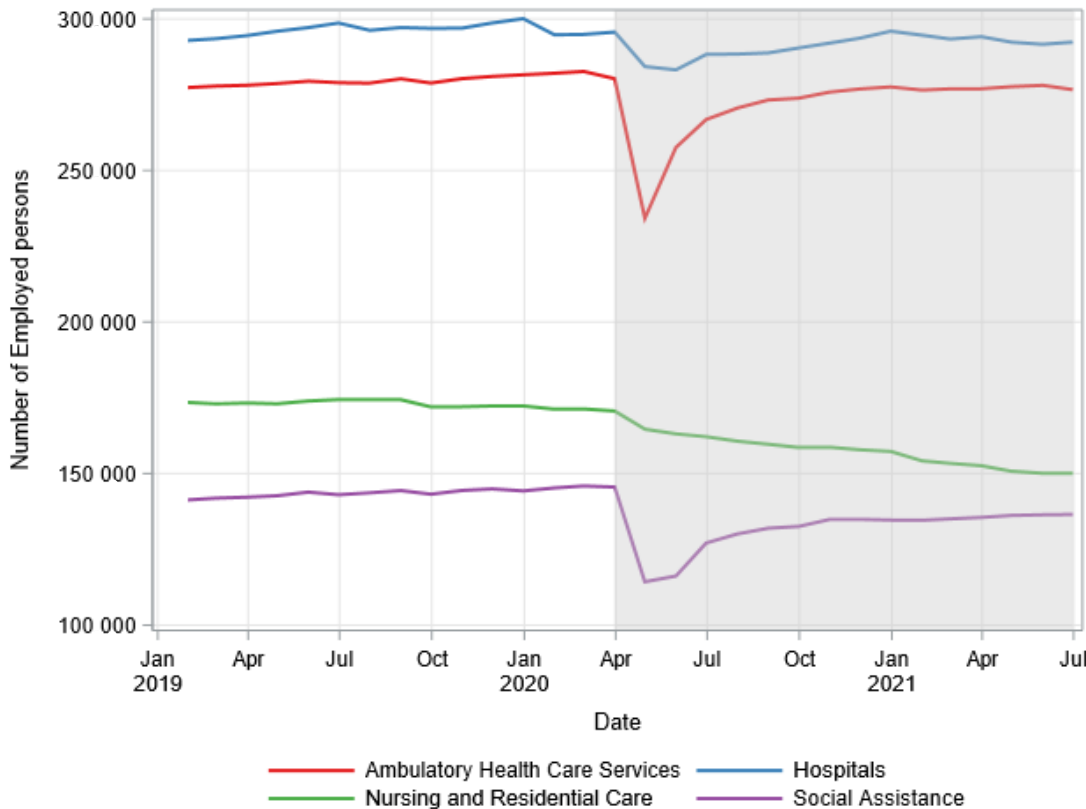

Figure 2. Ohio Health Care Sector: Number of Employed Persons per NAICS Subcategory

Table 1. Job Creation and Destruction Flows as a Percentage of Total Employment

Category	Period	Job Creation	Job Destruction	Job Reallocation	Net Employment	Measure
Ambulatory health care	Pre-COVID-19	3.26%	3.11%	6.38%	0.15%	
Ambulatory health care	Post-COVID-19	3.88%	4.15%	8.02%	(0.27%)	
		0.61	1.04			**0.42**
Hospitals	Pre-COVID-19	1.09%	1.01%	2.11%	0.08%	
Hospitals	Post-COVID-19	1.13%	1.19%	2.33%	(0.06%)	
		0.04	0.18			**0.14**
Nursing and residential care	Pre-COVID-19	2.53%	2.52%	5.05%	0.01%	
Nursing and residential care	Post-COVID-19	2.84%	3.68%	6.52%	(0.83%)	
		0.31	1.15			**0.84**
Social assistance	Pre-COVID-19	3.45%	3.17%	6.62%	0.28%	
Social assistance	Post-COVID-19	4.19%	4.84%	9.03%	(0.64%)	
		0.74	1.67			**0.93**
Health care sector	Pre-COVID-19	2.39%	2.27%	4.66%	0.12%	
Health care sector	Post-COVID-19	2.77%	3.10%	5.87%	(0.33%)	
		0.39	0.83			**0.44**

DISCUSSION

COVID-19 recession was different from the Great Recession in terms of its impact on the health care sector. While other sectors in Ohio experienced a decrease in workforce during the Great Recession, the health care sector experienced no such decline. However, COVID-19 had a very similar impact on both these sectors as all employees were forced to take safety measures. COVID-19 also had a dissimilar impact on different health care subsectors. The ambulatory health care subsector experienced the sharpest decline due to lockdown imposed by COVID-19. This seems reasonable given that all outpatient services were temporarily halted by the stay-at-home order imposed by ODH. Soon after the stay-at-home order was lifted, the subsector recovered from the temporary shock as units in this subsector were allowed to reopen, albeit with COVID-19 restrictions and policies in place. Hospitals were the most stable and were least impacted, at least in terms of payroll jobs, out of all health care subcategories as they were allowed to operate during the lockdown. The relatively small decline in this subsector can possibly be attributed to closure of certain nonessential services or increased COVID-19 spread forcing the workers to stay at home and, as a result, out of the payroll system. On the other hand, one would imagine that hospitals should have experienced a surge in new workforce as there were cases of extreme labor market tightening during the pandemic. However, even when they were the most important institutions during the pandemic, hospitals experienced a moderate decline in net employment rate. The social assistance subsector had an average post-COVID-19 job reallocation rate of 9% and was the highest among the health care subsectors, along with the highest gap between job destruction and job creation rates. This suggests a lot of movement of health care workers away from this subsector as a number of people in this subsector were laid off during lockdown and had to find other jobs. Nursing subsector had the lowest post-COVID-19 net employment rate and is experiencing a continuous decline in workforce. This suggests a deeper problem than a one-time shock. One possible explanation is the decline in demand of such services due to shift in demographics caused by COVID-19. Because the elderly and the disabled were disproportionately affected by COVID-19, this possibly resulted in a higher death rate among these groups and ultimately led to a lower demand for nursing and residential care facilities.

PUBLIC HEALTH IMPLICATIONS

The health care sector in Ohio experienced a tremendous increase in labor market activity due to the effects of COVID-19 and the stay-at-home order issued in March 2020. New jobs were created throughout the health care industry as demand for telehealth, telemedicine, and COVID-19-related health care services increased employment levels. However, this demand was more than offset by the decrease in jobs at some of the existing health care institutions, as they were forced to cut costs by eliminating nonessential services from their payrolls. Contrary to the common misconception that the health care sector is expanding due to increased demand for health care workers caused by COVID-19, the payroll data from ODJFS shows us a decrease in overall health care employment as of June 2021. In the future, some sectors such as hospitals may create new jobs as they seem to have relatively stable job creation and destruction rates. Since this subsector generally comprises of large institutions, doctors and nurses working for large health care-related establishments may experience greater job security than those working for smaller establishments. Furthermore, other subsectors such as nursing and residential care may be on their way towards permanent decline in job opportunities. As a result, nurses and other health care workers in this subsector may start moving toward other health care subsectors such as hospitals or ambulatory health care subsectors in hopes of finding better job opportunities. The recent surge in travel nurses may also continue as a result of limited job alternatives. If these trends continue in the future at the aggregate health care sector level, then we could also see a permanent movement of individuals out of the labor force for the health care sector in Ohio.

REFERENCES

1. Centers for Disease Control and Prevention (CDC). First Travel-related Case of COVID-19 in United States. 2020. Accessed June 22, 2022. https://www.cdc.gov/media/releases/2020/p0121-novel-coronavirus-travel-case.html

2. Centers for Disease Control and Prevention (CDC). COVID Data Tracker. 2022. Accessed June 22, 2022. https://covid.cdc.gov/covid-data-tracker/#datatracker-home

3. Adams-Prassl A, Cloyne J, Costa Dias M, Parey M, Ziliak JP. The COVID-19 economic crisis. *Fisc Stud.* 2020;41(3):489–492. https://doi.org/10.1111/1475-5890.12248

4. Bureau of Economic Analysis. Gross Domestic Product, 2nd Quarter 2020. 2020. Accessed January 16, 2023. https://www.bea.gov/news/2020/gross-domestic-product-2nd-quarter-2020-advance-estimate-and-annual-update#home

5. Bureau of Labor Statistics, US Department of Labor. *The Economics Daily.* Unemployment rate rises to record high 14.7 percent in April 2020. Accessed January 16, 2023. https://www.bls.gov/opub/ted/2020/unemployment-rate-rises-to-record-high-14-point-7-percent-in-april-2020.htm

6. Ohio Department of Health. Director's Stay Safe Ohio Order. 2020. Accessed January 16, 2023. https://coronavirus.ohio.gov/static/publicorders/Directors-Stay-Safe-Ohio-Order.pdf

7. KFF. Health Care Employment as a Percent of Total Employment. May 2021. 2023. Accessed January 16, 2023. https://www.kff.org/other/state-indicator/health-care-employment-as-total/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

8. National Bureau of Economic Research (NBER). US Business Cycle Expansions and Contractions. 2021. Accessed January 16, 2023. https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions.

9. Wager C, Telesford I, Hughes-Cromwick P, Amin K, Cox C. What impact has the coronavirus pandemic had on health employment? *Peterson-KFF Health System Tracker.* 2022. Accessed January 16, 2023. https://www.healthsystemtracker.org/chart-collection/what-impact-has-the-coronavirus-pandemic-had-on-healthcare-employment/#Cumulative%20change%20in%20health%20sector%20and%20non-health%20sector%20employment%20since%20January%201990%C2%A0

10. Ohio Department of Job and Family Services. UI Tax for New Employers. Accessed January 16, 2023. https://jfs.ohio.gov/ouio/uctax/UITaxForNewEmployers.stm 2021

11. US Census. North American Industry Classification System. 2022. Accessed January 16, 2023. https://www.census.gov/naics/reference_files_tools/2022_NAICS_Manual.pdf

RESEARCH ARTICLE

Factors Related to Drug Overdose Deaths in Ohio

Samuel Borgemenke[1]

[1]Heritage College of Osteopathic Medicine, Ohio University, Athens, OH

Corresponding Author: Samuel Borgemenke, 191 West Union Street, Athens, OH 45701, sb868821@ohio.edu

ABSTRACT

Background: Drug overdoses have had a devastating impact on public health in Ohio. Improving our understanding of the relationships between factors that are associated with drug overdose deaths can enhance the quality of public policy and health care reach in Ohio.

Methods: Utilizing data from the Centers for Disease Control and Prevention (CDC) and University of Wisconsin Population Health Institute, this research seeks to quantify the associations between the drug overdose rate for counties in Ohio with various factors via statistical regressions.

Results: The overwhelming majority of drug/alcohol overdose deaths during the years 2017-2019 were unintentional. Drug overdose deaths and life expectancy are strongly associated. Communities with higher overdose rates have lower life expectancies. Socioeconomic status and health care factors, such as mental distress and physical inactivity, are significantly correlated with increased drug overdose deaths. Household income is significantly correlated with increased access to health care, implying that communities of lower socioeconomic status may lack adequate access to quality care and suffer from increased overdose deaths.

Conclusion: The data indicate the importance of access to health care and health care providers in response to drug overdoses in Ohio. Health care access is currently proportional to income; higher income households have a greater proportion of insured, as well as a greater number of primary care physicians. Thus, implementing policies that support health care infrastructure should be prioritized to increase the capacity of treatment in under-resourced (low-income and low socioeconomic status) communities.

Keywords: Regression; Drug overdose; Health care; Social determinants; Opioids

INTRODUCTION

The prevalence of drug overdose deaths has been devastating to Ohio public health. In 2017, the drug overdose deaths rate for Ohio was 46.3 compared to 21.7 for the national average.[1] This extraordinarily high difference makes it critical to further study the factors associated with drug overdose deaths in Ohio.

From 2017-2019, there have been 13 342 Ohioans who have died as a result of a drug overdose. This equates to an average of 4447 Ohioans per year over this timespan. The average number of Ohioans who died by a drug overdose was 3461 during 2014-2016 (the preceding 3-year period).[2] Thus, Ohio experienced an increase of nearly 1000 more deaths due to drug overdose over these time periods.

The number of drug overdose deaths has had an immense impact on public health. Authors of 1 study described the burden of opioid-related deaths, stating 1 in 65 deaths was opioid related in the United States.[3] This represents an enormous toll in years of lost life. The years of lost life from just opioid-related deaths exceed those attributable to hypertension, HIV/AIDS, and pneumonia.[3]

Presently, the prevalence of drug overdoses has grown immensely. Since the start of the COVID-19 pandemic, every state, including Ohio, has experienced an increase in the number of overdose deaths.[4] Specifically, more Ohioans died of an opioid overdose during a 3-month period in 2020 than at any time since the opioid epidemic began.[5]

Considering this increase in drug overdose deaths, Ohio currently only has the capacity to treat 20% to 40% of residents abusing or addicted to opioids.[6] The need for treatment in combination with high costs of treatment, estimated at $8.8 billion per year, demonstrates the amount of stress placed on the Ohio health care system by opioid addiction.[6] This is exacerbated by the enduring nature of the issues; it was during October of 2017 that the US Department of Health and Human Services declared the opioid crisis a public health emergency.[7] Thus, the necessity to research and find creative solutions to mitigate this epidemic is crucial.

Previous researchers have performed temporal analysis on opioid and drug overdose deaths in Ohio.[8] Other studies have shown that opioid overdose death rates were associated with certain census tract level and socioeconomic characteristics in Ohio.[9] However, there has yet to be research that expands upon the relationship between social determinants of health and the drug overdose rate. Social determinants of health are factors, including economic stability, health care access and quality, and living environment, that affect health and quality-of-life outcomes.

This report seeks to satisfy the need for increased research on the social determinants of health as it pertains to the drug overdose rate in Ohio. Therefore, this research aims to quantify the associations between the drug overdose rate for counties in Ohio with various health and health care factors. The hypothesis for this project was that underserved and under-resourced areas would have higher rates of drug overdose deaths. By better understanding the relationship between these factors, public policy and health care systems in Ohio can enhance the quality and reach of desperately needed care.

METHODS

Data

The data were compiled from the University of Wisconsin Population Health Institute's program County Health Rankings and Roadmaps, which obtained original data from various governmental and health institutions.[10] Specific data sources are:

- The Comprehensive Housing Affordability Strategy (CHAS) is a subset of American Community Survey (ACS) data from the US Census Bureau sent to the US Department of Housing and Urban Development (HUD). These data depict the extent of housing problems and housing needs, particularly for low-income households.

- The Behavioral Risk Factor Surveillance System (BRFSS) is a collection of telephone surveys that collect state data about US residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services.

- National Center for Health Statistics (NCHS) is the nation's principal health statistics agency, providing data to identify and address health issues. The NCHS compiles statistical in-

formation collected from public and private health partners to help guide public health policy.

- National Vital Statistics System (NVSS) obtains information on deaths from the registration offices of each state. Federal law mandates the collection and publication of death registration statistics, which includes the cause of death when drug use is suspected.

- CDC WONDER (Wide-ranging ONline Data for Epidemiologic Research), a national database that collects public health information, was utilized to access the National Vital Statistics System (NVSS).[11] Data on drug overdose causes were analyzed via the dataset produced by CDC WONDER.

The desired variables were broken down by county across the entire United States. Thus, in order to prepare for analysis, the obtained variables and data were merged utilizing R-Studio, version 2022.12.0+353 (R Program for Statistical Computing) to create a singular dataset and trimmed to only include the 88 counties in Ohio.

Variables

Select variables that had statistics on the 88 counties in Ohio were chosen from the County Health Rankings and Roadmaps. The complete list of the variables and how they were defined are:

- Drug overdose rate. The number of deaths due to drug poisoning per 100 000 people. The drug overdose rate originated from the CDC and NCHS and were produced from the NVSS over the years 2017-2019.

- Life expectancy. The average number of years a person is expected to live. Life expectancy was calculated using data provided by NCHS and drawn from the NVSS over the years 2017-2019.

- Median household income. The 50th percentile for household income in a county. Household income was calculated from small area income and poverty estimates for the year 2019.

- Child poverty rate. The percentage of people under age 18 years who live in poverty. Child poverty rate was calculated from small area income and poverty estimates for 2019.

- Unemployment rate. The percentage of county population age 16 years and over who are not currently employed but seeking work. Unemployment rate was calculated from the Bureau of Labor Statistics for 2019.

- Severe housing problems. The percentage of households with at least 1 of 4 housing problems: overcrowding, high housing costs, lack of kitchen facilities, or lack of plumbing facilities. Severe housing problems was calculated using CHAS data from 2017.

- Mental distress frequency. The percentage of adults reporting 14 or more days of poor mental health per month. Frequent

Mental distress was calculated from BRFSS, which is a random telephone survey from the year 2018.

- Physical inactivity. The percentage of adults age 20 years and over who report having no leisure-time physical activity. Physical inactivity was calculated by the United States Diabetes Surveillance System for the year 2017.

- Primary care physician ratio. The ratio of primary care providers per 100 000 people. The number of primary care providers was provided by the American Medical Association (AMA). The AMA maintains the AMA Physician Masterfile which contains information on doctors of medicine and doctors of osteopathic medicine for the year 2018.

- Percentage of uninsured. The percentage of population under age 65 years without health insurance. Percentage of uninsured was calculated from small area health insurance estimates for the year 2018.

- Preventable hospitalizations. The rate of hospital stays for ambulatory-care sensitive conditions per 100 000 Medicare enrollees. Preventable hospitalizations was calculated from the Mapping Medicare Disparities tool for the year 2018.

- Percent rural. The percentage of population that live in a rural area. Percent rural was calculated using Census population estimates from 2010.

Statistical Analysis

The CDC WONDER dataset was used to illustrate the proportion of drug poisonings for each respective cause of death. This comparison, shown in Figure 1, denoted the drug/alcohol induced cause and the percentage of total deaths associated with each cause. The possible causes of death were unintentional, undetermined, suicide, homicide, and all others.

The local medical examiner or coroner established the cause and manner of death, as these deaths generally fall under their jurisdiction. The cause of death was determined in accordance with NVSS guidance and submitted by completing the death certificate.[12] Specifically, the NVSS and National Association of Medical Examiners state that the best classification for manner of death in deaths due to the misuse or abuse of drugs/alcohol without any apparent intent of self-harm is 'accident.'

An initial linear regression was conducted in order to establish purpose and analyze the relationship between drug overdose rate and life expectancy for Ohio counties. The linear regression was performed via the Pearson correlation test. This relationship is depicted in Figure 2.

For all tests performed in this study, a Bonferroni adjusted significance level was set at $\alpha = 0.01$ in order to take into account the number of variables being tested, as increasing the number of variables may incorrectly trigger a significant test result.
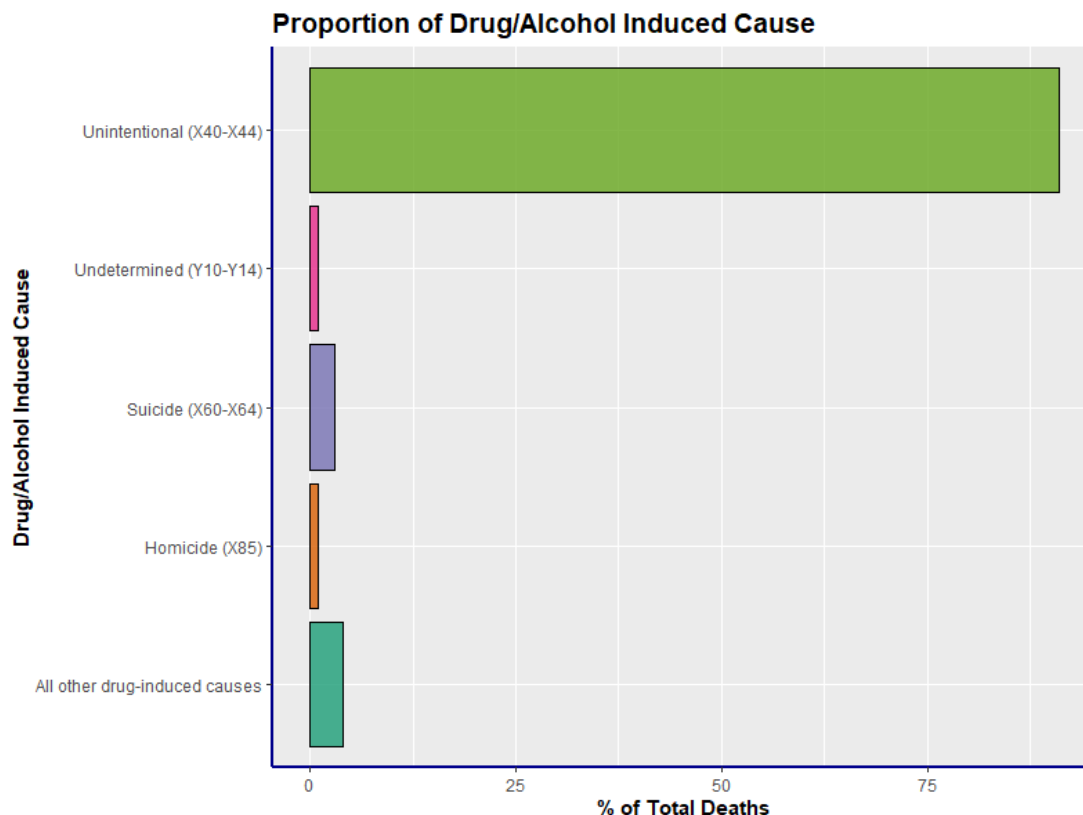

Figure 1. Proportion of Deaths Attributed to Drug/Alcohol Induced Cause for Residents in Ohio
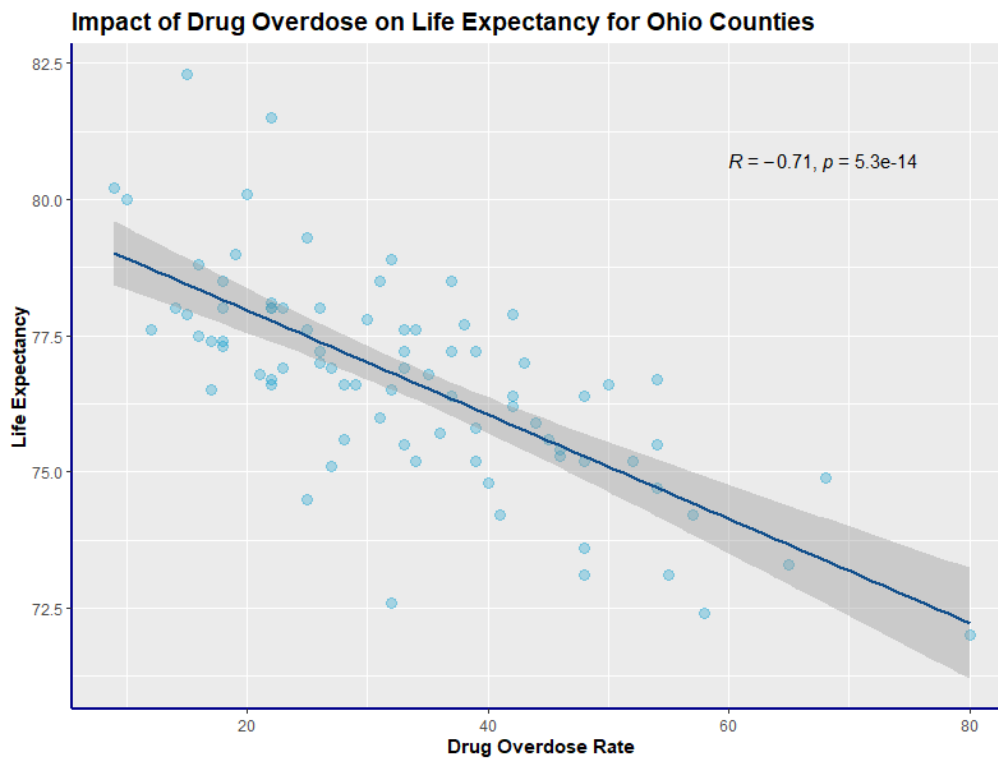
Figure 2. Relationship Between Life Expectancy and Drug Overdose Rate for Ohio Counties

A Pearson correlation test was performed between drug overdose rate and each of the following predictors: median household income, child poverty rate, unemployment rate, severe housing problems, mental distress frequency, and physical inactivity (Table 1). The median household income was transformed utilizing the log to properly scale the data. The correlation coefficient and corresponding *P* value from the Pearson correlation test was used to analyze the relationship between drug overdose rate and the examined variables.

A more in-depth analysis was conducted to determine the relationship between different health care factors (percentage of uninsured, primary care physician ratio, and preventable hospitalizations) and the log transformation of median household income for Ohio counties utilizing Pearson correlation tests (Figure 3).

A Pearson correlation test was performed between percent rural and the log transformation of median household income (Figure 4).

RESULTS

The percentage of total deaths associated with each drug/alcohol induced cause was plotted on a bar chart [Figure 1]. The vast majority of overdose deaths in Ohio from 2017-2019 are attributed to unintentional drug/alcohol overdoses (91%).

The Pearson correlation test for drug overdose rate and life expectancy was plotted [Figure 2]. The correlation test for life expectancy demonstrates a significant negative relationship (*P = 5.3e-14*, α = 0.01).

The Pearson correlation tests between drug overdose rate and median household income, child poverty rate, unemployment rate, severe housing problems, mental distress frequency, and physical inactivity were conducted; results are shown in Table 1. The relationships between drug overdose rate and each of the health-related and socioeconomic factors were significant (α = 0.01). There was a significant negative relationship between drug overdose rate and median household income. There was a significant positive relationship between drug overdose rate and child poverty rate, unemployment rate, severe housing problems, mental distress frequency, and physical inactivity.

The Pearson correlation test for the log transformation of median household income and percentage of uninsured, primary care physician ratio, and preventable hospitalizations were also plotted and are shown in Figure 3. The plots demonstrate a significant negative relationship between median household income and the variables: percentage of uninsured (R = -0.65, *P* = 1*e*-11, α = 0.01) and preventable hospitalizations (R = -0.4, *P* = 0.00012, α = 0.01). There is also a significant positive relationship between median household income and primary care physician ratio (R = 0.34, *P* = 0.0013, α = 0.01).

The Pearson correlation test for log transformed median household income and percent rural was plotted and is shown in Figure 4. The plot depicts a significant negative relationship between median household income and percent rural (R = -0.29, *P* = 0.0057, α = 0.01).

Table 1. Relationship Between Social Determinants of Health and Drug Overdose Death Rate for Ohio Counties

Pearson Correlation Coefficient with the Variable: 'Drug Overdose Rate'						
	Median household income	Child poverty rate	Unemployment rate	Severe housing problems (%)	Mental distress frequency	Physical inactivity
Drug overdose rate	-0.39	0.57	0.39	0.38	0.32	0.34
Significance level	P value < 0.001	P value < 0.001	P value < 0.001	P value < 0.001	P value < 0.01	P value < 0.01

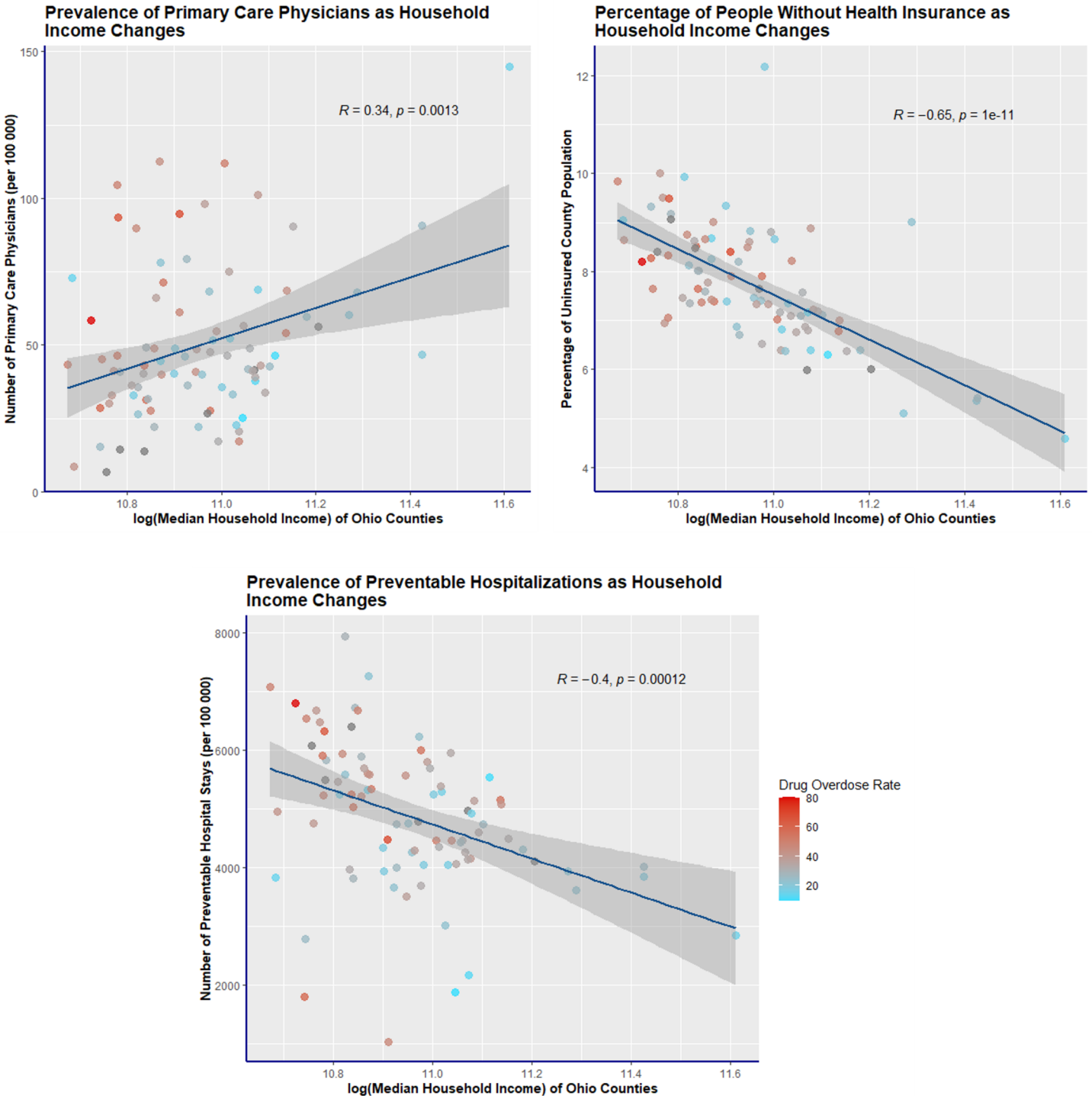Median household income underwent log transformation to satisfy normality condition.

Figure 3. Relationship Between Health Care Factors and Log Transformation of Median Household Income for Ohio Counties
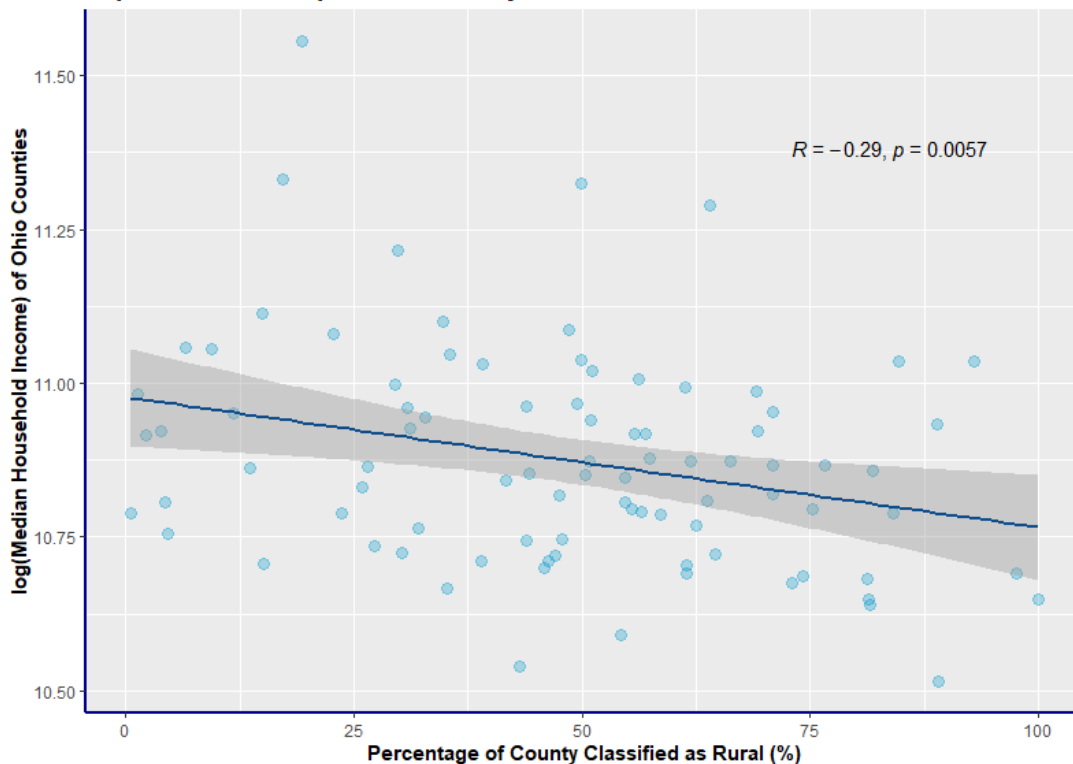
Figure 4. Relationship Between Percent Rural and Log Transformation of Median Household Income for Ohio Counties

DISCUSSION

This project sought to quantify relationships between social determinants of health and the drug overdose death rate in Ohio, with particular focus on health care as a social determinate of health. In Figure 1, it is evident that the preponderance of drug overdose deaths are attributed to unintentional causes.

Overdose deaths have a destructive effect on communities. Drug overdose deaths result in an average of 3.2 years of lost life for people in Ohio. As shown in Figure 2, the overall life expectancy for counties in Ohio is strongly correlated to the drug overdose rate. Each unit increase in the drug overdose rate (ie, an increase from a drug overdose rate of 40 to 41) is associated with -0.09564 years in life expectancy. Hence, an Ohio county with a drug overdose rate of 10 is associated with a population life expectancy of approximately 1 year lower than a county with a drug overdose rate of 0. Delaware County, for example, had the highest life expectancy rate of 82.3 years and had a drug overdose rate of 15. On the other hand, Scioto County had the lowest life expectancy of 72 years and a drug overdose rate of 80, which is 8 years of lost life associated with overdose deaths. This illustrates the profound impact of drug overdose deaths in Ohio and suggests the urgency and necessity of identifying strategies to minimize the number of accidental overdose deaths.

The hypothesis tested in this research was that underserved and under-resourced areas, indicated by selected social determinants

of health, would have higher rates of drug overdose deaths. Various socioeconomic and health care factors (median household income, child poverty rate, unemployment rate, severe housing problems, mental distress frequency, and physical inactivity) supported the hypothesis and had statistically significant relationships with the drug overdose death rate, as shown in Table 1.

These data illustrate a clear relationship between increased mental distress and higher rates of overdose deaths. This also speaks to the complex relationships among social determinants of health and mental health including substance use; exposure to adverse social determinants of health factors can elevate the level of stress experienced by individuals which can then increase their risk of substance use problems.[13]

Similarly, these data highlight the important relationship between the drug overdose death rate and socioeconomic status. Lower socioeconomic status, lower median household incomes and higher rates of child poverty, unemployment, and severe housing problems, was strongly correlated with higher rates of drug overdose deaths. This aligns with previous research using Census data that found socioeconomic status correlated with opioid overdoses.[9]

Thus, equitable access to quality and consistent health care could be another factor that corresponds with decreased rates of overdose deaths in Ohio. Figure 3 shows that household income is significantly correlated with access to health care. Lower socioeconomic status is associated with higher proportions of uninsured

population and lower ratios of primary care physicians. Lower socioeconomic status is also associated with higher rates of preventable hospital stays. For example, the average median household income is $58 037.75 for Ohio counties. Delaware County has a median household income of $110 252 and Scioto County has a median household income of $45 410. Delaware County consistently places in the top quartile for factors indicating access to quality health care. However, Scioto County places in the bottom quartile for these same factors. Hence, the disparities in household income imply that communities of lower socioeconomic status may lack adequate access to quality care and suffer from increased drug overdose deaths.

Enhancing the coverage and quality of health care may help mitigate these inequities and ultimately help stop the overdose epidemic. As depicted in Figure 4, a higher rural population density is correlated to lower median household income for Ohio counties. Therefore, these data emphasize the need to implement policies that direct aid and support to under-resourced communities, especially in rural and low-income areas.

One limitation of this analysis was that the selected variables were compiled from existing data. Further research studies that better select variables, including newly developed variables which focus on individuals' identified barriers to health and wellness, can enhance understanding on this topic. One potential way to identify these factors is by interviewing patients to determine what factors they perceive to be the greatest barriers to receiving quality health care.

PUBLIC HEALTH IMPLICATIONS

These results suggest the value of both specific strategies to focus on drug overdose rates and behaviors and broader strategies to address some of the contextual circumstances which exacerbate opioid use. These data established that areas that have lower socioeconomic status are more susceptible to higher rates of drug overdose deaths. Furthermore, it is known that minority and lower socioeconomic communities face many barriers that inhibit them from receiving consistent and quality health care.[14] Increasing funding to mobile care units and preexisting organizations such as Project DAWN,[15] which is an organization that distributes naloxone and provides training to prevent opioid overdose, could help remove some barriers to receiving lifesaving care and resources.

One proposed solution to specifically target the drug overdose rate is to implement supervised injection services. Studies have shown that supervised injection services promote safer injection conditions, enhance access to primary health care, and reducing the overdose frequency.[16] Moreover, the data do not suggest that supervised injection services increase drug injecting, drug trafficking, or crime in the surrounding community.[8] Hence, supervised injection services may provide a safe environment in which people most susceptible to drug overdoses can receive the help and care they need and deserve.

From a broader view, the data exemplify the importance of access to quality health care professionals in response to the drug overdose epidemic for the entire state of Ohio. Thus, enhancing services in these areas by hiring and allocating more health care professionals and resources could help in this fight against the drug overdose epidemic. Having incentive programs for physicians to practice in rural areas, such as loan forgiveness programs, may increase accessibility of care and help decrease the drug overdose rate.

The correlation between mental distress and overdose rates should urge policymakers to advocate for increased support systems, such as crisis help lines, and quality mental health providers. In conclusion, having a targeted response to lower socioeconomic and rural communities in Ohio should be a top priority for policymakers and public health officials.

REFERENCES

1. Stats of the state of Ohio. Centers for Disease Control and Prevention. Published 2019. Accessed December 30, 2021.
   https://www.cdc.gov/nchs/pressroom/states/ohio/ohio.htm

2. Drug overdose mortality by state. Centers for Disease Control and Prevention. Published March 1, 2022. Accessed January 4, 2023.
   https://www.cdc.gov/nchs/pressroom/sosmap/drug_poisoning_mortality/drug_poisoning.htm

3. Gomes T, Tadrous M, Mamdani MM, Paterson JM, Juurlink DN. The burden of opioid-related mortality in the United States. *JAMA Netw Open.* 2018;1(2), e 180217.
   https://doi.org/10.1001/jamanetworkopen.2018.0217

4. Zuckerman J. New data: fatal overdoses leapt 22% in Ohio last year. Ohio Capital Journal. Published July 15, 2021. Accessed February 1, 2022.
   https://ohiocapitaljournal.com/2021/07/15/new-data-fatal-overdoses-leapt-22-in-ohio-last-year/

5. Sullican L. Record surges in opioid overdoses prompts AG Yost to urge vigilance. Ohio Attorney General Dave Yost. Ohio Attorney General. Published January 11, 2021. Accessed January 21, 2022.
   https://www.ohioattorneygeneral.gov/Media/News-Releases/January-2021/Record-Surges-in-Opioid-Overdoses-Prompts-AG-Yost

6. Health Policy Institute of Ohio. OSU study: opioid epidemic costs Ohio up to $8.8 billion a year. Ohio Academy of Family Physicians. Published 2017. Accessed December 27, 2021.
   https://www.ohioafp.org/wfmu-article/osu-study-opioid-epidemic-costs-ohio-up-to-8-8-billion-a-year/

7. US Department of Labor awards $2.8M in funding to provide employment, training services to combat Ohio's opioid crisis. United States Department of Labor. Published March 21, 2022. Accessed January 7, 2023.
   https://www.dol.gov/newsroom/releases/eta/eta20220321#:~:text=In%20October%202017%2C%20the%20Department,crisis%20a%20public%20health%20emergency

8. Currie JM, Schnell MK, Schwandt H, Zhang J. Trends in drug overdose mortality in Ohio during the first 7 months of the COVID-19 pandemic.

JAMA Netw Open. 2021;4(4).
https://doi.org/10.1001/jamanetworkopen.2021.7112

9. Park C, Crawford S, Lopez R, et al. Opioid overdose in Ohio: comprehensive analysis of associated socioeconomic factors. *medRxiv.* 2019.
https://doi.org/10.1101/19005140

10. County health rankings & roadmaps. University of Wisconsin Population Health Institute. Published 2021. Accessed December 28, 2021.
https://www.countyhealthrankings.org/app/ohio/2021/overview

11. CDC WONDER. Centers for Disease Control and Prevention. Published 2022. Accessed December 28, 2021.
https://wonder.cdc.gov/

12. Vital statistics reporting guidance. A reference guide for completing the death certificate for drug toxicity deaths. Centers for Disease Control and Prevention. Published May 2019. Accessed January 6, 2023.
https://www.cdc.gov/nchs/data/nvss/vsrg/vsrg02-508.pdf

13. Allen J, Balfour R, Bell R, Marmot M. Social determinants of mental health. *Int Rev Psychiatry.* 2014;26(4):392-407.
https://doi.org/10.3109/09540261.2014.928270

14. Merzel C. Gender differences in health care access indicators in an urban, low-income community. *Am J Public Health.* 2000;90(6):837-989.
https://doi.org/10.2105/ajph.90.6.909

15. Project DAWN. Ohio Department of Health. Accessed February 8, 2023.
https://odh.ohio.gov/know-our-programs/violence-injury-prevention-program/projectdawn/

16. Potier C, Laprévote V, Dubois-Arber F, Cottencin O, Rolland B. Supervised injection services: what has been demonstrated? a systematic literature review. *Drug Alcohol Depend.* 2014; 145:48-68.
https:// doi.org/10.1016/j.drugalcdep.2014.10.012

RESEARCH ARTICLE

Ohio Health Care Professionals' Survey: Work and Home Stressors During the COVID-19 Pandemic

Rebecca J. McCloskey[1]; Lily Goldberg[1]; Robert Santucci[1]; Justin Koralewski[1]; Michael J. Kocinski II[1]; Gretchen Clark Hammond[1]

[1]Mighty Crow Media, LLC, Columbus, OH

Corresponding Author: Rebecca J. McCloskey, 11 Cooke Road, Columbus, OH 43214, (973) 876-4283, rebecca@mightycrow.com

ABSTRACT

Background: The COVID-19 pandemic brought unparalleled strain to the United States' already overburdened health care workforce, and research is just beginning to shed light on its effects. This study sought to document health care provider stressors during the pandemic to inform prevention and intervention strategies to better support their well-being.

Methods: A one-time online survey was completed in July and August 2021 by Ohio health care professionals employed during the COVID-19 pandemic. We assessed for work and employment status changes and measured the severity of various work and home stressors among respondents who worked during the COVID-19 pandemic (N = 12 807).

Results: Over a quarter of respondents had a change in work setting, and 59% had an increase in their workload; 20% of respondents were furloughed, laid off, or unemployed at some point during the COVID-19 pandemic. Over 37% reported a negative financial impact. The work stressors causing the greatest concern were spreading the virus and insufficient communication from leadership. The primary home stressors were a lack of quality time with family and friends, being too tired when home from work to cook, do chores, etc, and being a supportive, present parent. At least half of the sample scored each of these as moderate, significant, or extreme stressors.

Conclusion: The COVID-19 pandemic caused unrelenting stress affecting Ohio health care professionals at work and at home. Prevention and early intervention programs and public policies are required to prevent burnout and better support health care worker well-being.

Keywords: Health personnel; Occupational stress; Psychological stress; Psychological burnout; COVID-19

INTRODUCTION

The COVID-19 pandemic caused severe and unforeseen strain to populations and health care systems across the globe. Health care professionals have unique experiences and stressors given their varying degrees of proximity to caring for patients infected by the virus. While there have been innumerous anecdotes about the negative effects and stressors caused by COVID-19 on health care professionals, research is just beginning to determine the extent on a broader scale.

Health care professionals have reported high levels of stress related to concerns about infecting others with COVID-19 while also managing limited supplies of personal protective equipment (PPE) and inadequate staffing.[1] Additional documented stressors included emotional exhaustion and fatigue, staff shortages, and the uncertainty surrounding how long it would take to get the pandemic under control.[2] Further, stress and anxiety surrounding the pandemic, how to care for patients, and how to keep healthy were widespread among health care workers, whether doing direct patient care or not. Interestingly, while some research shows that frontline health care workers had more stress and negative outcomes during the pandemic, other studies found that they fared better.[3] This may be explained by potentially greater preparation among frontline staff (in terms of emotional and cognitive processes as well as concrete preparation in terms of possessing needed supplies and previously established training, policies, and procedures) for other health care crises.

Recent research local to Ohio includes a study of 785 Indiana-based physicians and administrators, 76% of whom reported significantly higher levels of stress during the pandemic.[4] Primary stressors included fear of spreading the virus to their family members (82%), meeting productivity goals (65%), and potential salary reductions or furloughs (59%), while more than half reported having sufficient PPE. When assessing some symptoms of stress, researchers documented significant increases in participants' reports of exhaustion, sleep problems, and anxiety.

In contrast, Northeast Ohio health care workers reported moderately high levels of well-being during the pandemic—perhaps higher than expected.[5] A closer look at the data showed significant gender differences whereby males reported higher overall well-being, more hours of exercise, and decreased emotional concerns and tobacco use compared to females; but males also reported less positive thinking, more physical concerns, less social support, and more alcohol consumption than females.

In a similar approach, we surveyed Ohio health care professionals in July and August 2021 (N = 13 532) to gain a better understanding of the impact of the COVID-19 pandemic on their employment, finances, well-being, and stressors in the workplace and the home. Prior to this survey there had not been an examination of these factors across a broad range of health care related disciplines in Ohio. Whereas much previous research has focused on the experiences of nurses and physicians, this study expanded its reach to collect data from other licensed health care professionals as well, including but not limited to social workers, counselors, pharmacists, chiropractors, physical therapists, and chemical dependency professionals.

Three research questions guided the current study: (1) how were Ohio health care professionals' employment and financial status affected by the COVID-19 pandemic, (2) what were the work-related experiences and stressors of Ohio health care professionals during the COVID-19 pandemic, and (3) what were the home-related experiences and stressors of Ohio health care professionals during the COVID-19 pandemic.

METHODS

Setting

In 2021, the Ohio Physicians Health Program, Inc. (OhioPHP), a nonprofit organization focused on advancing the health and well-being of health care professionals to improve patient care and safety,[6] received a grant from the Federation of State Medical Boards Foundation to facilitate increased understanding of the influence of the pandemic on Ohio health care workers' stress to improve health care providers' well-being and patient outcomes. The OhioPHP commissioned a Central Ohio-based professional services firm with research and evaluation expertise in the areas of public health and human services to conduct an online survey and analyze the results.

Design

The OhioPHP and the evaluation firm co-created the COVID-19 survey for health care professionals. The survey, shown in the Appendix, consisted of 61 questions (56 multiple choice; 5 open-ended) developed after completing a literature review on health care specific workplace stressors, symptoms of burnout, and related tools. Questions specific to the COVID-19 pandemic were also added (eg, stressors related to spreading the virus, availability of personal protective equipment (PPE), and concerns about homeschooling). OhioPHP's senior staff, its full board of directors, and medical director served as expert reviewers and beta tested and approved the survey before launch. The board consists of physicians, counselors, veterinarians, lawyers, and other health care professionals. Survey modifications were based on their recommendations. In addition to the focus on content, instrument length (as to not overburden respondents), ordering of items, and item clarity were also considered to increase survey validity.[7] The survey was administered through an online survey platform.

Participants

The population of interest for the survey included Ohio health care professionals who belonged to the 13 OhioPHP licensing boards (Appendix, question 2), representing a wide range of license types and including chiropractors, psychologists, physical and occupational therapists, and various types of dental, veterinary, vision, medical, nursing, social work, counseling, and chemical dependency professionals. The State Board of Emergency Medical, Fire, and Transportation Services was the only board to not participate as members' contact information are not publicly available as with other licenses. Some participants were dually licensed across more than one board. These individuals were instructed to complete the survey just once, using their primary license and identifying as a member of the corresponding board.

Due to differences and limitations in record keeping across the licensing boards, the exact population size of the Ohio health care professionals licensed by OhioPHP affiliated boards is unknown. However, OhioPHP records show that 490 707 emails were delivered to licensees inviting them to participate in the survey. Using this value as a proxy for the population, the survey response rate was 2.76%.

Procedures

The OhioPHP completed a public records request to obtain health care professionals' emails from each licensing board and distributed the survey link via email. Additionally, many membership associations promoted the survey to their members. The email linked interested participants to an informed consent screen. Acknowledgment of participant rights, risks, benefits, and commencement of the survey served as confirmation of consent. The survey was conducted between July and August 2021, and 2 email reminders were sent after the initial invitation. The survey took approximately 15 minutes to complete.

Measures/Outcomes

For the purposes of this study, outcomes of interest relative to the experience of working during the COVID-19 pandemic were organized under the following categories: (1) work changes and employment and financial impact; (2) work experiences and stressors; and (3) home stressors. Employment status was established using the number of participants who reported being furloughed (temporary, unpaid time off, but still employed), laid off (temporary or permanent time off, no longer employed), and/or unemployed for any reason during the pandemic or not. Financial impact was determined by the number of participants who said they were negatively impacted financially because of furlough, forced time off, pay reduction, or other reason. Respondents were able to choose multiple responses. Work experiences included changes in work setting and workload. Participants were asked to rate all stressors on an ordinal scale: 0 (not a stressor); 1 (minimal stressor); 2 (moderate stressor); 3 (significant stressor); 4 (extreme stressor). Not applicable (NA) was also a response option.

The 10 work stressors included concern of spreading COVID-19; insufficient communication from leadership; insufficient PPE; working too many hours; job security/employment status; insufficient training; distress about how to effectively treat COVID-19 patients; inappropriate role designation; working at a new location; and witnessing a high number of deaths. The 9 home stressors were being too tired when home to cook, do chores, etc; loneliness; financial stress; worry and/or guilt about infecting household members; taking stress out on family/friends; lack of quality time with family/friends; family/friends not understanding the stress participants were under; inconsistent work hours/coordinating schedules; and other family members having to take over responsibilities. An additional 4 stressors were asked of participants who said they had children living at home: being able to support children/being a present parent; lacking quality time with children; homeschooling; and childcare. Additionally, basic demographic data were collected categorically: licensing board affiliation, gender, age, race and ethnicity; annual household income; and whether individuals provided direct COVID-19 patient care.

Statistical Analysis

Data were cleaned and analyzed using IBM SPSS Statistics (Version 28).[8] Duplicate surveys were identified where responses matched on every demographic variable, starting with the computer's IP address. Cases were then reviewed manually to confirm. In total, 66 cases were removed from the dataset (less than 0.4% of cases). A final sample of 12 807, inclusive of those who reported working at some point during the pandemic, was used for analysis in this study.

Missing data ranged from 0.38% to 5.63% on variables of interest. Univariate descriptive statistics (eg, frequencies, percentages, median values) and tables were used to communicate highlights and trends in the data and allow for visual comparison across variables. Median values were reported instead of the mean as the ordinal responses were not normally distributed, stood alone, and were not part of a scale.[9]

RESULTS

Participants' demographic data are provided in Table 1. Most identified as female (76.69%) and White (89.99%). Over two-thirds (69.71%) were between the ages of 35 and 64 years. Nearly half (47.72%) reported having children who lived with them at home. The largest number of participants were from the Ohio Board of Nursing, followed by the State Medical Board of Ohio. Respondents averaged 18.67 years of work experience (SD = 12.49) and just less than half (46.90%) reported being directly involved in COVID-19 patient care.

Changes in work, employment status, and financial status are detailed in Table 2. Over a quarter reported a change in work setting (eg, from in-person to remote work, partially remote, or relocation from department). Over three-quarters had a change in workload. While 17.56% reported a decrease in workload, 58.98% had an increase or significant increase in workload. Nearly one-fifth of the sample (19.97%) lost a job and over one-third (37.24%) were negatively impacted financially during the pandemic. In addition to those who reported financial strain via furlough, forced time off, and/or a reduction in pay, another 7.06% submitted "other" reasons including partners' loss of income, having to care for family members who were unable to work, and leaving employment due to stress or fear of becoming ill.

Table 3 provides the median values for the top work and home stressors and the percentage of the sample who identified the stressor as significant or extreme. Among work stressors, concerns of spreading COVID-19 caused the highest levels of stress followed by insufficient communication from leadership (both had a median score of 2 (moderate stressor). Concerns about spreading the virus were a significant or extreme stressor for 41.23% of the sample and insufficient communication was a significant or extreme stressor for 28.64%. Insufficient PPE and working too many hours were the next highest reported work stressors. Over 25% of individuals also reported that insufficient PPE and working too many hours were significant or extreme stressors. The 2 work stressors causing the lowest levels of stress were inappropriate role designation and working at a new location. Lack of quality time with family and friends (38.71%), being too tired when home from work to cook, do chores, etc (33.71%), and family and friends not understanding the stress individuals were experiencing represented the most frequently reported significant and extreme home stressors; they all had a median of 2. The 2 top stressors among respondents with children were being able to support children/being a present parent (32.36%) and lack of quality time with children (30.98%). Other significant and extreme home and child-related stressors accounting for more than 25% of the sample included worry and/or guilt about infecting household members, taking stress out on family and friends, and

Table 1. Sample Demographics (N = 12 807)

Characteristic	n (%)
Age category in years	
18–24	161 (1.26)
25-34	2038 (15.91)
35-44	2933 (22.90)
45-54	2952 (23.05)
55-64	3043 (23.76)
65 and older	1412 (11.03)
Prefer not to answer	158 (1.23)
Missing	110 (0.86)
Gender	
Female	9822 (76.69)
Male	2572 (20.08)
Other	21 (0.16)
Prefer not to answer	180 (1.41)
Missing	212 (1.66)
Race and ethnicity[a]	
American Indian or Alaskan Native	182 (1.42)
Asian	190 (2.26)
Black or African American	696 (5.43)
Hispanic or Latino	231 (1.80)
Native Hawaiian or Pacific Islander	41 (0.32)
White	11 525 (89.99)
Other	140 (1.09)
Annual household income	
Below $20 000	230 (1.80)
$20 000-$40 000	1226 (9.57)
$40 001-$80 000	3407 (26.60)
$80 001-$120 000	2899 (22.64)
Above $120 000	3858 (30.12)
Prefer not to answer	1078 (8.42)
Missing	109 (0.85)
Professional board	
Ohio State Chiropractic Board	61 (0.48)
Ohio State Dental Board	452 (3.53)
Ohio Veterinary Medical Licensing Board	582 (4.54)
Ohio Vision Professionals Board	150 (1.17)
State Medical Board of Ohio	2661 (20.78)
Ohio Board of Nursing	3982 (31.09)
Ohio Board of Pharmacy	1417 (11.06)
Ohio Counselor, Social Worker, and Marriage and Family Therapist Board	1234 (9.64)
Ohio Occupational Therapy, Physical Therapy, and Athletic Trainers Board	1099 (8.58)
Ohio State Board of Psychology	126 (0.98)
Ohio Speech and Hearing Professionals Board	242 (1.89)
Ohio Chemical Dependency Professionals Board	552 (4.31)
Other	27 (0.21)
Missing	222 (1.73)
Years of experience	
0–5	2068 (16.15)
6–10	2287 (17.86)
11–15	1788 (13.96)
16–20	1518 (11.85)
21–25	1373 (10.72)
26–30	1284 (10.03)
31 or more	2440 (19.05)
Missing	49 (0.38)

[a] Participants could choose multiple responses.

homeschooling. The 2 home stressors causing the lowest levels of stress were needing other family members to take over one's responsibilities and financial stress. When summarizing work and home stressors together, over 50% of the sample ranked spreading the virus; insufficient communication from leadership; a lack of quality time with family and friends; being too tired when home from work to cook, do chores, etc; and being a supportive, present parent as a moderate, significant, or extreme stressor.

DISCUSSION

In this study, we examined Ohio health care professionals' employment and financial status, and work and home-related stressors during the COVID-19 pandemic. More than half of Ohio's health care professionals maintained employment and reported no negative financial impact. However, experiencing numerous work and home stressors simultaneously were very common. This is especially noteworthy as half the sample reported not providing direct COVID-19 patient care.

Study results point to a contrast between a smaller group of health care professionals who reported job loss or insecurity (ie, decreased hours, furlough) and a larger group who reported substantial increases in their workloads. Generally speaking, health care layoffs were common during the pandemic as revenue was dramatically reduced when nonemergency health care was placed on hold and patients were hesitant to seek care even when it was available.[10] Additionally, a recent scoping review documented financial insecurity related to pandemic salary reductions, furloughs, and unemployment among health care providers as a major stressor.[11] Contradicting much of the literature, furloughs, pay reductions, and financial insecurity were not commonly experienced by our sample. On the other hand, heavy workloads during the pandemic have been identified as a common cause of stress, burnout symptoms, and feeling generally overwhelmed for many providers worldwide.[12] This finding was validated by our sample as workload increases were widespread and working too many hours was identified a top stressor. In preparing for future public health emergencies, strategies for offering unemployed or furloughed health care workers reassignment from nonessential services to areas in increased demand for providers should be considered.

In this study, the top work-related stressors were related to issues of basic safety. Concern about spreading the virus, insufficient PPE, and insufficient communication from leadership relate to protecting oneself and others and feeling supported by those in positions of power. Similar safety concerns (eg, resource adequacy and getting/spreading COVID-19) have been documented in the literature and may be particularly important to women in health care.[13] Other research has shown that steady communication from leadership, in terms of providing acknowledgement of challenges, gratitude, support, and/or sharing good quality organizational information and updates on safety protocols, is fundamental to reduce workers' stress and anxiety.[14,15] Basic safety and

Table 2. Work Changes, Employment Status, Financial Status (N = 12 807)

Work changes[a]	n (%)
Change in work setting	3531 (27.76)
Change in workload	9802 (76.54)
Significant increase	4052 (31.64)
Increase	3502 (27.34)
Neutral	2855 (22.29)
Decrease	1521 (11.88)
Significant decrease	727 (5.68)
Not applicable	77 (0.60)
Missing	73 (0.57)
Employment status	
Lost job during pandemic[a]	2557 (19.97)
Furloughed	1165 (9.10)
Laid off	498 (3.89)
Unemployed	1222 (9.54)
None of the above	10 210 (79.72)
Missing	40 (0.31)
Financial status	
Negative financial impact[a]	4769 (37.24)
Furloughed	849 (6.63)
Forced time off	1897 (14.81)
Pay reduction	1846 (14.41)
Other	904 (7.06)
None of the above	7702 (60.14)
Missing	336 (2.62)

[a] Participants could choose multiple responses.

clear communication are, first and foremost, required for health care provider well-being and, secondarily, are needed to ensure good patient care.

Home stressors were also present for most respondents during the pandemic, and some were considered more severe than those specific to work. There was an inherent conflict between the desire to keep family and friends safe (ie, by not spreading the virus)

and wanting to spend quality time with loved ones. Similarly, other researchers have also documented health care providers' struggles related to work-life balance, the fear of exposing family, feeling emotionally exhausted, and neglecting personal and family needs.[2,16,17] In our study, health care workers wanted more quality time with family and friends, yet were tired and also felt that family and friends misunderstood the stress they were under at work. In an extension of these findings, a scoping review of health care workers' pandemic experiences summarized that for some, social and emotional connectedness to others served as a support, reduced anxiety, and provided encouragement for their work; for others; it was potentially harmful when family and friends rejected or stigmatized them out of fear that they would transmit the virus due to their increased exposure.[18] It is important not to overlook the effect of home stressors on health care providers at work and how home and work stressors can exacerbate one another, particularly during an unrelenting pandemic.

Furthermore, study results show that health care professionals who were also parents carried additional psychological and logistical burdens. Respondents were concerned about not spending enough quality time with their children and challenged by navigating their learning needs. In a study of health care workers in Turkey who were also parents, parenting stress during COVID-19 was highest for those who had a school-aged child and for those with multiple children.[19] Similarly, Canadian health care workers were strained by trying to work while having school-aged children whose education moved back and forth between in-person and virtual learning, and/or when children had to unexpectedly stay home because of exposure or required testing to rule out infection.[20]

Limitations

Limitations of the study include the use of a convenience sample and a very low response rate which precluded the generalization of the findings to the larger population of health care providers in Ohio. However, respondents were fairly representative of what we

Table 3. Top COVID-19 Pandemic Work and Home Stressors

Stressor	n	Median[a]	Significant or Extreme %
Work			
Spreading COVID-19	12 715	2	41.23%
Insufficient communication	12 571	2	28.65%
Insufficient personal protective equipment (PPE)	12 551	1	28.01%
Too many hours	12 420	1	27.28%
Home			
Lack of quality time with family/friends	12 496	2	38.71%
Too tired	12 724	2	33.17%
Family/friends don't understand the stress	12 446	2	31.81%
Children			
Being a supportive/present parent	6078	2	32.36%
Lack of quality time with children	6049	2	30.98%

[a] Scored on a 0 (not a stressor) to 4 (extreme stressor) scale.

know about the health care professional demographic in Ohio, which is heavily White and female.[21,22] Additionally, the survey was cross-sectional and represents just one snapshot of experiences in time. It is likely that health care professionals may have rated the severity of stressors differently at other points during the pandemic. While the work and home stressors of interest in the study were compiled based on a literature search, it is possible that other stressors that were not included in our survey impacted individuals.

PUBLIC HEALTH IMPLICATIONS

This research study adds to the growing knowledge base about the impact of the COVID-19 pandemic on health care professionals and provides a glimpse into stressors affecting those in Ohio. Numerous preexisting stressors worsened, and others were brought to light. An application of the findings about work and home experiences and stressors has implications for individual health care workers, workplaces, professional organizations, and public policy. By preventing and ameliorating stressors and bolstering the mental health and well-being of health care workers, we can prevent burnout and improve patient safety and quality of care.

The literature is rich with individual-focused, self-care practices for health care workers to reduce stress and improve overall well-being. Good sleep, hygiene, exercise, mindfulness meditation, and cognitive behavioral therapy have shown effectiveness in reducing stress and burnout and improving psychological wellness for diverse populations, including health care professionals.[23-25] The problem, however, is that many health care professionals do not utilize self-care activities because of lack of time and fatigue (both identified as prominent workplace stressors through our survey) and a lack of institutional support during work hours for these practices.[26,27] Health care leadership and professional organizations need to model these behaviors, facilitate cultures that encourage self-care, and integrate regular opportunities for self-care during the workday.[28]

In situations where burnout and mental health symptoms are severe, intervention beyond self-care may be required. In Ohio, a new tool has been introduced by the Ohio State Medical Association in partnership with OhioPHP to provide licensed health care professionals and students in the state with a free, fast, and confidential way to be screened and referred for emotional support. Through the Well-Being CARE (WellBeingCARE.org) service, health care professionals can anonymously complete a brief online screening and receive personalized recommendations from licensed mental health providers for local resources, including online and telehealth options.[29]

While individual-level interventions are crucial, they remain inadequate to address the widespread stress affecting health care workers in general and, particularly, during a pandemic. Various intraorganizational changes are also needed. As insufficient communication at the workplace was a noteworthy stressor in our study, facilitating effective internal communication is important to

decrease stress among workers, in addition to improving efficiency and effectiveness.[15,30] Additionally, an easy to implement activity such as having hospital leaders provide daily COVID-19 updates can reduce workers' stress.[2] Health care workers desire rationales for protocol changes and inclusion in decision-making processes, and a lack of clear communication and collaboration between clinical and administrative staff can contribute to stress and burnout.[18]

Other research-based recommendations for improving intraorganizational support and reducing stress for health care workers includes making time for camaraderie, developing a culture of teamwork, and providing recognition in terms of personal acknowledgement and financial remuneration.[2,16] Building social support resources in the workplace via interprofessional health care teams, the creation of shared spaces and opportunities to discuss stressful issues, and the development of an inclusive, organizational culture can combat feelings of isolation and symptoms of stress and burnout.[31] Such activities may have also provided validation to the many study respondents who reported that their stress was misunderstood by family and friends. Furthermore, research suggests that social integration and support are stress buffering and bolster the immune system, reducing the susceptivity to viruses like COVID-19.[32,33]

Developing peer-driven support networks within organizations may also be helpful in reducing stress and supporting health care worker well-being.[34] One program originating from Johns Hopkins University, Resilience in Stressful Events (RISE), emerged from staff requests and trains employees to give confidential support to each other surrounding stressful events to decrease the risk of burnout, self-doubt, and negative thoughts affecting health care workers.[35] The RISE program, which has been replicated by over 30 hospitals in the United States, has shown promising effects. Nurses who used RISE reported being more resilient than those who had not used the program, 65% felt better after utilizing it, and 80% of nurse leaders found that it created a safe and nonjudgmental space to discuss job concerns.[36] A similar program called YOU Matter has been employed at Nationwide Children's Hospital (NCH) in Columbus, Ohio. Since 2013, NCH has been training staff peers and offering individual and group support which is now available 24 hours a day.[37] Moreover, NCH has provided guidance to over 35 hospitals to initiate their own programs.[38] These strategies and others may be further supported by the appointment of leadership whose sole purpose is to promote a healthy workplace culture and ensure staff well-being. In 2011, The Ohio State University was the first university in the United States to hire a chief wellness officer and has since shown positive returns on the investment in terms of health care spending, morale, and job and patient satisfaction.[39]

Lastly, there is a weighty role for public policy in increasing support for health care worker well-being. This would require a shift from chiefly focusing on treatment and intervention post-exposure to an emphasis on public health and prevention. Policies

should incorporate flexible schedules to support workers' personal needs and ensure that individuals who must stay home when they are sick do not have to fear job loss or loss of income.[40] Since the COVID-19 pandemic, health care workers have been advocating for clear and strengthened policies regarding evidence-based guidelines for staff testing, infection prevention, illness and return to work protocols, and protected time for breaks at work and time away from work.[41] Pandemic-related policy changes should also consider placing limitations on hours worked, allowing for additional paid time off, hazard pay, safeguarding adequate staffing and patient-clinician ratios, and funding best practices and clearinghouses focused on health care worker well-being.[42] Such policies may help reduce or remove the primary stressors of spreading illness, inadequate PPE, insufficient communication from leadership, and working too many hours as identified by workers in the current study.

Conclusion

As the peak period of the COVID-19 pandemic appears to be behind us, time has come to examine its longer-term sequela which include the psychological burden of Ohio's health care professionals. As expected, Ohio health care workers' stress was magnified at work and at home during the pandemic. These stressors are important to monitor as they can lead to burnout and physical and mental health problems. Furthermore, if left unaddressed they can negatively impact patient care and result in resignation from the health care workforce. Supporting health care professionals' well-being through interventions at all levels (eg, individual, interpersonal, community, organizational) is vital for individual and population health now as well as for preparing for the next pandemic.

ACKNOWLEDGMENTS

REFERENCES

1. Kleinpell R, Doersam JK, Raman R. Clinicians report high stress in COVID-19 response. *Critical Connections Blog*. May 5, 2020. Accessed May 31, 2022. https://sccm.org/Blog/May-2020/SCCM-COVID-19-Rapid-Cycle-Survey-2-Report

2. Rose S, Hartnett J, Pillai S. Healthcare worker's emotions, perceived stressors and coping mechanisms during the COVID-19 pandemic. *PLoS One*. 2021;16(7):e0254252. https://doi.org/10.1371/journal.pone.0254252

3. Shreffler J, Petrey J, Huecker M. The impact of COVID-19 on healthcare worker wellness: a scoping review. *West J Emerg Med*. 2020;21 (5):1059-1066. https://doi.org/10.5811/westjem.2020.7.48684

4. Huffman EM, Athanasiadis DI, Anton NE, et al. How resilient is your team? Exploring healthcare providers' well-being during the COVID-19 pandemic. *Am J Surg*. 2021;221(2):277-284. https://doi.org/10.1016/j.amjsurg.2020.09.005

5. Dyer NL, Adan F, Barnett T, Dusek JA. Assessment of healthcare professionals' wellbeing during a peak of the COVID-19 pandemic in a healthcare system in Ohio. *Glob Adv Health Med*. 2022;11:2164957X221089258. https://doi.org/10.1177/2164957X221089258

6. About. The Ohio Physicians Health Program, Inc. (OhioPHP). Accessed March 23, 2002. https://www.ophp.org/about

7. Cobern W, Adams B. Establishing survey validity: a practical guide. *Int J Assess Tools in Educ*. 2020;7(3):404-419. https://doi.org/10.21449/ijate.781366

8. IBM SPSS Statistics for Mac [Computer software]. Version 28.0. Armonk, NY: IBM Corp; 2020.

9. Sullivan GM, Artino AR Jr. Analyzing and interpreting data from Likert-type scales data. *J Grad Med Educ*. 2013;5(4):541-542. https://doi.org/10.4300/JGME-5-4-18

10. Khullar D, Bond AM, Schpero WL. COVID-19 and the financial health of US hospitals. *JAMA*. 2020;323(21):2127-2128. https://doi.org/10.1001/jama.2020.6269

11. Franklin P, Gkiouleka A. A scoping review of psychosocial risks to health workers during the COVID-19 pandemic. *Int J Environ Res Public Health*. 2021;18(5):2453. https://doi.org/10.3390/ijerph18052453

12. Koontalay A, Suksatan W, Prabsangob K, Sadang JM. Healthcare workers' burdens during the COVID-19 pandemic: a qualitative systematic review. *J Multidiscip Healthc*. 2021;14:3015-3025. https://doi.org/10.2147/JMDH.S330041

13. Sriharan A, Ratnapalan S, Tricco AC, Lupea D. Women in healthcare experiencing occupational stress and burnout during COVID-19: a rapid review. *BMJ Open*. 2021;11(4):e048861. https://doi.org/10.1136/bmjopen-2021-048861

14. Ayyala RS, Taylor GA, Callahan MJ. Stresses and anxieties in the time of the COVID-19 pandemic — what we can learn. *Pediatr Radiol* 2020;50 (80):1052–1054. https://doi.org/10.1007/s00247-020-04727-9

15. Shanafelt T, Ripp J, Trockel M. Understanding and addressing sources of anxiety among health care professionals during the COVID-19 pandemic. *JAMA*. 2020;323(21):2133-2134. https://doi.org/10.1001/jama.2020.5893

16. Norful AA, Rosenfeld A, Schroeder K, Travers JL, Aliyu S. Primary drivers and psychological manifestations of stress in frontline healthcare workforce during the initial COVID-19 outbreak in the United States. *Gen Hosp Psychiatry*, 2021;69:20-26. https://doi.org/10.1016/j.genhosppsych.2021.01.001

17. Raudenská J, Steinerová V, Javůrková A, et al. Occupational burnout syndrome and post-traumatic stress among healthcare professionals during the novel coronavirus disease 2019 (COVID-19) pandemic. *Best Pract Res Clin Anaesthesiol*. 2020;34(3):553-560. https://doi.org/10.1016/j.bpa.2020.07.008

18. Chemali S, Mari-Sáez A, El Bcheraoui C, Weishaar H. Health care workers' experiences during the COVID-19 pandemic: a scoping review. *Hum Resour Health*. 2022;20(1):27. https://doi.org/10.1186/s12960-022-00724-1

19. Çakmak G, Öztürk ZA. Being both a parent and a healthcare worker in the pandemic: who could be exhausted more? *Healthcare*. 2021;9 (5):564.
    https://doi.org/10.3390/healthcare9050564

20. Maunder RG, Heeney ND, Kiss A, et al. Psychological impact of the COVID-19 pandemic on hospital workers over time: relationship to occupational role, living with children and elders, and modifiable factors. *Gen Hosp Psychiatry*. 2021;71:88-94.
    https://doi.org/10.1016/j.genhosppsych.2021.04.012

21. US Census Bureau. 22 million employed in health care fight against COVID-19. Published online 2021. Accessed July 7, 2022.
    https://www.census.gov/library/stories/2021/04/who-are-our-health-care-workers.html

22. Ohio Board of Nursing. 2019 Registered Nurse Ohio Workforce Data Summary Report. Accessed July 7, 2022.
    https://nursing.ohio.gov/static/uploads/2020/02/RN-Workforce-2019-Final.pdf

23. Crane PJ, Ward SF. (2016). Self-healing and self-care for nurses. *AORN J*. 2016;104(5):386-400.
    https://doi.org/10.1016/j.aorn.2016.09.007

24. Kuhn CM, Flanagan EM. Self-care as a professional imperative: physician burnout, depression, and suicide. *Can J Anaesth*. 2017;64(2):158-168.
    https://doi.org/10.1007/s12630-016-0781-0

25. Rudaz M, Twohig MP, Ong CW, Levin ME. Mindfulness and acceptance-based trainings for fostering self-care and reducing stress in mental health professionals: a systematic review. *J Contextual Behav Sci*. 2017;6(4):380-390.
    https://doi.org/10.1016/j.jcbs.2017.10.001

26. Ross A, Touchton-Leonard K, Perez A, Wehrlen L, Kazmi N, Gibbons S. Factors that influence health-promoting self-care in registered nurses: barriers and facilitators. *Adv Nurs Sci*. 2019;42(4):358-373.
    https://doi.org/10.1097/ANS.0000000000000274

27. Lagasse J. Physicians struggle with their own self-care, survey finds. Healthcare Finance News. Accessed February 2, 2023.
    https://www.healthcarefinancenews.com/news/physicians-struggle-their-own-self-care-survey-finds

28. Ross A, Bevans M, Brooks AT, Gibbons S, Wallen GR. Nurses and health-promoting behaviors: knowledge may not translate into self-care. *AORN J*. 2017;105(3):267-275.
    https://doi.org/10.1016/j.aorn.2016.12.018

29. Behrens C. New free service aims to connect Ohio's health care workers with mental health resources. *Columbus Dispatch*. Published May 19, 2022. Accessed July 12, 2022.
    https://www.dispatch.com/story/news/2022/05/19/ohio-state-medical-association-medical-mental-health-resources/9813470002/

30. Wu AW, Connors C, Everly GS Jr. COVID-19: peer support and crisis communication strategies to promote institutional resilience. *Ann Intern Med*. 2020;172(12):822-823.
    https://doi.org/10.7326/M20-1236

31. Southwick SM, Southwick FS. The loss of social connectedness as a major contributor to physician burnout: applying organizational and teamwork principles for prevention and recovery. *JAMA Psychiatry*. 2020;77(5):449-450.
    https://doi.org/10.1001/jamapsychiatry.2019.4800

32. Gryksa K, Neumann ID. Consequences of pandemic-associated social restrictions: role of social support and the oxytocin system. *Psychoneuroendocrinology*. 2022;135(105601):105601.
    https://doi.org/10.1016/j.psyneuen.2021.105601

33. Cohen S. Psychosocial vulnerabilities to upper respiratory infectious illness: implications for susceptibility to Coronavirus disease 2019 (COVID-19). *Perspect Psychol Sci*. 2021;16(1):161-174.
    https://doi.org/10.1177/1745691620942516

34. Donnelly PD, Davidson M, Dunlop N, et al. Well-being during Coronavirus disease 2019: a PICU practical perspective. *Pediatr Crit Care Med*. 2020;21(8):e584-e586.
    https://doi.org/10.1097/PCC.0000000000002434

35. Edrees H, Connors C, Paine L, Norvell M, Taylor H, Wu AW. Implementing the RISE second victim support programme at the Johns Hopkins Hospital: a case study. *BMJ Open*. 2016;6(9):e011708.
    https://doi.org/10.1136/bmjopen-2016-011708

36. Connors CA, Dukhanin V, March AL, Parks JA, Norvell M, Wu AW. Peer support for nurses as second victims: resilience, burnout, and job satisfaction. *J Patient Saf Risk Manag*. 2020;25(1):22-28.
    https://doi.org/10.1177/2516043519882517

37. Merandi J, Liao N, Lewe D, et al. Deployment of a second victim peer support program: a replication study. *Pediatr Qual* Saf. 2017;2 (4):e031.
    https://doi.org/10.1097/pq9.0000000000000031

38. YOU Matter program—providing second victim resources for hospital staff. *Nationwide Children's Hospital*. Accessed July 13, 2022.
    https://www.nationwidechildrens.org/careers/you-matter-program

39. Melnyk, BM. Making an evidence-based case for urgent action to address clinician burnout. *Am J Account Care*. 2019; 7:2.
    https://www.ajmc.com/view/making-an-evidencebased-case-for-urgent-action-to-address-clinician-burnout

40. Bender AE, Berg KA, Miller EK, et al. "Making Sure We Are All Okay": healthcare workers' strategies for emotional connectedness during the COVID-19 pandemic. *Clin Soc Work J*. 2021;49:445–455.
    https://doi.org/10.1007/s10615-020-00781-w

41. Mushtaq H, Singh S, Mir M, et al. The well-being of healthcare workers during the COVID-19 pandemic: a narrative review. *Cureus*. 2022;14 (5):e25065.
    https://doi.org/10.7759/cureus.25065

42. Søvold LE, Naslund JA, Kousoulis AA, et al. Prioritizing the mental health and well-being of healthcare workers: an urgent global public health priority. *Front Public Health*. 2021;9:679397.
    https://doi.org/10.3389/fpubh.2021.679397

Ohio Physicians Health Program COVID-19 Response and Supports Survey

Welcome Screen

Welcome to the Ohio Physicians Health Program COVID-19 Response and Supports Survey. This survey will ask you about your well-being during COVID-19 and your experience with accessing supports for wellness, mental health, and substance use as a health care professional during the pandemic. The purpose of this study is to gather the perspectives of professionals working across disciplines on the types of supports needed and the type of infrastructure that needs to be in place so that these supports can be easily accessed. Your insights will not only benefit the current system of support for health care professionals, but also better equip Ohio for future crises.

The Ohio Physicians Health Program (OPHP) provides a compassionate, supportive, and safe environment for health care professionals to receive confidential services to improve their health and well-being. Our goal is to inspire physicians and other health care professionals to seek treatment and monitoring for their illnesses in order to ensure patient care and safety. To meet this goal, we need an equitable and reliable system for providing supports across workplace settings and professional disciplines. Understanding the current status of stress, burnout, compassion fatigue, and physical exhaustion for health care professionals is one part of this important puzzle. The other piece is gaining a better understanding of what types of supports are most desired and how to help those supports be more accessible and less stigmatized. The OPHP has partnered with the evaluation team at Mighty Crow to design this survey and analyze the results. This survey is being funded through a grant from the Federation of State Medical Boards.

Your input is greatly appreciated. Your answers will help inform OPHP and its partners as we work to improve supports and services for health care professionals.

Consent

Purpose of the survey: The Ohio Physicians Health Program is conducting a survey across health professions on supports needed during the COVID-19 pandemic as well as prior to the pandemic. This survey will ask you about your experience with accessing supports for wellness, mental health, and substance use as a health care professional during the pandemic, as well as prior to the pandemic. The purpose of this study is to gather the perspectives of professionals working across disciplines on the types of supports needed and the type of infrastructure that needs to be in place so that these supports can be accessed without stigma.

What you will be asked to do: You'll be asked to complete an online survey about what supports you may have wanted or needed and types of supports you may have accessed. You will also be asked about the infrastructure in place to gain access to those supports and the stigma you may have experienced.

Total time required: Approximately 15 minutes.

Incentives: This survey does not include a paid incentive. Your participation is voluntary and without compensation from OPHP.

Confidentiality: All efforts will be made to keep the information provided confidential. The survey will not ask you for your name at any time. Any report of this survey that is made available to the public will not include your name, your organization's name, or any other information by which you or your organization could be identified. We will work to make sure that no one sees your survey responses outside of OPHP or the evaluation team at Mighty Crow.

1

Voluntary Participation: Your participation in this survey is completely voluntary. There is no penalty or loss of benefits to which you are otherwise entitled for not participating.

Risks and Benefits: The benefits to participation in this survey include providing your perspective to OPHP about the supports and services needed by health care professionals. Your participation informs OPHP's efforts to better advocate for the needs of health care professionals. We do not anticipate any adverse consequences to you for participating. If, however, you begin to feel a sense of stress or a change in your well-being, we encourage you to utilize OPHP's confidential services by emailing them at info@OPHP.org or calling 614.841.9690. You can also access the Crisis Text Line at 741741. Again, your personal information will be confidential, and answers will be aggregated. The risks associated with an information breach via the internet are minimal and unlikely.

Contact with Questions: If you have any questions about your participation, please contact Gretchen Clark Hammond, PhD, MSW, LSW, LCDCIII, TTS at Gretchen@mightycrow.com.
Clicking "I accept" below indicates your consent to participate in this survey.

Demographics

We are collecting basic demographic data to track our response rate to the survey. While we ask you to provide this information, all results will be kept confidential and will be aggregated in reports. This means that the answers you provide will never be tied directly to you, your organization, or your position, but rather will be presented as general categories and themes we have observed through completion of this survey.
Note: At any point in the survey you can use the arrows at the bottom right of your screen to move forward or scroll backward with you cursor to return to a previous question and adjust your answer.

2. Which health care licensing board certifies your license? (choose from dropdown)
   a. Ohio State Chiropractic Board
   b. Ohio State Dental Board
   c. Ohio Veterinary Medical Licensing Board
   d. Ohio Vision Professionals Board
   e. State Medical Board of Ohio
   f. Ohio Board of Nursing
   g. Ohio Board of Pharmacy
   h. Ohio Counselor, Social Worker, and Marriage and Family Therapist Board
   i. Ohio Occupational Therapy, Physical Therapy, and Athletic Trainers Board
   j. Ohio State Board of Psychology
   k. Ohio Speech and Hearing Professionals Board
   l. Ohio Chemical Dependency Professionals Board
   m. Ohio Department of Mental Health and Addiction Services (for Peer Support Specialists)
   n. Other

3. You indicated you are certified by the XXX Board. What is your license type? (choose as many as you like)
        - List of license types
Q3-12 recur for each license type. Respondent only answers the one relevant to their selection in Q2.

13. Position/Title in the Organization:

14. Years of Experience in the field:

2

15. Gender Identification:
   a. Male
   b. Female
   c. Prefer not to say
   d. Other: _____

16. Race/Ethnicity (choose as many as you like)
   a. American Indian or Alaskan Native
   b. Asian
   c. Black or African American
   d. Hispanic or Latino
   e. Native Hawaiian or Pacific Islander
   f. White
   g. Other: _____

17. Which of the following best describes your household income last year (before taxes and deduction)?
   a. Below $20,000
   b. $20,000-$40,000
   c. $40,001-$80,000
   d. $80,001-$120,000
   e. Above $120,000
   f. Prefer not to answer

18. Please select your age group
   a. 18-24
   b. 25-34
   c. 35-44
   d. 45-54
   e. 55-64
   f. 65+
   g. Prefer not to answer

This first set of questions asks about your employment status during the pandemic and prior to the pandemic.

19. Were you employed at any point during the pandemic?
   a. Yes
   b. No

20. If yes, did you experience times when you were (choose as many as you like):
   a. Unemployed
   b. Furloughed
   c. Laid off
   d. None of the above

21. Were you employed prior to the pandemic?
   a. Yes
   b. No

3

22. If you were employed prior to the pandemic but not during the pandemic, was that situation of your own choosing? *(Only asked if people say "no" to 19 and "yes" to 21)*
   a. Yes
   b. No

The following set of questions asks about burnout from work during and prior to the pandemic.

23. During the pandemic, how often have you felt emotionally drained from your work?
   a. Never
   b. A few times a year or less
   c. Once a month or less
   d. A few times a month
   e. Once a week
   f. A few times a week
   g. Every day
   h. NA (I did not work during the pandemic)

24. Prior to the pandemic, how often did you feel emotionally drained from your work?
   a. Never
   b. A few times a year or less
   c. Once a month or less
   d. A few times a month
   e. Once a week
   f. A few times a week
   g. Every day
   h. NA (I did not work prior to the pandemic)

25. During the pandemic, how often have you felt that you don't really care what happens to some patients?
   a. Never
   b. A few times a year or less
   c. Once a month or less
   d. A few times a month
   e. Once a week
   f. A few times a week
   g. Every day
   h. NA (I did not work during the pandemic)

26. Prior to the pandemic, how often did you feel that you didn't really care what happens to some patients?
   a. Never
   b. A few times a year or less
   c. Once a month or less
   d. A few times a month
   e. Once a week
   f. A few times a week
   g. Every day
   h. NA (I did not work prior to the pandemic)

4

27. During the pandemic, how often have you felt you have accomplished many worthwhile things in your job?
   a. Never
   b. A few times a year or less
   c. Once a month or less
   d. A few times a month
   e. Once a week
   f. A few times a week
   g. Every day
   h. NA (I did not work during the pandemic)

28. Prior to the pandemic, how often did you feel you accomplished many worthwhile things in your job?
   a. Never
   b. A few times a year or less
   c. Once a month or less
   d. A few times a month
   e. Once a week
   f. A few times a week
   g. Every day
   h. NA (I did not work prior to the pandemic)

The following set of questions ask about your well-being during and prior to the pandemic.

29. During the pandemic, how often have you felt down, depressed, or hopeless? (Note: no NA option)
   a. Not at all
   b. Several days
   c. More than half the days
   d. Nearly every day

30. Prior to the pandemic, how often have you felt down, depressed, or hopeless? (Note: no NA option)
   a. Not at all
   b. Several days
   c. More than half the days
   d. Nearly every day

31. During the pandemic, have you had any thoughts of suicide? (Note: no NA option)
   a. Never
   b. Some thoughts of death
   c. Some thoughts of suicide
   d. Some attempt at suicide

32. Prior to the pandemic, did you ever have thoughts of suicide? (Note: no NA option)
   a. Never
   b. Some thoughts of death
   c. Some thoughts of suicide
   d. Some attempt at suicide

5

33. During the pandemic, have you been concerned about your own alcohol consumption or substance abuse? (Note: no NA option)
   a. Yes
   b. No
   c. Sometimes

34. Prior to the pandemic, were you concerned about your own alcohol consumption or substance abuse? (Note: no NA option)
   a. Yes
   b. No
   c. Sometimes

35. Have you had changes in alcohol consumption or substance use since the COVID-19 pandemic began? (Note: no NA option)
   a. Significant decrease
   b. Decrease
   c. No change
   d. Increase
   e. Significant increase

This next set of questions will ask you about the impact of the COVID-19 pandemic on your work and home life.

36. Were you negatively impacted financially due to COVID-19? (Choose as many as apply)
   a. No
   b. Furlough
   c. Forced to take time off
   d. Pay reduction
   e. Other

37. How has your workload changed due to COVID-19?
   a. Significant decrease
   b. Decrease
   c. Neutral
   d. Increase
   e. Significant increase
   f. NA (I did not work during the pandemic)

38. Were you directly involved in COVID-19 patient care?
   a. Yes
   b. No
   c. No but I have potential exposure (ie, cafeteria, same floor, patient rooms)
   d. NA (I did not work during the pandemic)

39. Has your work setting changed?
   a. No
   b. From onsite to remote
   c. Partially remote
   d. Relocated from primary department
   e. From remote to onsite
   f. NA (I did not work during the pandemic)

6

40. How affected were you by the following work-related stressors PRIOR to COVID-19 Pandemic? (Each rated on a scale from: Not a Stressor, Minimal Stressor, Moderate Stressor, Significant Stressor, Extreme Stressor, NA (I did not work prior to the pandemic.)).
   a. Insufficient communication from leadership
   b. Working too many hours
   c. Job security/employment status
   d. Insufficient training
   e. Inappropriate role designation
   f. Working at a new location
   g. Witnessing high number of deaths

41. How affected were you by the following work-related stressors DURING the COVID-19 Pandemic? (Each rated on a scale from: Not a stressor, Minimal Stressor, Moderate Stressor, Significant Stressor, Extreme Stressor, NA (I did not work during the pandemic.)).
   a. Concern of spreading COVID-19
   b. Insufficient communication from leadership
   c. Insufficient PPE
   d. Working too many hours
   e. Job security/employment status
   f. Insufficient training
   g. Distress about how to effectively treat COVID-19 patients
   h. Inappropriate role designation
   i. Working at a new location
   j. Witnessing high number of deaths

42. During the pandemic how CONCERNED have you been about exposing the people you live with to COVID-19? (Each rated on a scale from: Not a Concern, Minimal Concern, Moderate Concern, Significant Concern, Extreme Concern, NA)
   a. Exposing my child
   b. Exposing my older adult family
   c. Exposing my spouse or partner
   d. Exposing my roommate

43. At home how much have these stressors impacted you during the COVID-19 pandemic? (Each rated on a scale from: Not a Stressor, Minimal Stressor, Moderate Stressor, Significant Stressor, Extreme Stressor, NA)
   a. I am too tired when I get home to cook, do chores, etc.
   b. Loneliness
   c. Financial stress
   d. Worry and/or guilt about infecting household members
   e. Taking stress out on my family and friends
   f. Lack of quality time with family and friends
   g. My family and friends don't understand the stress I'm under
   h. Inconsistent work hours/coordinating schedules
   i. Other family member(s) needing to take over my responsibilities

7

44. Do you have children living at home?
   a. Yes
   b. No

45. How much have these additional home related stressors impacted you during the COVID-19 pandemic. (Each rated on a scale from: Not a Stressor, Minimal Stressor, Moderate Stressor, Significant Stressor, Extreme Stressor, NA)
   (*Only answered by people who said "Yes" to Q44*)
   a. Being able to support children/being a present parent
   b. Lack of quality time with children
   c. Homeschooling
   d. Childcare

This final set of questions will address what supports if any you accessed during the pandemic.

46. At your workplace, did you receive any type of screening, assessment, or monitoring regarding the stressors you faced specifically due to the pandemic?
   a. Yes
   b. No
   c. NA (I did not work during the pandemic.)

47. At your workplace, did you feel personally acknowledged for the challenges you were facing specifically due to the pandemic?
   a. Yes
   b. No
   c. NA (I did not work during the pandemic.)

48. At your workplace, did you receive adequate rest from the job specifically due to the pandemic?
   a. Yes
   b. No
   c. NA (I did not work during the pandemic.)

49. Did you seek emotional services for any mental health concerns such as stress, burnout, substance abuse, depression or unstable mood (eg, from family, friends, therapists, etc)?
   a. Yes
   b. No
   c. NA (I did not experience mental health issues during the pandemic.)

50. Please rate your level of satisfaction with the type of emotional support you received. (Each rated on a scale from: Dissatisfied, Somewhat Dissatisfied, Neutral, Somewhat Satisfied, Very Satisfied, NA)
   (*Only answered by people who said "Yes" to Q49*)
   a. From coworkers
   b. From supervisor or boss
   c. In general from the work setting
   d. From family and friends
   e. From my Employee Assistance Program (EAP)
   f. From other support groups
   g. From a therapist
   h. From faith community
   i. Other:

8

51. If you did not seek assistance, please indicate how much each of the following was an obstacle to seeking assistance. (Each rated on a scale from: Not an Obstacle, Minimal Obstacle, Moderate Obstacle, Moderate Obstacle, Significant Obstacle, Extreme Obstacle) (Note: no NA option) *(Only answered by people who said "no" to Q49).*
   a. Cost of counseling or treatment
   b. Did not know where to turn for support
   c. Time commitment
   d. Fear of being committed/ taking medicine
   e. Confidentiality concerns
   f. Insufficient health insurance coverage
   g. Negative opinion from family, friends, community
   h. Faith in effectiveness of counseling or treatment
   i. Negative impacts to my job position
   j. Fear of regulatory board taking/restricting license

52. What type of support do you wish you had? (Choose as many as apply) (Note: no NA option) (O*nly answered by those who said "no" to Q49).*
   a. Emotional support from coworkers
   b. Emotional support from my supervisor or boss
   c. Emotional support in general from the work setting
   d. Emotional support from family and/or friends
   e. Other types of emotional support.

53. Does your workplace offer a program to address mental health concerns (ie, changes to mood, anxiety, burnout, depression, and/or substance abuse)? This is typically referred to as an Employee Assistance Program (EAP). (Note: no NA option)
   a. Yes
   b. No
   c. Not sure

54. How likely are you to participate in such a program? (Note: no NA option) *(Only answered by those who say "Yes" to Q53).*
   a. Very unlikely
   b. Neither unlikely or likely
   c. Very likely

55. Please indicate what might be improved or needed in order for you to access this program. (open text response) *(Only answered by people who say "Very unlikely" to Q54).*

56. Does your state professional organization offer a program to address mental health concerns (ie, changes to mood, anxiety, burnout, depression and/or substance abuse)? This is typically referred to as a Professional Health Program. (Note: no NA option)
   a. Yes
   b. No
   c. Not sure

57. How likely are you to participate in such a program? (Note: no NA option) *(Only answered by those who say "Yes" to Q56).*
   a. Very unlikely
   b. Neither unlikely or likely
   c. Very likely

9

58. Please indicate what might be improved or needed in order for you to access this program. (open text response) *(Only answered by people who say "Very unlikely" to Q57).*

59. If you could request one thing to help you in your job during the next pandemic, what would you request? (open text response)

60. What is one change that could be made at a policy level that could benefit professionals as it relates to issues of burnout, stress, and dealing with a pandemic? (open text response)

61. During the pandemic, what is something that made you resilient? (open text response)

Thank you for your participation!

10

RESEARCH BRIEF

A Close-up Examination of Racial Disparities in Infant and Maternal Outcomes in Montgomery County, Ohio

Kelsey M. Harman[1]; Keith M. Reisinger-Kindle[1]; Rose A. Maxwell[1]

[1]Department of Obstetrics and Gynecology, Wright State University, Dayton, OH

Corresponding Author: Keith Reisinger-Kindle, 128 Apple Street, Suite 3800, Dayton, OH 45409, (937) 208-2850, keith.reisinger-kindle@wright.edu

ABSTRACT

Background: Infant and maternal outcomes in Montgomery County, Ohio, are among the worst in the state and rival that of many low-income nations. This study compares maternal and infant outcomes across 3 zip codes in Montgomery County to discern factors that are influencing health outcomes for their residents. The zip codes represent 3 distinct communities with unique racial and socioeconomic makeups.

Methods: A cohort of mother-infant dyads (n=5098) who delivered at Miami Valley Hospital and Good Samaritan Hospital from January 1, 2009, to January 1, 2019, was analyzed via retrospective chart review. Maternal health outcome composite score (MCS) and infant health outcome composite score (ICS) from Trotwood, Ohio, (zip code 45426) were compared to those of 2 nearby zip codes (45415 and 45424), which were chosen for their lower infant mortality rates and proximity to Trotwood. Continuous variables were compared by ANOVA followed by post hoc Tukey tests. Categorical variables were compared via chi-square analysis.

Results: The MCS and ICS were stratified by zip code and maternal age, race, and BMI. There was a statistically significant difference in MCS for race and BMI across all zip codes, but no statistically significant difference for maternal age. There was no statistically significant difference in ICS across maternal age, race, and BMI.

Conclusion: Maternal outcomes for Black women were consistently worse across communities while outcomes for other races varied. Our study shows that maternal outcomes did not correlate with infant outcomes, indicating that interventions focusing on improving maternal outcomes may be inadequate at addressing infant outcomes. Investigations surrounding race-specific interventions in all populations are needed.

Keywords: Race-based disparities; Montgomery County; Maternal morbidity and mortality; Infant morbidity and mortality

INTRODUCTION

Recent state and county public health energy has been focused on improving maternal and infant health outcomes in Ohio. The infant mortality rate (IMR), the number of live born infants who die in the first year of life per 1000 live births, is a strong indicator of the health and well-being of a community.[1] While the IMR in the United States in 2019 was 5.6, the IMR in Ohio during the same year was 6.9 and was even worse in Montgomery County at 9.0.[2,3] Data from Dayton and Montgomery County Public Health in 2019 showed that Trotwood, Ohio, (zip code 45426) had one of the highest IMR (16.8) in the state. These statistics demonstrate the need for significant efforts to improve infant outcomes within Montgomery County and Dayton, Ohio.

The overall IMR in Ohio declined from 2015 to 2019, however the IMR in Montgomery County increased.[4] In 2019, a total of 58 infants in Montgomery County died before their first birthday, resulting in an increased IMR for 2019 compared to prior years. Of these deaths, 69% were neonatal deaths and were more common among Black infants.[4] Unfortunately, racial disparities in infant mortality continue to persist, and in 2019 Black infants in Mont-

gomery County died at a rate nearly double that of White infants, with IMRs of 13.1 and 7.1, respectively.[4]

Maternal morbidity and mortality are other significant indicators of community health. Similar to nationwide trends, Black-identifying mothers in Ohio, from 2016 to 2019, experienced severe maternal morbidity at more than twice the rate of White mothers, with similar trends for pregnancy-related mortality ratio (PRMR) at 29.5 for Black-identifying women and 11.5 for White women from 2008 to 2016.[5] The Ohio Department of Health identified 610 maternal deaths in Ohio, from 2008 to 2018, as temporally related to pregnancy, with 186 (31%) of these deaths determined to be pregnancy-related.[6] The most common causes of pregnancy-related death were cardiovascular and coronary conditions, infection, hemorrhage, preeclampsia and eclampsia, and cardiomyopathy.[5] In Montgomery County, 48 deaths were pregnancy-associated and 12 were pregnancy-related.[5] Of the 4 Ohio counties with 10 or more pregnancy-related maternal deaths, Montgomery County had the highest PRMR at 19.7 deaths per 100 000 live births over the 9-year period.[5]

All neighborhoods are not equally impacted by the ongoing maternal and infant mortality crises. Significant racial differences in outcomes in Montgomery County are consistent with previous literature that has shown Black infants have at least twice the infant mortality rate of White infants.[7] Much of this literature, however, focuses on poor infant and maternal outcomes on the state and national level and may overlook nuances that exist at the community level. This study compares maternal and infant outcomes across 3 zip codes in Montgomery County that represent 3 distinct communities with unique racial and socioeconomic makeups in order to better understand the factors influencing health outcomes for their residents.

METHODS

A retrospective chart review was performed to examine maternal and infant birth outcomes to explore differences within these communities. We evaluated a cohort of women who delivered at Miami Valley Hospital (MVH) and Good Samaritan Hospital (GSH) from January 1, 2009, to January 1, 2019. This period was chosen for convenience as it overlaps with electronic record keeping at these institutions.

Data were extracted from the medical records for mother-infant dyads from Trotwood, Ohio, (zip code 45426) and mother-infant dyads from the 2 comparison zip codes. The comparison zip codes were chosen because they have lower infant mortality rates than Trotwood and, yet, are in close geographic proximity. Zip code 45426 (Trotwood) was chosen given its extremely high IMR of up to 16.8 from 2015-2019. Zip code 45415 (Northview) was chosen given its similar racial composition and geographic location to Trotwood (mostly Black-identifying residents) and had a lower IMR. Zip code 45424 (Huber Heights) was chosen given its different racial composition (mostly White), yet similar socioeconomic composition to zip code 45415 and had a lower IMR.

All pregnancies for each mother during the period of interest were included in the analysis if the mother resided in the zip codes of interest at the time of delivery. Mother-infant dyads were identified by searching for patients by the zip codes of interest and having procedure codes for vaginal delivery or cesarean delivery. Of note, reported race is based on patients' self-selected identity. The authors reviewed the data set to ensure that inclusion/exclusion criteria were met. Inclusion criteria included delivery at MVH or GSH (including transports from outside facilities) and women with a pregnancy resulting in live birth or fetal demise at greater than 20 weeks gestation. Cases were excluded if mother and infants could not be paired. This study was submitted to the institutional review board of Wright State University and determined to be exempt.

An infant health outcome composite score (ICS) was calculated based on the top causes of infant death per the 2019 Ohio Infant Mortality Report which included prematurity, congenital malformations, external injuries, obstetric conditions, and sudden infant death syndrome/perinatal infections.[3] A maternal health outcome composite score (MCS) was calculated based on the US Centers for Disease Control and Prevention definition of severe maternal morbidity and included myocardial infarction, cerebrovascular disease, renal disease, eclampsia, congestive heart failure, pulmonary disease, anesthesia complications, and embolus.[8] Composite scores were calculated by coding each of the above conditions as yes (1, present) or no (0, not present) and summing the number of conditions for each mother and infant. The composite scores (MCS and ICS) were then converted to represent 1 (at least 1 condition present) or 0 (no conditions present) for each mother and each infant, respectively. Adequacy of prenatal care was estimated using the Kotelchuck Index.[9]

Data analysis was performed using SPSS version 27 (IBM, Armonk, NY). For continuous variables, ANOVA was performed followed by post hoc Tukey tests. Categorical variables were compared via chi-square analysis. A p value of < .05 was considered statistically significant.

RESULTS

A total of 5098 mother-infant dyads were eligible and were included in the analysis. Maternal demographic and clinical characteristics by zip code are included in Table 1.

Table 2 shows MCS stratified by zip code and maternal age, race, and BMI. There were no differences in rates of MCS or ICS across zip codes when stratified for maternal age (p = .61 and p = .06, respectively). Rates of MCS were significantly different across zip codes when stratified by race with higher rates of MCS for White women living in Trotwood and Northridge than for White women living in Huber Heights, although Black women had similar rates of MCS regardless of zip code (p = < .001). This pattern was not evident for rates of ICS across the zip codes when stratified by race (p = .43).

Table 1. Maternal Demographic and Clinical Characteristics

	45426 (Trotwood zip code) n = 1473	45415 (Northview zip code) n = 719	45424 (Huber Heights zip code) n = 2906	p
Age at delivery (mean ± SD)	25.42 ± 5.50	27.56 ± 6.06	27.26 ± 5.51	<.001
Gravida	3.08 ± 2.16	2.81 ± 1.97	2.76 ± 1.74	<.001
Para	1.46 ± 1.61	1.20 ± 1.31	1.27 ± 1.32	<.001
BMI	33.95 ± 7.72	33.18 ± 6.88	32.93 ± 7.06	<.001
Race				<.001
Black	83.4% (1228)	52.3% (376)	18.2% (529)	
White	13.2% (194)	43.7% (314)	73.9% (2148)	
Hispanic/Latino	0.5% (7)	0.4% (3)	1.5% (44)	
Non-Black people of color	2.2% (44)	3.2% (23)	6.0% (174)	
Insurance				<.001
Private	23.5% (343)	43.1% (304)	48.3% (1334)	
Public	75.6% (1103)	56.3% (397)	51.1% (1528)	
Other	0.9% (13)	0.6% (4)	0.6% (34)	
Delivery facility				<.001
Miami Valley Hospital	66.3% (977)	63.8% (459)	76.8% (2233)	
Good Samaritan Hospital	33.7% (496)	36.2% (260)	23.2% (673)	
Adequacy of prenatal care				<.001
Adequate	46.6% (686)	53.3% (383)	44.1% (1281)	
Intermediate	12.4% (182)	10.6% (76)	13.5% (392)	
Inadequate	36.0% (530)	28.2% (203)	35.1% (1020)	
Unable to determine	5.1% (75)	7.9% (57)	7.3% (213)	

Rates of MCS were significantly different across zip codes when stratified by BMI category (p = < 0.001). Within zip codes, Trotwood had its lowest rate of MCS among women in the normal BMI category (4.5%; p = .004) and Huber Heights had its highest rate of MCS among women in the class III obesity category (12.7%; p < .001). There were no differences across zip codes for rates of ICS when stratified by BMI category (p = .07), and the only difference within a zip code occurred in Trotwood where the highest rate of ICS (12.0%) occurred among infants born to women in the normal BMI category (p = .004). Rates of MCS did not correlate with rates of ICS (r = .01, p = .48).

DISCUSSION

We found that Black women had the highest rates of MCS regardless of zip code of residence. White women exhibited high rates of MCS only in Trotwood and Northridge, and the highest rate of MCS among White women was still lower than the lowest rate of MCS among Black women. We also found that higher rates of MCS were evident in higher BMI categories. However, higher rates of ICS were seen in women with normal BMI. The MCS among all zip codes, when stratified by race and BMI, was significantly different while ICS stratified by race and BMI was not. Rates of MCS were not associated with rates of ICS.

Although the 3 zip codes differed on socioeconomic level as indicated by higher graduation rates (high school and college), higher median income, and lower unemployment rate (see Appendix for a breakdown of population level demographic information for the individuals residing in these zip codes), Black mothers had consistently poor outcomes in all zip codes, while White women had

poor outcomes only in the zip codes with lower socioeconomic level. Socioeconomic factors such as unemployment rate and food insecurity negatively affect maternal mortality while other socioeconomic factors such as percentage of college educated adults and percentage of owner-occupied homes are protective, although the impact of these varies by race and ethnicity.[10] Our results showed little positive impact on maternal health for Black women living in the higher socioeconomic neighborhoods. Even with a higher percentage of women having private insurance in Huber Heights and no differences in adequacy of prenatal care across the zip codes, outcomes for Black women in Huber Heights did not differ from outcomes for Black women in other neighborhoods. Infant outcomes in Huber Heights were worse for Black infants than any other neighborhood.

These results strongly suggest the influence of other factors, such as experiences of racism or racial isolation occurring in mostly White neighborhoods, that may have a stronger influence on health outcomes than the impact of poverty on health. There is sparse literature exploring the experiences of Black women in predominantly White communities, although what is available suggests that Black women often feel socially and culturally isolated due to differences in race, gender, and difficulty connecting with the local Black community.[11]

It has been well demonstrated in the literature that Black populations are more likely to face poverty, live in violent neighborhoods, have fewer financial resources, and have higher mortality rates from disease.[12] In our study, Trotwood had higher rates of poverty, lower median income, and higher rates of poor maternal outcomes than the 2 comparison neighborhoods similar to the

Table 2. Composite Scores Stratified by Maternal Age, Race, and BMI

	Maternal health outcome composite score (MCS)				Infant health outcome composite score (ICS)			
	45426 zip code	45415 zip code	45424 zip code	P value	45426 zip code	45415 zip code	45424 zip code	P value
Age								
< 35 years	11.5%	10.8%	6.6%	.61	5.1%	3.7%	5.0%	.06
> 35 years	10.7%	8.1%	6.8%		4.9%	7.1%	7.4%	
P value within zip code	1.00	.48	.91		1.00	.17	.08	
Race								
Black	11.9%	11.2%	10.6%	<.001	4.9%	4.8%	6.2%	.43
White	10.3%	9.9%	5.8%		7.2%	3.8%	4.8%	
Hispanic/Latino	0.0%	0.0%	2.3%		0.0%	0.0%	11.4%	
Non-Black people of color	3.0%	4.3%	5.7%		3.0%	0.0%	6.9%	
Unreported	9.1%	33.3%	9.1%		0.0%	0.0%	0.0%	
P value within zip code	.44	.52	.002		.53	.79	.15	
BMI								
< 18.5	--	0.0%	--	<.001	--	0.0%	--	.07
18.5-24.9	4.5%	6.1%	4.8%		12.0%	4.1%	7.0%	
25-29.9	11.6%	8.3%	4.9%		4.6%	4.9%	5.0%	
30-34.9	11.3%	10.1%	6.1%		4.8%	3.5%	5.0%	
35-35.9	9.5%	16.0%	6.3%		3.7%	3.1%	5.6%	
> 40	17.0%	10.9%	12.7%		4.1%	5.9%	4.8%	
P value within zip code	.004	.26	<.001		.004	.88	.69	

Table values represent the percentage of mothers and of infants who had at least 1 condition present.

findings reported in the literature. Of note, infant outcomes were minimally better for Black infants compared to White infants in Trotwood, though both rates remain significantly higher than national and state averages. While clear explanations for this would be beyond the scope of this study, these results may suggest that maternal and/or community resiliency may provide mild blunting or be a protective factor for Black infant health compared to Black maternal health, particularly in regions that are majority Black.[13,14] Additionally, the differential impact of maternal BMI on infant outcomes suggests that higher BMI may also be protective for infant health which is consistent with the 2020 National Vital Statistics report on infant mortality.[12] Nonetheless, this study encourages public health and medical professionals to use caution in assuming that factors impacting Black maternal and infant outcomes are similar/connected, when in fact they are likely complex and require separate attention, research, and resources.

This study is limited by the lack of demographic information such as income and education level for the women included in this study. This information was added from publicly available statistics to summarize the socioeconomic level of each neighborhood to provide context (Appendix). Another limitation of this study was the disproportionate sample size within each zip code. Huber Heights was selected because of the racial diversity of the neighborhood although the larger sample size could have influenced our overall results.

This study demonstrates that poor maternal outcomes for Black women are consistent across neighborhoods that differ by socio-economic level and racial diversity and that poor infant outcomes differed by race and neighborhood. These findings suggest that interventions directed toward improving infant health may not translate into improved maternal health. While efforts to impact racism through the lens of poverty and through the lens of infant outcomes may serve a role in improving maternal health outcomes, this study suggests that experiences of women of color in mostly White communities, regardless of wealth, still result in poor outcomes. Race specific maternal interventions in all populations, regardless of wealth, are needed.

PUBLIC HEALTH IMPLICATIONS

Future research and public health interventions in this region should focus on several key gaps that remain poorly understood in these populations. First, it remains unclear why the infant mortality rates in Trotwood remain higher for White infants than Black infants, though both rates remain unacceptably high. Community-based participatory research that focuses on the outcomes of these groups is needed to do a deeper dive into this phenomenon. Second, ongoing maternal specific interventions are necessary in Ohio to address the ongoing maternal mortality crisis that is being disproportionately experienced by Black women. Third, more investigation and attention are needed on community specific outcomes for non-Black communities of color in Montgomery County. These findings likely highlight the consequences of public health programming that is infant focused with secondary goals of impacting maternal outcomes, a strategy that has been widely used to date to address maternal health outcomes in Ohio.

REFERENCES

1. Reidpath DD, Allotey P. Infant mortality rate as an indicator of population health. *J Epidemiol Community Health*. 2003;57(5):344-346.
   https://doi.org/10.1136/jech.57.5.344

2. Centers for Disease Control and Prevention. Infant Mortality | Maternal and Infant Health | Reproductive Health. Published September 8, 2021. Accessed June 13, 2022.
   https://www.cdc.gov/reproductivehealth/maternalinfanthealth/infantmortality.htm

3. Ohio Department of Health. *2019 Infant Mortality Annual Report*. Accessed January 3, 2023.
   https://odh.ohio.gov/know-our-programs/infant-and-fetal-mortality/reports/2019-ohio-infant-mortality-report

4. Dayton and Montgomery County Public Health, Department of Epidemiology. *Infant Mortality Montgomery County & Ohio, 2019*. Published December, 2020.

5. Ohio Department of Health. *Severe Maternal Morbidity and Racial Disparities in Ohio, 2016-2019;* 2020. Accessed January 9, 2023.
   https://odh.ohio.gov/know-our-programs/pregnancy-associated-mortality-review/media/pamr-smm

6. Ohio Department of Health. *A Report on Pregnancy-Associated Deaths in Ohio 2008- 2016.*; 2017. Accessed January 9, 2023.
   https://odh.ohio.gov/wps/wcm/connect/gov/f5f620c6-d444-4873-bbc8-bbc76bba1a71/A+Report+on+Pregnancy-Associated+Deaths+in+Ohio+20018-16+finalx.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_M1HGGIK0N0JO00QO9DDDDM3000-f5f620c6-d444-4873-bbc8-bbc76bba1a71-mVLW5zb#:~:text=Women%20died%20from%20pregnancy-related,births%20from%202008%20through%202016.&text=The%20rate%20of%20deaths%20related,change%20significantly%20over%20that%20time

7. Lorenz JM, Ananth CV, Polin RA, D'Alton ME. Infant mortality in the United States. *J Perinatol*. 2016;36(10):797-801.
   https://doi.org/10.1038/jp.2016.63

8. Centers for Disease Control. How Does CDC identify severe maternal morbidity? Published February 8, 2021. Accessed January 3, 2023.
   https://www.cdc.gov/reproductivehealth/maternalinfanthealth/smm/severe-morbidity-ICD.htm

9. Kotelchuck M. An evaluation of the Kessner Adequacy of Prenatal Care Index and a proposed Adequacy of Prenatal Care Utilization Index. *Am J Public Health*. 1994;84(9):1414-1420.
   https://doi.org/10.2105/ajph.84.9.1414

10. Barrera CM, Kramer MR, Merkt PT, et al. County-level associations between pregnancy-related mortality ratios and contextual sociospatial indicators. *Obstet Gynecol*. 2022;139(5):855-865.
    https://doi.org/10.1097/AOG.0000000000004749

11. Terhune CP. Coping in isolation: the experiences of black women in white communities. *J Black Stud*. 2008;38(4):547-564.
    https://doi.org/10.1177/0021934706288144

12. Ely DM, Gregory ECW, Drake P. Infant mortality by maternal prepregnancy body mass index: United States, 2017-2018. *Natl Vital Stat Rep* 2020;69(9):1-11.
    https://stacks.cdc.gov/view/cdc/93222

13. Brown DL. African American resiliency: examining racial socialization and social support as protective factors. *J Black Psychol*. 2008;34(1):32-48.
    https://doi.org/10.1177/0095798407310538

14. Miller DB, MacIntosh R. Promoting resilience in urban African American adolescents: racial socialization and identity as protective factors. *Soc Work Res*. 1999;23(3):159- 169.
    https://doi.org/10.1093/swr/23.3.159

APPENDIX.

Descriptive Facts and Figures for the Selected Zip Codes

	45426 (Trotwood)	45415 (Northview)	45424 (Huber Heights)
Zip code			
Total population[a,b]	15 315	12 653	51 344
Black	73.7%	40.0%	14.2%
White	18.6%	54.9%	74.6%
Hispanic	0.9%	1.6%	3.1%
Two or more races	5.0%	3.2%	4.2%
Female[c]	57.5%	48.7%	51.4%
Median age (years)[a]	39.8	44.9	39.1
Median education level (for population 25 years and over)[b]			
High school or higher	90.3%	93.5%	92.7%
Bachelor's degree or higher	16.0%	33.6%	28.2%
Graduate or professional degree	6.4%	12.3%	11.5%
Median income[a]	$35 637	$62 772	$69 452
Living in poverty	26.4%	10.0%	5.8%
Employment status[b]			
Unemployed	7.6%	4.7%	4.7%
Renters[b]	55%	34%	26%
Marital status[b]			
Married	31.5%	43.2%	52.3%
Never married	39.7%	31.8%	29.4%
Infant mortality rate [number of infant deaths per 1000 live births] (2014-2016)[c]			
Black	16.0	6.5	13.8
White	19.0	0.0	3.4

[a]Information collected from https://www.ohio-demographics.com/zip_codes_by_population (Cubit Planning, Inc., 2021).
[b]Information collected from https://www.city-data.com/2000-2020 (Advameg Inc, 2021).
[c]Information collected from https://www.phdmc.org/services/epidemiology (Dayton Montgomery County Public Health, 2021).

COMMENTARY

Ohio's Public Hospital System: Challenges and Opportunities

Sterling Shriber[1]; Palak Rath[1]

[1]Cleveland Clinic Akron General, Akron, OH

Corresponding Author: Sterling Shriber, 1 Akron General Avenue, Akron, OH 44307, (330) 730-4803, sshriber1@neomed.edu

ABSTRACT

Public hospitals have long been a cornerstone of the American health care system, providing an increased share of care to indigent and historically marginalized populations. Public hospitals have provided an increased share of their revenues as community benefit spending, often taking on added roles of community service and civic consequence. The number of public hospitals has decreased nationally over recent decades, with the forces of hospital system consolidation and increasing technological and medical complexity being contributory. As the architecture of public hospital structure governance differs by state or even municipality, public hospitals have become sensitive to political currents in their respective localities. This article serves as an analysis and commentary on the current state of the public hospital network in Ohio. While Ohio has both state-operated and city or county-operated hospital systems, special attention is given here to the latter, which have been decreasing in number at an alarming rate over recent years. Despite recent challenges, the system harbors substantial potential to both rural and urban communities alike. A call to action, inclusive of civic support and new investment, should be made to bolster Ohio's public hospital system for the benefit of its communities.

Keywords: Public hospitals; Ohio; Community benefit

INTRODUCTION

Public hospitals, administered at the city, county, and state level, exist in many states in the United States (US) and have historically provided an essential cornerstone of the health care and social safety net apparatus within their respective regions.[1] As of 2018, approximately 18.5% of acute care hospitals in the US were operated by state and local governments,[2] and 56% of the 50 largest US metropolitan areas had at least 1 such hospital.[3] Public hospitals have historically faced challenges ranging from political interference and cronyism, financial mismanagement and underfunding, and social stigmatization,[4,5] with the US losing over a quarter of its public hospitals since the 1980s.[2] In Ohio, these challenges have combined to contract the network of such institutions. Ohio's state-operated hospitals have remained relatively stable, but the state's city or county-operated hospitals have been particularly vulnerable, decreasing by 38% over the past 14 years.[6,7] Funding and staffing cuts to state and local government operations have

diminished the resources being afforded to local governments, reducing capabilities for public institutions and services at the local level.[8] Increased competitive pressures driven by health care consolidation[9] have combined with difficulties serving indigent populations in the state's rural and urban areas to place public health care institutions in a difficult position often necessitating closure or transition away from public ownership in the form of privatization or sale.[10-12]

Present Situation

As of 2020, approximately 9.5% of acute care hospitals in Ohio were operated by local and state governments,[7] compared with 21% nationally as of 2018.[2] Most of Ohio's network of public hospitals have historically been governed at the city or county level as independent functionaries of those respective bodies of local government. Such hospitals are generally governed by boards of appointees designated by elected city or county government officials, and the scope of hospital governance and powers is generally dic-

tated rather strictly by state law.[13] Organization as an agency of county government is more common than city government, though several of the state's public hospital systems are organized as special joint township hospital districts, with the districts comprised of several communities within a county. Funding mechanisms for these hospitals have proven contentious, with subsidies from city and county general funds often proving politically difficult for legislative and public appetite. Most have also proven slower to expand services or grow across metropolitan areas or regions due to constraints, in part, by state law prohibiting county-operated hospitals from expanding beyond county borders.[14] According to hospital registration data obtained from the Ohio Department of Health, in 2008 (the earliest year on file) there were 18 city or county-operated hospitals in Ohio, with 2 being city-operated and 16 being county-operated.[6] In 2022, the total number was 11, with 1 being city-operated and 10 being county-operated.[7,12] Over that 14-year interval, 2 were transitioned away from public ownership toward not-for-profit status that continued to be governed locally, 3 were transferred to regional not-for-profit health systems, and 2 were transferred to private for-profit operators (with 1 of these eventually closing). All but 1 of the 7 hospitals losing public ownership were located in counties with populations of less than 50 000 residents. Restrictiveness of state laws governing county-operated hospitals was cited in at least 2 of the cases where the transition from public to private ownership occurred.[15,16]

Most of Ohio's public hospitals have historically been operated by county or special joint township governments, with many serving as the primary health care provider in many of the state's rural and exurban counties. Of the state's 25 largest cities, only 1 anchors a city or county-operated hospital system; The MetroHealth System in Cleveland, Ohio. MetroHealth operates as an independent agency of the Cuyahoga County government and receives less than 5% of its revenues as subsidies from taxpayer funds.[17] Its main campus, with 702 registered beds, is situated in Cleveland, though it operates satellite hospital campuses in the suburbs of Cleveland Heights and Parma.[7] As of 2016, MetroHealth provided community benefits equal to 22% of its total revenues, a higher share than its private not-for-profit counterparts in Cleveland, the Cleveland Clinic Foundation (10%) and University Hospitals (9%).[18] As of 2014, MetroHealth's Medicaid and low-income inpatient utilization rates were 56% and 35%, respectively, compared to 21% and 11%, respectively, for hospitals within the Cleveland, Ohio, hospital referral region.[19] Though not without its challenges, MetroHealth serves as a comparison to large urban public hospitals in other states which serve as health care anchor institutions and social safety net hospitals.

In contrast to hospitals operated by city and county governments, Ohio's state-operated acute care hospitals have fared better and grown appreciably over time. Several large academic medical centers are operated as state agencies, answerable to the boards of trustees of their affiliated universities. These include the Ohio State University Wexner Medical Center in Columbus, the University of Cincinnati Medical Center in Cincinnati, and the University of Toledo Medical Center (UTMC) in Toledo. The Ohio State University Wexner Medical Center is the third largest health system headquartered in Ohio by revenue, and its main campus is the state's second largest hospital facility by total registered beds.[7] Ohio's state-operated medical centers have performed better than their counterparts at the county level, likely due in large part to size, academic reputation, and niche status as referral centers. The UTMC serves as an exception to this, having been troubled in recent years by private competition and the transfer of its academic and training programs to a competing private hospital.[20]

Opportunities and Future

It appears that distinctions are often not drawn between public and private hospitals, either as pertains to the actions of government entities or in the perception of the general public and body of health care consumers. This has contributed to a general apathy toward the scope and importance of public hospitals, eventually contributing to their transfer away from public ownership. Legal and financial structures of governance and taxation have granted private not-for-profit hospitals a nebulous status as community institutions that are privileged above most other forms of private corporate enterprise.[21] In addition to tax-exempt status, private not-for-profit hospitals are afforded measures of public financing which, in Ohio, include the ability to issue tax-exempt bonds to fund capital projects as local governments would[22] as well as some government subsidies for the construction of facilities and operation of programs.[23]

The future of public hospitals, therefore, rests on getting the public and government to see their merit, as a fundamental precondition to giving them the resources to succeed. Public hospitals are indeed worthy of this respect. They have historically provided a level of care to indigent and underserved patients that exceeds their private counterparts. Public hospitals also provide levels of community benefit as a share of revenue that exceeds the level of their private counterparts.[24] As governmental agencies, public hospitals are subject to levels of accountability and transparency that private hospitals are not, with most aspects of public hospital operations being subject to the transparency provisions of the Ohio Public Records Act, and meetings of governing bodies being publicly accessible under the Ohio Open Meetings Act.[25]

If the public hospital system in Ohio is to endure, and reverse its decline for the benefit of the public, such will have to come with the assertion of the inherent value of public hospital systems. This will necessitate the recognition that public hospitals are uniquely positioned and motivated to provide public benefit and to care for the underserved. They will need to invoke a sense of civic pride and communal purpose by cementing the perception of public hospitals as institutions that are owned by communities, for the benefit of communities. Also of benefit will be to stress that public hospitals can be governed by the public in ways uniquely open and accessible to the public. While traditionally localized to the state's

rural counties, the public ownership model of hospitals has the potential to improve health care in the state's urban and metropolitan areas as well, not only in providing care to underserved populations, but also to serve as economic engines. In the 21st century, health care is the largest sector of US gross domestic product.[26] Hospitals are often the largest employers and economic engines in postindustrial cities,[27] especially so for many of Ohio's communities. In certain circumstances, public ownership and control of urban hospitals could prove transformative toward staving off decline and building a sustainable and inclusive economic order at the local level.

Buy-in from the public and communities will only be half of the metaphorical battle. Local governments will need to muster the political and financial will and resources to keep public hospitals funded. State government will need to think seriously about committing more resources to funding and improving these institutions through state operating and capital expenditures. Ohio's public hospitals can reverse decades of decline and become anchors of healthier, more vibrant communities. But this will not happen unless Ohioans as a collective recognize their value and commit to making them better.

REFERENCES

1. Anderson RJ, Boumbulian PJ, Pickens SS. The role of US public hospitals in urban health. *Acad Med.* 2004;79(12):1162-1168.
   https://doi.org/10.1097/00001888-200412000-00008

2. *Fast Facts on US Hospitals, 2022.* American Hospital Association (AHA); 2022.
   https://www.aha.org/statistics/fast-facts-us-hospitals

3. Shandera WX. Have public hospitals outlived their usefulness? Is it possible to assess with health care parameters the impact of public hospitals on major American cities? *Med Hypotheses.* 2019;132: 109265.
   https://doi.org/10.1016/j.mehy.2019.109265

4. Friedman E. Public hospitals often face unmet capital needs, underfunding, uncompensated patient-care costs. *JAMA.* 1987;257(13):1698.
   https://doi.org/10.1001/jama.1987.03390130016003

5. Kane NM, Singer SJ, Clark JR, Eeckloo K, Valentine M. Strained local and state government finances among current realities that threaten public hospitals' profitability. *Health Aff.* 2012;31(8):1680-1689.
   https://doi.org/10.1377/hlthaff.2011.1401

6. *Directory of Registered Hospitals, 2006.* Ohio Department of Health (ODH); 2006.

7. *Directory of Registered Hospitals, 2020.* Ohio Department of Health (ODH); 2020.

8. Maciag M, Wogan JB. With Less State Aid, Localities Look for Ways to Cope. Governing. Published January 26, 2017. Accessed May 31, 2022.
   https://www.governing.com/archive/gov-state-aid-revenue-sharing-intergovernmental- revenue.html

9. Cutler DM, Scott Morton F. Hospitals, market share, and consolidation. *JAMA.* 2013;310(18):1964.
   https://doi.org/10.1001/jama.2013.281675

10. Baker J. Pomerene Hospital now private, not-for-profit. *Times-Reporter.* Published February 19, 2015. Accessed May 15, 2022.
    https://www.timesreporter.com/story/news/2015/02/20/pomerene-hospital-now-private-not/35150505007/

11. Galloro V. Officials move to sell county-owned system to RegionalCare. Modern Healthcare. Published May 21, 2010. Accessed May 10, 2022
    https://www.modernhealthcare.com/article/20100521/NEWS/305219965/officials-move- to-sell-county-owned-system-to-regionalcare

12. Ghose C. Adena Health to acquire Fayette County Memorial Hospital, its fourth. Bizjournals.com. Published May 18, 2022. Accessed June 3, 2022.
    https://www.bizjournals.com/columbus/news/2021/02/02/adena-health-acquires-fayette-county-hospital.html

13. *Board of County Hospital Trustees - Qualifications.* Ohio Revised Code, §339.02 (2017). Accessed May 19, 2022.
    https://codes.ohio.gov/ohio-revised-code/section-339.02

14. Astolfi C. After 181 years, MetroHealth can compete outside Cuyahoga County. *cleveland.com.* Published August 12, 2018. Accessed May 19, 2022.
    https://www.cleveland.com/news/erry-2018/08/35be77e4ba7759/after-181-years-metrohealth-ca.html

15. Baker J. Pomerene Hospital now private, not-for-profit. *Times-Reporter.* Published February 19, 2015. Accessed May 15, 2022.
    https://www.timesreporter.com/story/news/2015/02/20/pomerene-hospital-now-private-not/35150505007/

16. Robinson Memorial Hospital moves closer to ownership change. *Akron Beacon Journal.* Published March 31, 2012. Accessed May 19, 2022.
    https://www.beaconjournal.com/story/lifestyle/health-fitness/2012/03/31/robinson- memorial-hospital-moves-closer/10455218007/

17. *Annual Operating budget Discussion, Cuyahoga County Council.* The MetroHealth System; 2015. Accessed May 19, 2022.
    http://council.cuyahogacounty.us/pdf_countil/en-US/Misc.%20Reports%20and%20Presentations/2017%20County%20Annual%20Budget%20Presentation_120616_Final.pdf

18. Christ G. Big 3 hospitals say community benefits equal $1.3 billion in tradeoff for tax exemption. *cleveland.com.* Published August 19, 2018. Accessed May 19, 2022.
    https://www.cleveland.com/healthfit/2018/08/big_3_hospitals_say_community.html

19. *MetroHealth Medical Center, Fact Sheet.* Medicaid and CHIP Payment and Access Commission (MACPAC); 2017. Accessed May 19, 2022.
    https://www.macpac.gov/wp-content/uploads/2017/03/MetroHealth-Medical-Center.pdf

20. Sutherland B. University of Toledo board, citing operating losses, says it is considering sale of UTMC. *The Blade.* Published February 10, 2020. Accessed May 19, 2022.
    https://www.toledoblade.com/news/medical/2020/02/10/university-of-toledo-board-citing-operating-losses-says-it-is-considering-sale-of-utmc/stories/20200210134

21. Rozier MD. Nonprofit hospital community benefit in the US: a scoping review from 2010 to 2019. *Front Public Health.* 2020;8:72.
    https://doi.org/10.3389/fpubh.2020.00072

22. Bell J. IRS scrutinizes hospital bonds. Bizjournals.com. Published March 25, 2002. Accessed May 19, 2022.
    https://www.bizjournals.com/columbus/stories/2002/03/25/story1.html

23. *2021-2022 Ohio State Capital Budget.* House Bill 137, 134th Ohio General Assembly. 2022. Accessed June 2, 2022.

https://search-prod.lis.state.oh.us/solarapi/v1/general_assembly_134/bills/hb687/PS/03/hb687_03_PS?format=pdf

24. *Toleos A.* Press release: Most US nonprofit hospitals neglect community investment obligation, analysis reveals. Lown Institute. Published July 12, 2021. Accessed June 2, 2022. https://lowninstitute.org/press-release-most-us-nonprofit-hospitals-neglect-community-investment-obligation-analysis-reveals/

25. *2022 Ohio Sunshine Laws Manual.* Ohio Attorney General (OAG); 2022. Accessed June 2, 2022. https://www.ohioattorneygeneral.gov/yellowbook

26. Papanicolas I, Woskie LR, Jha AK. Health care spending in the United States and other high-income countries. *JAMA*. 2018;319(10):1024-1039. https://doi.org/10.1001/jama.2018.1150

27. Winant G. *The Next Shift: The Fall of Industry and the Rise of Health Care in Rust Belt America*. Harvard University Press; 2021.

COMMENTARY/POLICY

Primary Amoebic Meningoencephalitis and the *Naegleria fowleri* Freshwater Amoeba: A New Concern for Northern Climates

Karen Towne[1-3]; Barbara Polivka[3]

[1]Department of Nursing, University of Mount Union, Alliance, OH
[2]Jonas Scholar 2021-2023
[3]School of Nursing, University of Kansas, Kansas City, KS

Corresponding Author: Karen Towne, 1972 Clark Avenue, Alliance, OH 44610, (330) 829-4155, towneka@mountunion.edu

ABSTRACT

Naegleria fowleri (N fowleri), the freshwater amoeba known to cause primary amoebic meningoencephalitis (PAM), is historically found in the southern United States and Central America. Increased incidence of this rare, deadly, and often misdiagnosed illness in northern states causes concern that *N fowleri* is expanding northward due to climate change, posing a greater threat to human health in new regions where PAM has not yet been documented. This case study provides an example of public health nurses incorporating environmental health data into communicable disease investigations, demonstrating how public health professionals, health care providers, and individuals living in northern climates can work together to prevent, detect, and treat *N fowleri* infection.

INTRODUCTION

Communicable Disease Investigation Case Study

During a recent summer, a public health nurse (PHN) working at a local public health department in the northern midwest United States received notice from the infection control nurse (ICN) at the local hospital of a suspected bacterial meningitis case. A female in her mid-30s, and mother of a young child, was unconscious upon arrival to the local emergency department via emergency medical services transport, having recently developed neurological symptoms including severe headache, photosensitivity, nausea, and confusion. Her long-term personal medical history included a bicycle accident 10 years prior that caused facial trauma and septum deviation.

The PHN immediately opened a communicable disease investigation under the case classification suspect bacterial meningitis. The PHN interviewed the patient's spouse via phone regarding potential sources of exposure. Responses to investigative questions (including close contact with other symptomatic individuals prior to and since symptom onset and contact tracing based upon bacterial meningitis communicability guidelines) were unremarkable.

However, the spouse and child had experienced confirmed or potential direct contact with the mother's oral secretions that would merit medication to prevent the development of illness. As the PHN broadened questions to capture other activities occurring in the 2 weeks prior to symptoms, the spouse stated that 4 days ago the family had traveled to a public-access beach at a freshwater lake in a neighboring county where the patient swam and submerged her head. The PHN coordinated the prescription of post-exposure medication to prevent the development of illness in household contacts via their primary care providers, educated the family to watch for signs and symptoms of bacterial meningitis, and instructed them to report symptoms immediately for rapid treatment should they occur.

Diagnostic Test Results

Cerebrospinal fluid (CSF) cultures yielded no bacterial growth, and CSF findings were also inconsistent with bacterial infection. No viral infection was detected in CSF; however, conventional laboratory techniques may fail to detect infectious agents, leaving up to 60% of presumed viral encephalitis cases unexplained.[1] The case classification in the communicable disease reporting system was then updated to suspect viral (aseptic) meningitis (Table 1). The

Table 1. Epidemiological Comparison of Primary Amoebic Meningoencephalitis, Bacterial Meningitis, and Viral (Aseptic) Meningitis

	Primary amoebic meningoencephalitis[2,3,4]	Bacterial meningitis[5,6]	Viral (aseptic) meningitis[7,8]
Organism	*N fowleri* amoeba (protozoan)	Most common: Neisseria meningitidis, Streptococcus pneumoniae, and Haemophilus influenza Group B	Most common: Non-polio enteroviruses; may also be caused by measles, mumps, varicella-zoster, Epstein-Barr, influenza, and other viruses
Source/ Reservoir	Warm, untreated freshwater/soil	Humans	Humans
Mode of transmission	Contact of contaminated water to nasal membrane; not infectious via ingestion	Spread by respiratory droplet or direct contact with respiratory secretions; sharing cups or utensils, kissing, coughing	Transmission varies by virus; infection may occur in contacts but is unlikely to cause meningitis.
Incubation period	Range 1-9 days (median 5 days) after exposure	Range 1-10 days (median 3-4 days) after exposure	Varies by virus
Period of communicability	Not contagious from person to person	Immediately following symptom onset until at least 24 hours after treatment with appropriate antibiotics	Varies by virus
Signs/Symptoms	Stage 1: Severe frontal headache, fever, nausea/vomiting Stage 2: Stiff neck, seizures, altered mental status, hallucinations, coma	Fever, headache, and stiff neck in meningococcal meningitis cases, (sepsis and rash in meningococcemia)	Fever, headache, stiff neck, photophobia, somnolence, nausea, irritability, vomiting, anorexia, lethargy
Prognosis	Usually fatal (94.6-97%); postmortem diagnosis	10-15% mortality; up to 20% of survivors experience long-term disability including loss of limb(s), deafness, nervous system problems, or brain damage	Usually resolves spontaneously in 7-10 days

ICN reported to the PHN that the patient's condition was worsening, increasingly inconsistent with viral meningitis, and the infectious disease team used the working diagnosis of meningoencephalitis, but diagnostic testing remained inconclusive.

Public Health Nursing Actions

As the infectious disease team manages aspects of direct patient care and treatment of communicable disease, the public health department is responsible for considerations of disease transmissibility and outbreak prevention. In this case, given the absence of detectable pathogens, the patient's deteriorating condition, no known symptomatic contacts, and the continued search for noninfectious causes, the PHN has a set of expected interventions. These include prophylaxis coordination for close contacts, symptom education for the family, preparations for rapid close-contact treatment response and outbreak case management, community surveillance of other potential cases, and follow-up with the ICN for confirmatory updates as details emerge.

The PHN was faced with 3 possible outcomes impacting case reporting and management. If symptoms resolve spontaneously, leading the infectious disease team to conclude the cause was likely viral, the patient will recover and the case may be closed under the classification confirmed viral (aseptic) meningitis. If a noninfectious cause is identified, the case may be closed under the classification viral (aseptic) meningitis—not a case regardless of patient outcome. However, if the PHN were to leverage the interdisciplinary nature of public health practice to pursue the patient's environmental exposure as a potential cause of meningoencephalitis, an effective treatment method may be found for the patient. With support from the medical director, the PHN chose to consult the Bureau of Infectious Diseases at the state department of health

for expertise related to potential meningoencephalitis cases of unknown etiology in humans related to exposure to fresh water.

Possible Cause

The state department of health contacted the Centers for Disease Control and Prevention (CDC). The CDC offered the state department of health a small number of collected case reports from the southern United States and Central America describing patients with similar neurological symptoms who had a recent history of swimming in warm freshwater ecosystems. Case reports indicated the cause of infection was the amoeba *Naegleria fowleri* (*N fowleri*).

Naegleria fowleri and Primary Amoebic Meningoencephalitis

N fowleri is a thermophilic amoeba occurring in warm, untreated freshwater, soil, and dust that is known to cause primary amoebic meningoencephalitis (PAM) in humans. Primary amoebic meningoencephalitis is a necrotizing, hemorrhagic, and often fatal meningoencephalitis occurring most frequently in healthy children and young adults with a history of recent contact with untreated fresh water.[9]

Not infectious through oral ingestion, water vapor, or human-to-human transmission,[10] *N fowleri* infects by entering the nose via contaminated water, crossing the nasal membrane, and following the olfactory nerve through the cribriform plate to the brain.[9,11] The incubation period typically ranges from 1 to 9 days (median 5 days) after exposure.[2] The rapid onset of neurological symptoms may be categorized as early (flu-like symptoms including headache, fever, nausea, and vomiting) or late (central nervous system signs including stiff neck, seizures, altered mental status, hallucinations, and coma).[2,3] Cerebrospinal fluid analysis may resemble

bacterial meningitis (high opening pressures, elevated white blood cell counts, and elevated protein levels). Abnormal imaging results are present in most cases but are not diagnostic for amoebic infection.[2] Disease progression is often too rapid for premortem diagnosis and intervention, leading to case fatality in 1 to 18 days (median 5 days) after symptom onset.[2] While a treatment regimen including the current gold standard medication for free-living amoeba infections, miltefosine, and therapeutic hypothermia have been successful in some cases, PAM is usually fatal (94.6% to 97%) and often diagnosed postmortem.[9,11-13]

Naegleria fowleri Life Cycle and Transmission

N fowleri has 3 stages: cyst, trophozoite, and ameboflagellate.

The thermophilic *N fowleri* is most prolific in water temperatures up to 115 °F (46 °C) but is tolerant of even higher temperatures for short periods, making it able to easily withstand human fever. If environmental conditions become cold, nutrient depleted, or dry, the trophozoite can revert to a non-feeding form for protection from freezing water temperatures.[14]

Because *N fowleri* infects via the nasal membrane, activities that push contaminated water into the nasal cavity are epidemiologically associated with infection. This includes swimming, splashing, and submersion in naturally occurring bodies of freshwater, such as lakes, ponds, hot springs, and reservoirs[15] (Figure 1). In addition to geographical changes in recent years, novel routes of transmission have been documented, including warm hose water, lawn water slide and splash pad use, and exposure of the nasal membrane to tap water from private well systems, which has been known to occur when using a nasal irrigation device at home.[16,17]
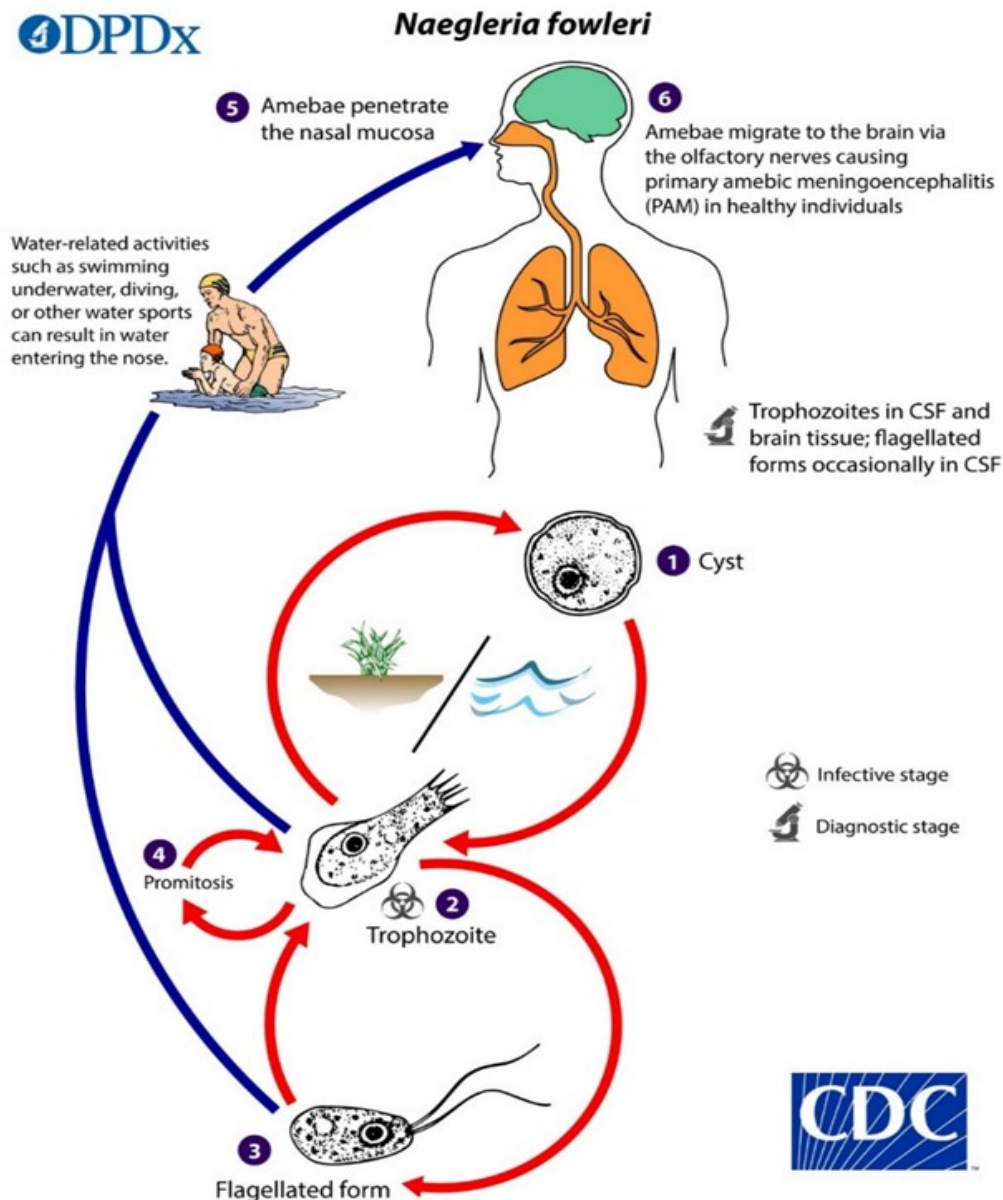

Figure 1. Transmission of *Naegleria fowleri* to a Human Host

Naegleria fowleri Incidence and Climate Change

Historically, *N fowleri* cases in the US have been known to occur in southern states, but recent data indicate an increased incidence since 2010 in northern states such as Minnesota, Indiana, and Missouri.[2,16,19,20] The incidence of *N fowleri* infections is historically rare; 138 PAM cases were reported in the US from 1962 to 2015 with a range of 0 to 8 cases annually.[16] Patients have been predominantly male (76%) and less than or equal to 18 years of age (83%, N = 142).[2]

Climate change data indicate consistent increases in surface water temperatures, increasing the likelihood that *N fowleri* will pose a greater threat to human health in regions with a history of occurrence and new regions where PAM has not yet been documented.[13,19-22] Despite its rarity, the severity of illness and poor patient outcomes make the increased incidence of PAM in northern climates an emerging health concern. Combined with increased incidence in northern climates, untrained and unaware public health professionals and health care providers may exacerbate prolonged diagnostic periods and delay time-sensitive treatment in what is ultimately a quick decline for PAM patients.

Case Study Outcome

Acting in the role of liaison between direct care personnel and state/national public health entities, the PHN obtained and relayed evidence pertinent to the case for health care provider review. Information regarding miltefosine availability and dosage were communicated from the CDC team (this product has since become commercially available). The patient responded favorably to the medication. Two weeks after symptom onset, she recovered with minimal neurological damage and was able to resume a high quality of life with her family.

Primary Amoebic Meningoencephalitis Prevention

Effective treatment is essential when confronting PAM, but tertiary prevention is only one aspect of proactive care. When confronting any condition of public health importance, be it a reportable communicable disease, rare illness of environmental etiology, or chronic disease impacting a substantial portion of the population, interventions focused on secondary and primary prevention are crucial. Below are recommendations for public health professionals, health care providers, and individuals to take regarding *N fowleri* in northern regions.

Public health professionals: In northern climates, consider monitoring warm, freshwater recreational sites for presence of *N fowleri* amoebae.[9] As repeated cases have been documented in the same freshwater lake over years, perform public education and outreach to inform visitors to freshwater recreational sites.[16] Integrate environmental exposure screening into meningitis case investigation protocols; if PAM is suspected, immediately contact the Centers for Disease Control and Prevention at (800) 232-4636 in concert with the health care provider.

Health care providers: Incorporate environmental exposure screening into initial patient assessment for suspect meningitis cases. Regardless of geography, consider PAM in the differential diagnosis for meningitis[16] and, if suspected, immediately contact the public health department.

Individuals: When swimming in freshwater, do not splash or submerge your head. Maintain adequate chlorine concentrations in water distribution systems, especially those with elevated temperatures, to inactivate *N fowleri* cysts and trophozoites.[16] If neurological symptoms occur, seek care quickly and report environmental exposures if applicable.

PUBLIC HEALTH IMPLICATIONS

Within the last century, Ohio temperatures have increased approximately 1 °F and up to 2.35 °F in the northeastern portion of the state.[23] The popularity of Ohio's state parks, of which 71% offer freshwater swimming access and 97% allow fishing,[24] increased due to the COVID-19 pandemic. Ohio public health professionals should take note of the incidence of *N fowleri* infections in northern states including Indiana, Iowa, and Minnesota, as well as common vacation destinations for Ohioans where *N fowleri* infection has been reported, such as Virginia, North Carolina, South Carolina, Georgia, and Florida.[10]

Increased incidence of *N fowleri* in northern climates is but one of many ways climate change threatens human health and merits novel education of health care providers. Health care providers, especially those working in northern climates, should be prepared for increases in waterborne and vector-borne diseases, air quality issues, extreme weather events, impacts on food production, and temperature-related death and illness.[25] It is crucial for nurses in public health and direct care settings to seamlessly collaborate when providing patient care for those with reportable communicable diseases and their contacts, especially those with suspected environmental exposures.

REFERENCES

1. Kennedy P, Quan PL, Lipkin W. Viral encephalitis of unknown cause: current perspective and recent advances. *Viruses*. 2017;9(6):138.
https://doi.org/10.3390/v9060138

2. Capewell LG, Harris AM, Yoder JS, et al. Diagnosis, clinical course, and treatment of primary amoebic meningoencephalitis in the United States, 1937-2013. *J Pediatric Infect Dis Soc*. 2014;4(4):e68-e75.
https://doi.org/10.1093/jpids/piu103

3. Centers for Disease Control and Prevention. Illness & Symptoms | Naegleria fowleri. Published 2019.
https://www.cdc.gov/parasites/naegleria/illness.html

4. Texas Health and Human Services. Primary Amebic Meningoencephalitis. March 3, 2021.
https://dshs.texas.gov/IDCU/disease/primary_amebic_menigo
encephalitis/Primary-Amebic-Meningoencephalitis.aspx

5. Centers for Disease Control and Prevention. Meningococcal disease: Technical and clinical information. Published 2019.
https://www.cdc.gov/meningococcal/clinical-info.html

6. Florida Department of Health. Bacterial meningitis. http://orange.floridahealth.gov/programs-and-services/infectious-disease-services/epidemiology/_documents/bacterial-meningitis.pdf

7. Mbaeyi S, Duffy J, McNamara LA. (2021). Meningococcal Disease. In Hall E, Wodi AP, Hamborsky J, et al. (Eds.), Pinkbook: Epidemiology and Prevention of Vaccine-Preventable Diseases. (14th ed.). Centers for Disease Control and Prevention. Public Health Foundation. https://www.cdc.gov/vaccines/pubs/pinkbook/mening.html

8. Centers for Disease Control and Prevention. Viral meningitis. CDC. Published 2019. https://www.cdc.gov/meningitis/viral.html

9. Visvesvara GS, Moura H, Schuster FL. Pathogenic and opportunistic free-living amoebae: Acanthamoebaspp., Balamuthia mandrillaris, Naegleria fowleri, and Sappinia diploidea. *FEMS Immunol Med Microbiol*. 2007;50(1):1-26. https://doi.org/10.1111/j.1574-695x.2007.00232.x

10. Centers for Disease Control and Prevention. Sources of infection & risk factors | Naegleria fowleri | CDC. Published October 20, 2021. https://www.cdc.gov/parasites/naegleria/infection-sources.html#:~:text=Naegleria%20fowleri%20is%20naturally%20found

11. Yoder JS, Eddy BA, Visvesvara GS, Capewell L, Beach MJ. The epidemiology of primary amoebic meningoencephalitis in the USA, 1962–2008. *Epidemiol Infect*. 2009;138(7):968-975. https://doi.org/10.1017/s0950268809991014

12. Centers for Disease Control and Prevention. Treatment | Naegleria fowleri. Published 2019. https://www.cdc.gov/parasites/naegleria/treatment.html

13. Maciver SK, Piñero JE, Lorenzo-Morales J. Is Naegleria fowleri an emerging parasite? *Trends Parasitol.* Published online November 2019. https://doi.org/10.1016/j.pt.2019.10.008

14. Centers for Disease Control and Prevention. Pathogen & environment | Naegleria fowleri | CDC. Published March 22, 2019. https://www.cdc.gov/parasites/naegleria/pathogen.html#env-three

15. Centers for Disease Control and Prevention. CDC - DPDx - Free living amebic infections: Causal agents. Published August 23, 2019. https://www.cdc.gov/dpdx/freelivingamebic/index.html

16. Cope JR, Ali IK. Primary Amebic Meningoencephalitis: what have we learned in the last five years? *Curr Infect Dis Rep.* 2016;18(10):31. https://doi.org/10.1007/s11908-016-0539-4

17. Boy dies from brain-eating amoeba found at Texas splash pad. AP NEWS. Published September 27, 2021. https://apnews.com/article/health-texas-centers-for-disease-control-and-prevention-463a4b8be3488aeefaa9fa8e61d4035e

18. Centers for Disease Control and Prevention Division of Parasitic Diseases. Naegleria fowleri. Published 2022. https://www.cdc.gov/dpdx/freelivingamebic/modules/Nfowleri_LifeCycle_lg.jpg

19. Gharpure R, Gleason M, Salah Z, et al. Geographic range of recreational water–associated primary amebic meningoencephalitis, United States, 1978–2018 - Volume 27, Number 1—January 2021 - *Emerging Infectious Diseases Journal* - CDC. https://doi.org/10.3201/eid2701.202119

20. Centers for Disease Control and Prevention. Number of case-reports of primary amebic meningoencephalitis by state of exposure | Naegleria fowleri | CDC. Published September 29, 2020. https://www.cdc.gov/parasites/naegleria/state-map.html

21. Kemble SK, Lynfield R, DeVries AS, et al. Fatal Naegleria fowleri infection acquired in Minnesota: possible expanded range of a deadly thermophilic organism. *Clin Infect Dis.* 2012;54(6):805-809. https://doi.org/10.1093/cid/cir961

22. Stahl LM, Olson JB. Environmental abiotic and biotic factors affecting the distribution and abundance of Naegleria fowleri. *FEMS Microbiol Ecol*. Published online November 26, 2020. https://doi.org/10.1093/femsec/fiaa238

23. United States Environmental Protection Agency. Climate indicators explorer: US and global temperature – rate of temperature change in the United States, 1901-2020. 2021. https://edap.epa.gov/public/extensions/CCIDataViewer/CCIDataViewer.html

24. Ohio Department of Natural Resources. The guide to Ohio state parks. Accessed March 8, 2023. https://ohiodnr.gov/static/documents/parks/Ohio-State-Parks-Brochure.pdf

25. Rehr, RC, Perkowitz RM, ecoAmerica. Moving forward: A guide for health professionals to build momentum on climate action. 2019. Washington, DC. https://climateforhealth.org/wp-content/uploads/2020/06/CFHMFG-web.pdf

PUBLIC HEALTH PRACTICE

Real-time Monitoring and Evaluation of the Vax Cash Program: A Case Study from Columbus, Ohio

Ayaz Hyder[1]; Cheryl Graffagnino[2]; Gavin French[2]; John A. Maloney[2]; Ben DeJesus[2]; Kathleen Cowen[2]; Jane Iversen[3]; Suellen Bennett[2]

[1]College of Public Health, The Ohio State University, Columbus, OH
[2]Columbus Public Health, Columbus, OH
[3]College of Business, The Ohio State University, Columbus, OH

Corresponding Author: Ayaz Hyder, 1841 Neil Avenue, Columbus, OH 43210, (614) 247-4936, hyder.22@osu.edu

ABSTRACT

Background: The prevention of severe outcomes due to SARS-CoV-2 infection among vulnerable populations is an important public health goal. The purpose of our study was to report on the implementation and evaluation of an innovative public health prevention program. This program aimed to reduce the projected gap in COVID-19 vaccine uptake between more and less vulnerable neighborhoods by addressing issues around access and trust among communities at high risk for COVID-19 positive cases, hospitalization, and death.

Methods: Columbus Public Health implemented the Vax Cash program in Columbus, Ohio, from July 6, 2021, to August 22, 2021, based on regular community feedback and using a data-driven approach. The program provided a financial incentive to eligible individuals upon receiving their first dose of a COVID-19 vaccine. A time-series model was used to create short-term forecasts for COVID-19 vaccine uptake for neighborhoods in and around the 10 clinics in the program. These projections were compared with the observed uptake as the program was implemented over a 6-week period.

Results: Seven out of ten sites showed an increase in the observed COVID-19 vaccine uptake in and around the sites compared to projected uptake values. We observed a rapid increase in uptake among Black residents and a reduction in the Black-White vaccine uptake gap in and around the Vax Cash sites.

Conclusion: Vaccination rates increased in areas of high social vulnerability through the Vax Cash program. Similarly designed programs could be applied to achieve other public health prevention goals.

Keywords: COVID-19; Vaccination; Vulnerable populations; Financial incentive

INTRODUCTION

An important public health goal is to reduce the incidence of severe outcomes among vulnerable populations. The COVID-19 vaccines protect against severe outcomes, such as hospitalization and death, due to SARS-CoV-2 infection. Vulnerable populations face multiple barriers to getting the COVID-19 vaccine, including limited access to vaccine providers, which can manifest in terms of time to make an appointment, navigating appointment scheduling systems, travel time to vaccine provider, and paid time off to get vaccinated and/or recover from side effects. Additionally, gaps in

COVID-19 vaccine uptake between more and less vulnerable populations may be associated with hesitancy among historically marginalized populations such as people of color and populations who continuously face discrimination in their interactions with public health and health care systems.[1-3] During a pandemic, it is essential that public health programs innovate to close this gap in vaccine uptake, especially when vaccines are widely available although not always accessible.

A preliminary analysis by 1 of the authors (Hyder) in May 2021 suggested that at the current levels of vaccine uptake more vulner-

able neighborhoods in Franklin County, Ohio, which includes the city of Columbus, may lag by approximately 7 months compared to less vulnerable neighborhoods in order to achieve 70% COVID-19 vaccine uptake as a county. The preliminary analysis was based on a review of the trends in vaccine uptake among vulnerable neighborhoods and simulations using a mathematical model that took into account differences in access to vaccines and delays in vaccine supply. This preliminary analysis motivated Columbus Public Health to design and implement the Vax Cash program[4] for eligible individuals. This public health practice report describes the implementation and evaluation of this innovative public health prevention program.

METHODS

Setting

The Vax Cash program was implemented starting on July 6, 2021, at 10 satellite neighborhood clinics (Figure 1) in Columbus, Ohio, which is the capital city of Ohio.

Community, Participant Characteristics, Recruitment

The program was designed and implemented based on regular community feedback and a data-driven approach. Local focus groups conducted by Columbus Public Health highlighted barriers to vaccination that residents faced living in high vulnerability are-

as (based on the Centers for Disease Control's Social Vulnerability Index[5]). Reasons why people did not get vaccinated included the financial cost of unpaid time off work to get the vaccine or to recover from potential side effects, lack of trust, historical injustices, and discriminatory experiences in public health and health care settings.[6] The Vax Cash program added a financial incentive and was implemented only at trusted community sites. The monetary amount was calculated assuming a pay rate of $12 to $13 per hour for an 8-hour work day. Thus, the $100 gift card would cover wages for 1 day. Additionally, data from previous and ongoing immunization incentive programs in Ohio indicated that cash rewards of $50 or less were ineffective.

The Vax Cash program at Columbus Public Health differed from previous incentive programs[7-9] in significant ways. Columbus Publich health selected Visa gift cards so that program participants could use the money where they most needed it instead of being limited to a specific store. The gift cards were on-site and given to residents immediately after their first dose (the first dose of the 2-dose Pfizer/BioNTech for individuals aged 12 years and up or the single dose of the 1-dose Johnson & Johnson vaccine for individuals aged 18 years and up was offered at the clinics) so as not to bias choice of the vaccine by individuals. Interpreters were present to ensure all clients at the clinics understood the program and received the gift card.
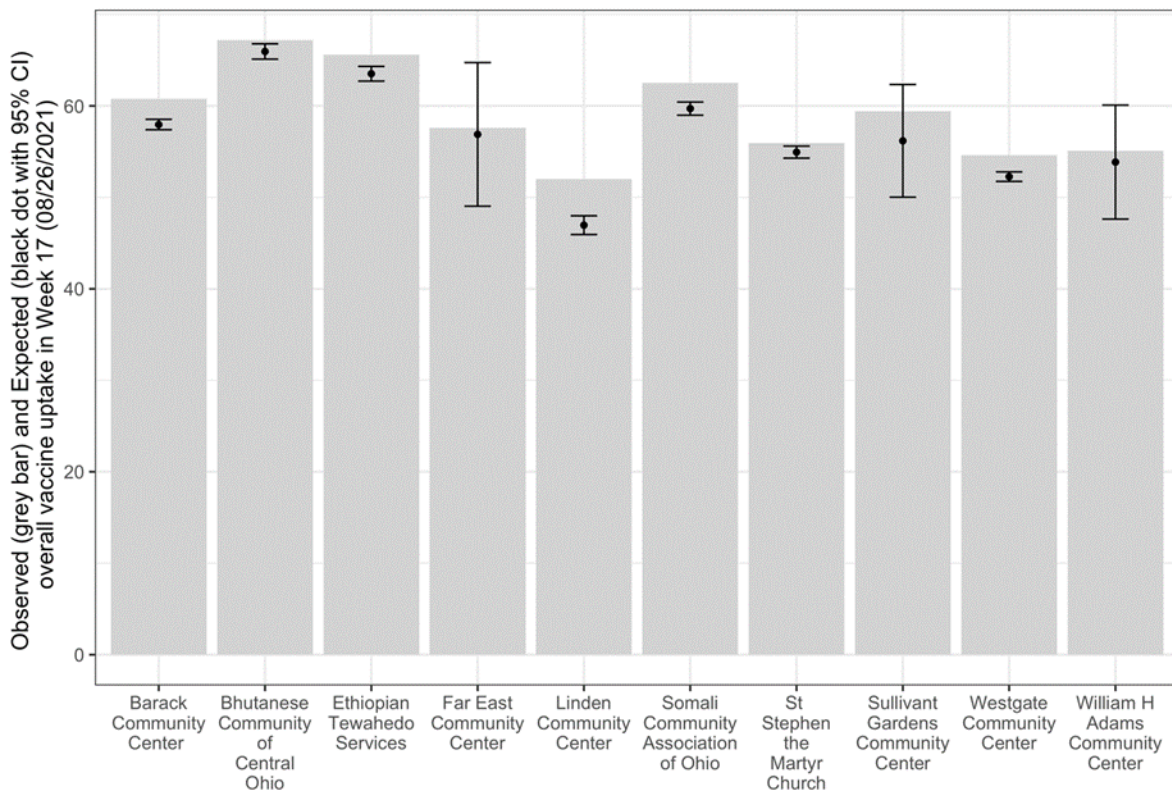
Observed (grey bar) uptake is a point value and expected (black dot) uptake is an estimate based on time-series forecast model with 95% confidence intervals. Grey bars that do not include the black dot and confidence intervals indicated that the observed vaccine uptake by the end of the Vax Cash program was higher than the expected vaccine uptake in and around those Vax Cash clinic sites.

Figure 1. Observed and Expected Vaccine Uptake in and Around Each Vax Cash Clinic Site

Each clinic site had a preexisting relationship with Columbus Public Health and was trusted by community members living near the site. The Social Vulnerability Index (SVI) is a numerical value (range: 0=low vulnerability to 1=high vulnerability) based on 16 variables from the US Census.[5] Clinic sites were chosen based on social vulnerability (using the SVI[5]), census-tract level vaccine uptake, and a spatial accessibility analysis to identify areas with limited access by car or public transit to permanent or mobile vaccination sites. It is widely used for public health planning to identify vulnerable communities in need of support before, during, and after disasters. Eligible individuals had to be a resident of Franklin County, Ohio, and not have previously received the COVID-19 vaccine. Clinics were open 1 day a week (same day for each week of the program) at each location and individuals were able to walk in during opening hours (eg, clinics were open until 7:00PM). Columbus Public Health used several strategies to make eligible individuals aware of the Vax Cash program including media interviews, social media, flyers, community navigators, and outreach to community leaders and community-based organizations.

Measures/Outcomes

Data on vaccine uptake stratified by race at the census-tract level were provided to Columbus Public Health by the Ohio Department of Health as part of a larger project called the Equity Mapping Tool project.[10] Columbus Public Health reported the data from each clinic to the Ohio Department of Health via the Ohio Impact Statewide Immunization Information System (ImpactSIIS) web application. An exponential smoothing time-series model based on simple exponential smoothing[11] was used to create short-term

forecasts for COVID-19 vaccine uptake for neighborhoods in and around the 10 clinics in the Vax Cash program. These projections or expected uptake were compared each week in real time with the observed uptake over a 6-week period. Ultimately, the program was extended for additional weeks and changes were made to the location of sites offering the program. Therefore, to avoid bias in assessing the impact of the program due to these changes, we only included data from the first 6 weeks of the program, which is how long it was originally intended to run. We also compared trends in vaccine uptake among White residents and Black residents of census tracts where Vax Cash clinic sites were located and surrounding census tracts.

RESULTS

The observed vaccine uptake was above the upper 95% confidence levels of the expected uptake estimates based on the time-series model in 7 sites: Barack Community Center, Bhutanese Community of Central Ohio, Ethiopian Tewahedo Services, Linden Community Center, Somali Community Association of Ohio, St Stephen the Martyr Church, and Westgate Community Center (Figure 1). Three sites: Far East Community Center, Sullivant Gardens Community Center, and William H Adams Community Center had observed uptake values increase over time but were within the 95% confidence levels of the expected vaccine uptake estimates (Figure 2). We observed a rapid increase in vaccine uptake among Black residents in and around the Vax Cash sites that occurred during the same time that the intervention was ongoing (Figure 3). These trends have continued similarly beyond the initial 6-week period of the Vax Cash program.
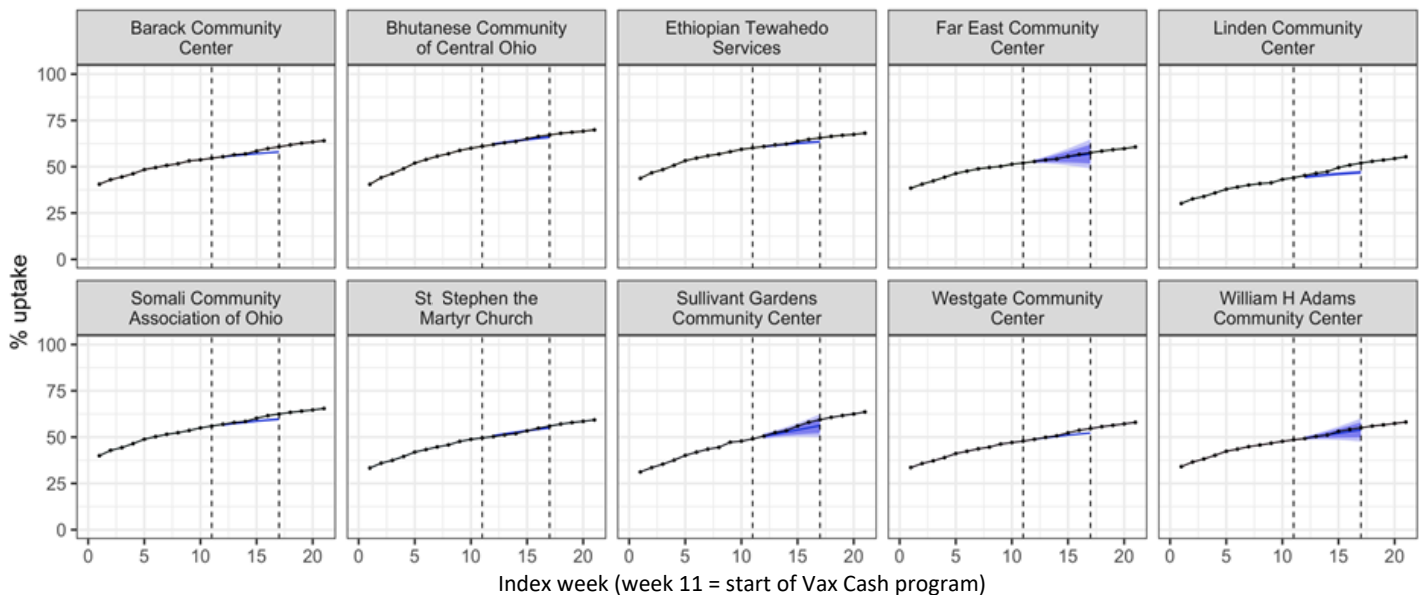
Trends from week 1 (calendar week of March 29, 2021) to 4 weeks after the end of the intervention in week 21 (calendar week of September 14, 2021). In both panels, black lines with dots show the observed vaccination uptake in and around the Vax Cash clinic site. The blue line shows the short-term forecast for uptake during the data collection phase of the intervention period (week 11 to week 17 and indicated by the area between the vertical dashed lines) with 95% confidence intervals in dark blue and 90% confidence intervals in the light blue shaded area.

Figure 2. Temporal Trends in Vaccine Uptake Where Vax Cash Clinic Sites Were Located and Surrounding Census Tracts
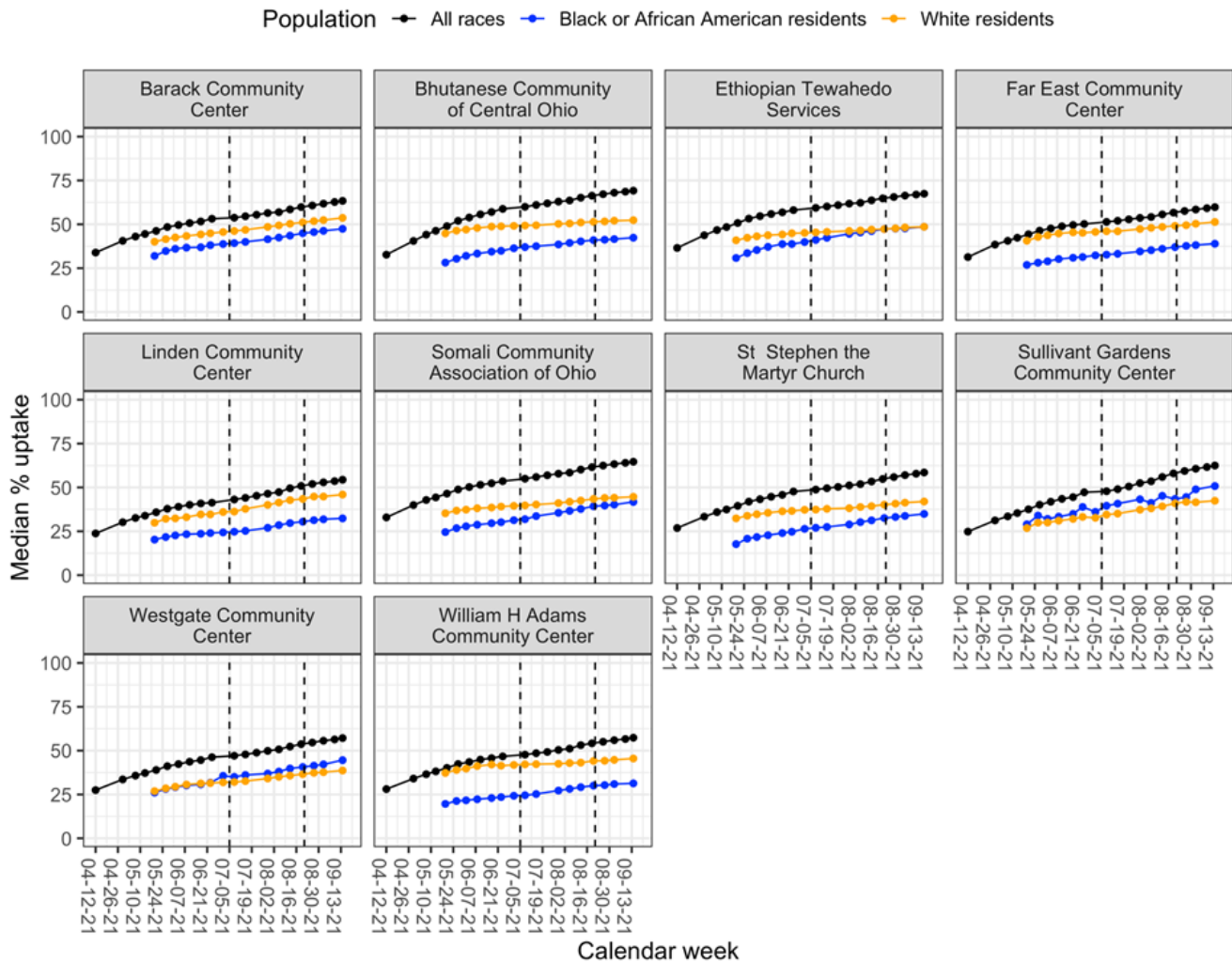
Temporal trends in vaccine uptake among White (orange dotted line) residents, Black (blue dotted line) residents, and all (black dotted line) residents of census tracts where Vax Cash clinic sites were located and surrounding census tracts. In several sites, the gap in uptake between Black residents and White residents started to close during the intervention period. The intervention period was from the calendar week of July 5, 2021, to the end of the week of August 16, 2021 (indicated by the area between vertical dashed lines). The actual start to end dates were July 6, 2021 to August 22, 2021, respectively.

Figure 3. Temporal Trends in Vaccine Uptake by Population

DISCUSSION

Innovative strategies have been applied to increase vaccine uptake, but there is limited information on their impact and descriptions of their implementation in the literature. We report on an innovative public health program that identified new mobile vaccination sites and provided financial incentive to eligible individuals for getting vaccinated. The Vax Cash program was designed to focus on individuals who were hesitant about the COVID-19 vaccine for reasons including concerns about the side effects and had limited access to vaccination sites in terms of travel time and hours of operation. Sustaining the program is important for reaching this latter group of individuals and new strategies may be needed that go beyond offering a financial incentive. Also, burnout among public health professionals who were staffing multiple community clinics will need to be addressed through changes to the program to ensure that it remains effective and responsive to

the changing dynamics of the pandemic, such as new variants. New variants and the need for boosters will require changes in public health messaging, too. Motivating individuals to get their first shot by giving a financial incentive may result in those individuals getting motivated to continue getting subsequent series of vaccinations beyond the initial vaccine dose. Financial incentives for getting vaccinated pose ethical concerns as well, such as exploitation and autonomy, when one person's vulnerability is used to achieve the goals of another person. On the other hand, arguments for offering financial incentives include utility and equity where lives could be saved, hospitalizations could possibly be averted, and disease transmission could possibly be reduced among vulnerable populations. We did not measure these outcomes in our study. Additional research is needed to measure these possible impacts of the Vax Cash program.

One may argue that 2 separate interventions were implemented at the same time; new sites as well as a financial incentive. Therefore, a limitation of our findings is that they may not be completely attributable to the financial incentive alone. Comparing vaccination rates of other providers in the same neighborhoods as the Vax Cash sites before and after the intervention would allow us to better measure the impact of the Vax Cash program. A preliminary analysis for such a comparison was done by epidemiologists at Columbus Public Health and indicated that Columbus Public Health was the provider for most vaccines administered in and around the Vax Cash clinic sites over the course of the program. Other potential sources of bias may be the rise of the COVID-19 Delta variant as well as school reopening and resumption of in-person learning, both of which occurred near the end of the evaluation period of the Vax Cash program.

The Vax Cash program further helps build a bridge between local health departments and the community. A higher uptake rate among the high SVI populations may also help build trust in the vaccine as residents see their neighbors get vaccinated and, in the community overall, people in general start feeling safer about getting the COVID-19 vaccine. Given what we as public health researchers know about the likelihood of hospitalization due to COVID-19 infection among unvaccinated and vaccinated individuals,[12] it is more important than ever for public health efforts to continue to increase uptake within socially vulnerable communities and, consequently, increase the overall uptake in the city/county and bring the community at large closer to achieving desired levels of herd immunity.

PUBLIC HEALTH IMPLICATIONS

This public health practice report provides details on the design, implementation, and evaluation of a COVID-19 vaccination effort in an urban setting. Our findings imply that financial incentives may be effective under certain circumstance even though the literature is mixed on the impact of such incentives as part of public health prevention strategies. Also, real-time monitoring of program impact through the Equity Mapping Tool[10] offers a new way for public health departments to use local data for local decision-making to close gaps in immunization rates among vulnerable populations.

REFERENCES

1. Ferdinand KC. Overcoming barriers to COVID-19 vaccination in African Americans: the need for cultural humility. *Am J Public Health*. 2021;111(4):586-588.
https://doi.org/10.2105/AJPH.2020.306135

2. Tewarson H, Greene K, Fraser MR. State strategies for addressing barriers during the early US COVID-19 vaccination campaign. *Am J Public Health*. 2021;111(6):1073-1077.
https://doi.org/10.2105/AJPH.2021.306241

3. McFadden SM, Demeke J, Dada D, et al. Confidence and hesitancy during the early roll-out of COVID-19 vaccines among Black, Hispanic, and undocumented immigrant communities: a review. *J Urban Health*. 2022; 99(1):3-14.
https://doi.org/10.1007/s11524-021-00588-1

4. Columbus Public Health extends $100 Vax Cash incentive through September 10 at select locations. 2021. August 16, 2021. Accessed March 22, 2023.
https://www.columbus.gov/publichealth/press/Columbus-Public-Health-Extends-$100-Vax-Cash-Incentive-through-September-10-at-Select-Locations/

5. Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research A, and Services Program. Data from: CDC/ATSDR Social Vulnerability Index 2018. Accessed March 22, 2023.
https://www.atsdr.cdc.gov/placeandhealth/svi/data_documentation_download.html

6. Ojikutu BO, Stephenson KE, Mayer KH, Emmons KM. Building trust in COVID-19 vaccines and beyond through authentic community investment. *Am J Public Health.* 2021;111(3):366-368.
https://doi.org/10.2105/AJPH.2020.306087

7. Campos-Mercade P, Meier AN, Schneider FH, Meier S, Pope D, Wengström E. Monetary incentives increase COVID-19 vaccinations. *Science*. 2021;374(6569):879-882.
https://doi.org/10.1126/science.abm0475

8. Barber A, West J. Conditional cash lotteries increase COVID-19 vaccination rates. *J Health Econ*. 2022;81:102578.
https://doi.org/10.1016/j.jhealeco.2021.102578

9. Chang T, Jacobson M, Shah M, Pramanik R, Shah SB. Financial incentives and other nudges do not increase COVID-19 vaccinations among the vaccine hesitant. National Bureau of Economic Research Working Paper Series. 2021;29403
https://doi.org/10.3386/w29403

10. Hyder A, Graffagnino C, Barbeau R, et al. Addressing health equity goals for COVID-19 vaccination using integrated data and mapping tools: a collaboration between academia, public health, and health care systems in Columbus and Franklin County, Ohio. *J Public Health Manag Pract*. 2022;28(6):739-748.
https://doi.org/10.1097/PHH.0000000000001550

11. Brown RG. Statistical Forecasting for Inventory Control. McGraw-Hill; 1959.

12. Danza P, Koo TH, Haddix M, et al. SARS-CoV-2 infection and hospitalization among adults aged ≥18 years, by vaccination status, before and during SARS-CoV-2 B.1.1.529 (Omicron) variant predominance - Los Angeles County, California, November 7, 2021-January 8, 2022. *MMWR Morb Mortal Wkly Rep*. 2022;71(5):177-181.
https://doi.org/10.15585/mmwr.mm7105e1

OPHA
Ohio Public Health Association

Ohio Journal of Public Health

Public Health