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COVID-19 behavioral questionnaire (CoBQ): Comparing the pandemic's impact on health behavior in three US states

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Abstract

Background: The COVID-19 pandemic impacted daily routines for a majority of the population, with implications for their health behaviors. Racial and ethnic minorities have been disproportionately impacted by COVID-19. The novel COVID-19 Behavioral Questionnaire (CoBQ) was developed in Fall 2020 to provide a means to measure the impact of the COVID-19 pandemic on the United States population. The study utilized behavioral domains to determine which demographic groups reported that they were made the most vulnerable during Fall-Winter 2020–2021 of the pandemic.

Objectives: The study aimed to further validate and test the CoBQ in varied US regions and compare the scores obtained from three states, California, Ohio, and Illinois.

Methods: A prospective, multi-site survey-based study was designed to further validate and test the 17-item CoBQ in varied populations. Respondents included patients on routine visits at each pharmacy or clinical site who agreed to complete the survey online via Qualtrics. Data analyses included descriptive statistics, psychometric testing, and comparison of groups using Analysis of Variance.

Results: Completed surveys ($n = 507$) between October 2021 and March 2021 were analyzed. Respondents were mostly female, white, and had some college education. The CoBQ showed improved reliability compared with previous testing and strong construct validity through factor analysis. Overall scores were similar between three states. The most impacted groups included those who reported within the 18–49 age group, a yearly household income <$50 000, or education up to high school.

Conclusions: The CoBQ is the first validated tool to measure the negative impact of the COVID-19 pandemic on health behaviors. Results could serve as a baseline to address the most vulnerable patient groups and support identified behavioral needs during a similar pandemic situation.

KEYWORDS
CoBQ, COVID-19, health behavior, mental health, pandemic, public awareness

1 | INTRODUCTION

As of January 2022, the coronavirus 2019 (COVID-19) pandemic has affected more than 72 million people and caused more than 870 000 deaths in the United States (US).[1] The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) recommended preventative measures such as mask mandates, hand hygiene, and social distancing to curb the spread of this virus. Additional public health recommendations to prevent COVID-19 spread and infection included avoiding crowds, self-isolation, and getting vaccinated when eligible.[2,3] These measures had a positive impact, reducing infection rates, subsequent hospitalizations, and deaths.[4-6] However, these measures also resulted in people staying at home, working from home, and subsequently facing isolation.[7-9] Routines for many people, especially families with children, shifted due to the sudden closure of schools, daycares, recreational services, and workplaces during the COVID-19 pandemic.[10,11] In addition, the COVID-19 pandemic altered the availability and delivery of outpatient medical care services and affected the health-seeking behaviors of patients.[12-15] Health care systems were overwhelmed during the pandemic with the demand on the health care workers to handle high volumes of COVID-19 related emergencies and hospitalizations. Resources such as hospital beds, personal protective equipment (PPE), life-support devices, and medications were redirected toward these services.[16] Many health care institutions reduced or stopped nonurgent procedures and care during this time.[17] Patients with chronic conditions delayed regular healthcare visits; about 41% of US adults missed planned medical visits from March to July 2020, primarily due to medical practice closure, financial repercussions of the pandemic, and fear of COVID-19 infection.[18] During the second quarter of 2020, primary care visits decreased by 21.4% in the US.[19]

According to WHO, health behavior is defined as any action taken by an individual who affects health maintenance.[20] Health behaviors are determined by a blend of factors such as income, education, health beliefs, access to healthcare, and physical environment.[21] Examples of health behaviors include physical activity, dietary habits, substance use, sleep, health-seeking behavior, and adherence to medical recommendations.[22] Much of these health behaviors, as well as access to care, were adversely impacted during the COVID-19 pandemic. For example, adults under the age of 50, women, and those with moderate to severe depression were more likely to exhibit less than optimal health behaviors in the US.[23] One poll published in April 2021 by the Kaiser Family Foundation reported younger adults and women (especially mothers) were affected the most by the current pandemic in terms of negative mental health impact.[24] When examining ethnicity, communities of color have been disproportionately affected by COVID-19 and generally are noted to have barriers to accessing health care.[25,26]

There were reports during the COVID-19 pandemic of unexpected health care behaviors (eg, increase in alcohol consumption, smoking, decreased exercise, increased eating).[27] For example, a recent study conducted in the United Kingdom suggested social lockdown led to higher rates of overeating and decreased physical activity for those with a negative mental health condition during the pandemic.[28] The combined impact of delayed regular health care visits and poor health behavior had consequences on patients' quality of life in the physical, emotional, and social domains.[29]

Evidence from past outbreaks, such as severe acute respiratory syndrome (SARS) and H1N1, have emphasized important predictors of health behaviors such as public awareness, beliefs toward preventative behaviors, perceived disease severity, and perceived susceptibility to illness.[30,31] Tools were developed to measure the impact of the COVID-19 pandemic on health behaviors, but were notably complex to administer, had not been tested for validation, or did not address COVID-19 challenges other than lifestyle-related behaviors.[32,33] The COVID-19 Behavioral Questionnaire, also referred to as the CoBQ, is a tool that was developed by the authors (ARM and AVL) to assess the impact of the COVID-19 pandemic on the health behaviors of the US population. The initial 18-item CoBQ was developed after conducting extensive literature review and was first tested for reliability and validity in a national panel of 525 respondents with balanced demographics representative of recent US census data. Four domains were hypothesized, namely (1) General Health Habits (GHH), (2) Perspective/Attitudes, (3) Public Awareness, and (4) Mental Health. The authors noted an overlap in the loading of GHH and Mental Health items in the results; otherwise, with the deletion of one item, items loaded as expected with their corresponding domains.[34]

The current study focused attention on certain patient groups to understand the difference in the impact of the COVID-19 pandemic on different regions and to determine if there are unequal effects on health behaviors based on demographics such as age, gender, and ethnicity. While the initial study utilized a representative Qualtrics panel, the current study aimed to test the CoBQ tool in pharmacies and clinics in various regions of the US. The objectives of this study were to (1) further validate and test the adapted 17-item CoBQ in different regions of the United States and (2) compare the scores obtained from the three states, California (CA), Ohio (OH), and Illinois (IL).

2 | METHODS

A prospective, multi-site survey-based study was designed to further validate and test the 17-item CoBQ in varied populations from CA, OH, and IL.

2.1 | Site and sampling description

The OH site was CedarCare Pharmacy, LLC, Cedarville, OH which serves the local village and includes patients from a variety of settings, including both urban and rural. It also serves the campus of Cedarville University, providing a mix of students, faculty, and staff who utilize the pharmacy. The Cedarville University School of Pharmacy provides support and guidance for the pharmacy. The CA sites included one federally qualified health center (FQHC) and one independent

TABLE 1 Respondent demographics

	Ohio (n = 308)	California (n = 47)	Illinois (n = 152)	Total (n = 507)
Gender identity				
Male	143 (46.4%)	13 (27.7%)	39 (25.5%)	195 (38.5%)
Female	165 (53.6%)	33 (70.2%)	113 (73.9%)	310 (61.1%)
Nonbinary or other	0 (0%)	1 (2.1%)	1 (0.7%)	2 (0.4%)
Age group				
18–29	158 (51.3%)	3 (6.4%)	11 (7.2%)	171 (33.7%)
30–49	81 (26.3%)	14 (29.8%)	50 (32.7%)	145 (28.6%)
50–69	60 (19.5%)	27 (57.4%)	79 (51.6%)	166 (32.7%)
70 or older	7 (2.3%)	2 (4.3%)	13 (8.5%)	22 (4.3%)
Chose not to disclose	2 (0.6%)	1 (2.1%)	0 (0%)	3 (0.6%)
Race/ethnicity				
American Indian or Alaska native	3 (1.0%)	1 (2.1%)	0	4 (0.8%)
Asian	9 (2.9%)	19 (40.5%)	0	28 (6.5%)
Black or African American	3 (1.0%)	6 (12.8%)	8	17 (3.4%)
Native Hawaiian or other Pacific Islander	0 (0%)	0 (0%)	0	0 (0%)
Hispanic or Latinx	2 (0.6%)	10 (21.3%)	4	16 (3.2%)
White	279 (90.6%)	7 (14.9%)	137	423 (83.4%)
Mixed Race[a]	9 (2.9%)	1 (2.1%)	N/A	10 (2.0%)
Chose not to disclose	3 (1.0%)	3 (6.4%)	3	9 (1.8%)
Highest educational qualification				
Some high school [or less]	8 (2.6%)	8 (17.0%)	N/A	16 (3.2%)
High school diploma	38 (12.3%)	12 (25.5%)	14	64 (12.6%)
Some college	101 (32.8%)	11 (23.4%)	34	146 (28.8%)
Associates degree (eg, AA, AS)	22 (7.1%)	4 (8.5%)	28	54 (10.7%)
Bachelor's degree (eg, BA, BS)*[or higher]	81 (26.3%)	6 (12.8%)	75	162 (32.0%)
Master's degree or higher[a]	56 (18.2%)	3 (6.4%)	N/A	59 (11.6%)
Chose not to disclose	2 (0.6%)	3 (6.4%)	1	6 (1.2%)
Yearly household income				
$50 000 or less	70 (22.7%)	29 (61.7%)	39 (25.7%)	138 (27.2%)
Greater than $50 000	165 (41.6%)	7 (14.9%)	88 (57.9%)	260 (51.2%)
Chose not to disclose	73 (23.7%)	11 (23.4%)	25 (16.4%)	109 (21.5%)
Respondent language				
English	308 (100%)	29 (61.7%)	152 (100%)	337
Spanish	0	3 (6.4%)		3
Chinese	0	4 (8.5%)		4
Vietnamese	0	11 (23.4%)		11
Not reported	0	0 (0%)		153
Number of prescription medications taken on regular basis[a]				
0	183 (59.4%)	13 (27.7%)		196
1–2	92 (29.9%)	13 (70.2%)		105
3-4	26 (8.4%)	16 (34.0%)		42
6 or more	7 (2.3%)	5 (10.6%)		12
Not reported	0 (0%)	0 (0%)		153

[a]IL sample was not provided with this question or response option.

pharmacy in Los Angeles County that serve as university-affiliated rotation sites. Participants in IL were recruited either directly at one rural pharmacy site or by voluntary response to a flyer with the survey link (and quick response [QR] code) on a shared partnership Facebook page for the rural community.

2.2 | Survey description

The survey included the CoBQ and demographic items to determine respondent health behavior during the COVID-19 pandemic. Patient-reported outcomes included the CoBQ score based on a 4-item Likert

TABLE 2 17-item CoBQ four-factor analysis with varimax rotation

	Component			
	Public awareness	GHH	Social/mental health	Chronic health maintenance
During the COVID-19 pandemic, I have been seeing my doctor only for emergencies, not for regular care	−0.059	−0.022	0.128	**0.806**
Avoiding COVID-19 risk is more important than taking care of my chronic health issues	−0.199	0.196	−0.157	**0.718**
It has gotten more difficult to take care of myself since the COVID-19 pandemic	−0.119	**0.631**	0.258	−0.001
I have not been eating healthy during the COVID-19 pandemic	−0.014	**0.782**	0.128	0.097
I have not exercised as much during the COVID-19 pandemic	−0.134	**0.729**	0.084	0.001
I have developed some poor habits during the COVID-19 pandemic (eg, poor sleep patterns, smoking, drinking more alcohol)	0.033	**0.701**	0.217	0.102
I avoid crowds as much as possible to prevent my risk of getting COVID-19 [R]	**0.809**	−0.069	0.027	−0.117
Since COVID-19 pandemic, I have seen my extended family/friends less often than usual [R]	**0.664**	−0.086	−0.199	0.084
I always wear a mask when outside of my home or around other people [R]	**0.807**	−0.028	0.016	−0.082
I am concerned that people who do not follow the rules will get others sick [R]	**0.856**	−0.040	0.052	−0.075
I think that all who follow quarantine lower the risk of getting COVID-19 [R]	**0.798**	−0.054	0.107	−0.027
Going out and participating in large gatherings (more than 15 people) puts everyone at risk [R]	**0.826**	−0.068	0.009	−0.110
I have become sad or angry more often since the COVID-19 pandemic	−0.090	0.355	**0.666**	−0.095
Since the COVID-19 pandemic, I have had less energy to do things	−0.129	0.536	**0.577**	−0.062
The level of social interaction during the COVID-19 pandemic has impacted me negatively	0.029	0.253	**0.704**	−0.130
The COVID-19 pandemic has had some positive effects on my daily life (eg, reduced stress, time-spent commuting, expenses) [R]	0.201	−0.089	**0.667**	0.249
Overall, my physical/social/mental health has remained fairly stable during the COVID-19 pandemic [R]	−0.033	0.285	**0.712**	0.033

Note: Extraction method: Principal component analysis; Rotation method: Varimax with Kaiser normalization. Rotation converged in 7 iterations.
Abbreviation: [R], reverse coded.

Scale (Strongly Disagree = 1, Disagree = 2, Agree = 3, Strongly Agree = 4). The higher the CoBQ score, the greater the (negative) impact of the COVID-19 pandemic on the respondent's health behavior. Scores could range from 17 (the lowest) to 68 (the highest). Demographic questions included gender identity, age group, race/ethnicity, highest educational qualification, and household income. The CoBQ survey questions were identical for CA and OH sites. For IL, some of the wording was altered to improve understanding and increase relevance to the primarily rural population being surveyed. The investigators reviewed the items and agreed that the modifications preserved

the meaning and intent of the original CoBQ items. The survey items and study were Institutional Review Boards (IRB) approved as exempt, prior to administration at each site.

2.3 | Participant eligibility and data collection

Data were collected between October 12, 2020 and March 30, 2021. Eligible respondents included patients who visited each pharmacy or clinical site during routine visits and were able to complete a site-specific

TABLE 3 Domain and overall CoBQ scores

	OH (n = 308)	CA (n = 47)	IL (n = 152)	All (n = 507)
Chronic health maintenance domain[a]				
Average score ± SD	2.47 ± 0.66	2.86 ± 0.73	2.22 ± 0.68	2.43 ± 0.69
Total score ± SD	4.95 ± 1.32	5.72 ± 1.46	4.43 ± 1.35	4.87 ± 1.38
Total score Min-Max (possible 2–8)	2–8	2–8	2–8	2–8
General health habits/mental health domain[a]				
Average score ± SD	2.17 ± 0.65	2.54 ± 0.60	2.33 ± 0.62	2.25 ± 0.65
Total score ± SD	8.69 ± 2.62	10.17 ± 2.41	9.32 ± 2.48	9.01 ± 2.59
Total score Min-Max (possible 4–16)	4–16	4–16	4–16	4–16
Public awareness domain[a]				
Average score ± SD	1.94 ± 0.58	1.59 ± 0.59	1.80 ± 0.72	1.86 ± 0.63
Total score ± SD	11.63 ± 3.46	9.51 ± 3.53	10.78 ± 4.34	11.18 ± 3.80
Total score Min-Max (possible 6–24)	6–24	6–20	6–24	6–24
Perspective/attitudes domain[a]				
Average score ± SD	2.37 ± 0.54	2.50 ± 0.53	2.50 ± 0.62	2.42 ± 0.57
Total score ± SD	11.86 ± 2.71	12.51 ± 2.68	12.53 ± 3.11	12.12 ± 2.85
Total score Min-Max (possible 5–20)	5–19	7–18	6–20	5–20
Overall CoBQ				
Total score ± SD	37.12 ± 5.37	37.91 ± 5.62	37.07 ± 6.88	37.18 ± 5.88
Total score Min-Max: (possible 17–68)	24–55	21–58	23–59	21–59

Note: ANOVA showed a significant difference between groups ($p < 0.05$).

Qualtrics online/mobile-enabled survey. In OH, the respondents also had the option to complete a paper version that the site investigator could then enter manually into Qualtrics. The following inclusion criteria were required for participation: respondent at least 18 years old, was able to independently answer the survey questions, able to understand English, Vietnamese, Traditional Chinese, or Spanish where provided (CA sites), visited one of the pharmacy sites for service (CA, OH), identified that they live in a rural area (IL), and consented to participate (through the first question in the survey). While there were no incentives for CA or OH respondents, those in IL were presented with a chance to win one of 20 available $10 gift cards upon completion of the survey.

2.4 | Data analysis

The study required a minimum of 30 respondents per state for comparative analysis and determined that a total of 377 respondents would provide a 95% confidence interval with 5% margin of error (Raosoft)." Respondents were obtained through convenience sampling at the previously mentioned sites. Only completed surveys were used for data analysis. All data were input electronically via Qualtrics and moved to IBM SPSSv26.0 for analysis. Demographic characteristics are presented as counts and percentages according to categories. Analysis of Variance (ANOVA) was used to compare the respondents from different states. One-sample scale reliability of the CoBQ was assessed using Cronbach's Coefficient alpha. Construct validity was measured through four-factor analysis with Varimax rotation. Item-item and inter-domain

correlations were further examined to validate the CoBQ in theses samples. Mean scores were calculated for the total CoBQ and each CoBQ domain. These scores were then compared by demographic characteristics and US state using ANOVA. Tukey's HSD (honestly significant difference) post hoc test was completed where appropriate.

3 | RESULTS

A total of 556 respondents from the three states agreed to participate in the survey, of which, 507 surveys were completed and eligible for data analysis (91.2%). Data collection for each state occurred in the following date ranges: CA began October 21, 2020 and concluded March 30, 2021, OH began October 30, 2020 and concluded Jan 27, 2021, IL began February 20, 2021 and ended March 3, 2021. Table 1 presents the comparison of demographic information from each state. The majority of respondents identified as female (61.1%), white (83.4%), and had at least some college education. There were statistically significant differences ($p < 0.05$) between groups as demonstrated by one-way ANOVA in each demographic category except for income ($p = 0.123$). Tukey's post-hoc test revealed OH to be different than both CA and IL in gender identity and age group (all $p < 0.01$). California and IL were not different from each other ($p = 0.993$, $p = 0.967$). Similarly, CA differed from OH and IL in race/ethnicity and highest educational qualification ($p < 0.001$); OH and IL were not significantly different from each other ($p = 0.927$, $p = 0.723$). Chi-square test revealed a significant difference between the reported number of

TABLE 4 Associations between CoBQ domains and demographic characteristics (n = 507)

	Average chronic health maintenance score ± SD	Average general health habits score ± SD	Average public awareness score ± SD	Average social/ mental score ± SD	Total CoBQ score ± SD
Gender identity					
Male	2.52 ± 0.63	2.17 ± 0.66	1.97 ± 0.60	2.31 ± 0.54	37.10 ± 5.67
Female	2.38 ± 0.72	2.30 ± 0.64	1.79 ± 0.65	2.50 ± 0.58	37.23 ± 6.03
Nonbinary or other[b]	3.00 ± 0.71	2.63 ± 0.18	1.83 ± 0.94	1.80 ± 0.28	36.50 ± 4.95
Age group					
18–29	2.51 ± 0.64	2.26 ± 0.66	2.06 ± 0.62	2.43 ± 0.58	38.57 ± 5.58
30–49	2.44 ± 0.73	2.28 ± 0.69	1.82 ± 0.66	2.44 ± 0.59	37.10 ± 6.46
50–69	2.37 ± 0.69	2.26 ± 0.61	1.71 ± 0.58	2.42 ± 0.56	36.16 ± 5.47
70 or older[b]	2.20 ± 0.81	1.95 ± 0.54	1.83 ± 0.58	2.25 ± 0.47	34.41 ± 5.07
Chose not to disclose[b]	2.33 ± 0.29	2.33 ± 0.29	2.00 ± 0.50	2.33 ± 0.31	37.67 ± 2.08
Race/ethnicity					
American Indian or Alaska native[b]	2.38 ± 0.25	2.56 ± 0.24	1.92 ± 0.59	2.30 ± 0.35	38.00 ± 4.69
Asian[b]	3.02 ± 0.69	2.52 ± 0.49	1.71 ± 0.47	2.47 ± 0.49	38.71 ± 5.60
Black or African American[b]	2.32 ± 0.56	2.31 ± 0.38	1.67 ± 0.65	2.53 ± 0.60	36.53 ± 4.57
Hispanic or Latinx[b]	2.56 ± 0.70	2.27 ± 0.81	1.31 ± 0.45	2.43 ± 0.69	34.19 ± 6.41
White	2.39 ± 0.68	2.23 ± 0.66	1.89 ± 0.63	2.42 ± 0.57	37.17 ± 5.90
Mixed race[a,b]	2.60 ± 0.57	2.33 ± 0.70	2.08 ± 0.51	2.48 ± 0.68	39.40 ± 7.01
Chose not to disclose[b]	2.44 ± 0.81	2.22 ± 0.32	1.94 ± 0.96	2.16 ± 0.60	36.22 ± 4.71
Education					
Some high school[b]	3.06 ± 0.75	2.45 ± 0.57	1.85 ± 0.45	2.55 ± 0.46	39.81 ± 2.88
High school diploma	2.53 ± 0.63	2.29 ± 0.71	1.91 ± 0.60	2.52 ± 0.47	38.31 ± 5.53
Some college	2.45 ± 0.70	2.23 ± 0.63	1.92 ± 0.71	2.40 ± 0.60	37.37 ± 5.80
Associates degree (e.g., AA, AS)	2.46 ± 0.74	2.33 ± 0.74	1.95 ± 0.81	2.45 ± 0.65	38.22 ± 7.75
Bachelor's degree (e.g., BA, BS) [or higher]	2.35 ± 0.65	2.29 ± 0.62	1.81 ± 0.55	2.47 ± 0.56	37.03 ± 5.74
Master's degree or higher[a]	2.32 ± 0.69	2.02 ± 0.62	1.76 ± 0.50	2.22 ± 0.56	34.35 ± 4.66
Chose not to disclose[b]	2.50 ± 0.93	2.50 ± 0.25	1.63 ± 0.65	2.20 ± 0.32	35.80 ± 2.59
Yearly household income					
$50 000 or less	2.59 ± 0.74	2.41 ± 0.70	1.76 ± 0.61	2.51 ± 0.60	37.94 ± 6.59
Greater than $50 000	2.32 ± 0.66	2.20 ± 0.61	1.89 ± 0.63	2.43 ± 0.55	36.90 ± 5.37
Chose not to disclose	2.50 ± 0.65	2.20 ± 0.64	1.92 ± 0.67	2.31 ± 0.56	36.86 ± 6.04

Note: ▬, lowest scoring group. ▬, highest scoring group.
[a]n < 30.
[b]IL sample was not provided with this question or response option.

regularly-scheduled prescription medications, between CA and OH groups ($p < 0.001$).

Forced four-component factor analysis with Varimax rotation of the 17-item CoBQ resulted in factor loading as expected on the four domains (Table 2). Two items from the GHH domain continued to load separate from Mental Health/GHH (similar to previous testing) and the domain was renamed "Chronic Health Maintenance" (CHM) to reflect the meaning of these items more accurately. The authors also renamed the domains to better represent the items (GHH/Mental Health to just GHH and Perspective/Attitudes to Social/Mental Health). All item-item correlations within each domain were strong [Public Awareness (0.664–0.856), General Health Habits (0.631–0.782), Social/Mental Health (0.577–0.712), and Chronic Health Maintenance (0.718–0.806)]. The CoBQ showed good scale reliability as determined by Cronbach's alpha = 0.712.

Table 3 presents a comparison of domain-specific and overall CoBQ scores. California respondents reported the greatest negative impact on their CHM and GHH scores, averaging at least 1 point higher in both domains than OH and IL. OH respondents reported the greatest negative impact involving Public Awareness, scoring over 2 points greater than CA and nearly 1 point greater than IL. CA and IL scored nearly identical in Social/Mental Health at 12.5 points, more than 0.7 greater than OH respondents. The ranges of scores were nearly identical for all domains by the different states; the most varied

score was Public Awareness, showing CA respondents at a maximum score of 20 compared with the others at 24. For all state respondents, the total CoBQ scores differed by less than 1 point.

Chi-square tests revealed no significant differences from the pooled OH and CA respondents between prescription medication groups in any domain or total CoBQ score. However, there were significant differences between Public Awareness Scores and Total CoBQ scores between age groups ($p < 0.005$), the 18–49-year-old groups score highest (most negative impact). Table 4 highlights associations between CoBQ domains and demographic characteristics. In addition, there were significant differences in CHM and Public Awareness Scores between gender groups ($p < 0.005$), with females reporting the lowest negative impact. However, in the Social/Mental Health domain, females were most negatively impacted as a group. Those with high school education or lower were most negatively impacted in CHM and Total CoBQ scores ($p < 0.005$). Within those who disclosed income (76.4% of respondents), the negative impact of the COVID-19 pandemic was greater in the <$50 000 yearly income group in CHM, GHH, and Social/Mental Health domains ($p < 0.05$). Despite the significant differences among demographics between states, the Total CoBQ scores did not show a significant difference among state groups.

4 | DISCUSSION

The 17-item CoBQ showed improved reliability with Cronbach's alpha of 0.712 compared with its previous testing (18-item CoBQ at 0.636). The item-item correlation was also higher compared with the previous range (18-item CoBQ at 0.436–0.845).[35] Timing did not seem to impact the overall CoBQ scores within this 5 month-period between the previous (37.19 ± 6.14) and current studies; scores were consistent within the hundredths place (37.18 ± 5.88). The construct validity of the CoBQ and its corresponding domains were confirmed in this sample. The difference in demographic results between the two studies may indicate that the negative impact of the COVID-19 pandemic from October 2020 to March 2021 did not appear to rely on region, timing (specific month, duration of pandemic), or recruitment method. It is possible that the survey attracted those with higher engagement and willingness to respond to a lengthy survey.

Although overall scores were similar between the three states, the differences in domain scores revealed unique impacts of the COVID-19 pandemic in areas of public and personal health. For example, there was higher negative impact in CHM and the lowest negative impact in Public Awareness in CA than OH and IL. The rules and restrictions imposed in CA may have allowed a greater sense of safety and public security while also limiting the ability to seek regular health care. Conversely, this better sense of public awareness in CA may also explain the higher negative impact on mental and social health. Social media and continual coverage of the COVID-19-related data (polls, infection rate, hospitalizations, death) may have influenced the mental health. The impact of the COVID-19 surge (second wave), specifically

in the winter in CA, may have been a contributing factor for CA's results. Some of the differences in results between the states could be attributed to the variability in designation of study sites (suburban in OH, urban in CA, rural in IL).

CoBQ has demonstrated moderately strong reliability and strong validity specific to this period of the COVID-19 pandemic. Compared with recently published tools during the COVID-19 pandemic, the CoBQ appears to be more comprehensive in addressing domains of health behavior and studying a larger sample size. Chopra and colleagues and Kumari and colleagues developed their questionnaires through similar methodology using (1) literature review, (2) focus group discussions, (3) expert evaluation, and (4) pilot testing. Both groups studied three domains, Chopra and colleagues included eating habits, physical activity, and sleep pattern and Kumari and colleagues included diet, physical activity, and sleep patterns during the COVID-19 pandemic.[32,33] While Chopra and colleagues questionnaire was validated, it did not address all challenges related to the COVID-19 pandemic such as healthcare-seeking behaviors, adherence to prevention behaviors, and mental health.[33] The CoBQ has also demonstrated robustness in psychometric properties with relation to region and timing, which supports its generalizability.

The utility of this tool is its ability to provide the insight needed for health care workers and policy makers to properly address vulnerable populations and predict patient needs during a COVID-19 outbreak. With communities of color and other vulnerable populations experiencing disparities along with being at greater risk of the negative consequences of COVID-19, it may be important to identify the challenges patients face and promote health equity.[35] By utilizing a questionnaire such as the CoBQ, healthcare providers could potentially connect patients with specific resources to address their needs rather than making assumptions of their needs. Through follow-up conversations and dialogue, providers could build long-term relationships with patients who further promote health equity.[36,37] Further research could explore the utility of this tool in patient-provider encounters and include training of providers on how best to address the areas of concerns identified.

4.1 | Limitations

While recruitment was intended to reach patients who utilized pharmacies and clinical sites, there may have been selection bias due to requirements of understanding English in OH and IL sites and technological requirements. Self-selection could also have occurred from respondents who are more engaged with their health and willing to respond to a lengthy survey. Access to the survey was limited at certain sites; most locations required their respondents to use an internet connection and mobile, tablet, or computer device to participate. All potential respondents may not have been given an equal chance to participate due to the inability to discuss the study at busier times and the prioritization of pharmacy and clinical services. The study fell short in its ability to recruit a range of ethnicities and access to

medical care; this is possibly explained by convenience sampling and characteristics of the majority of respondents within each state (eg, percentage of self-reported as white: 72% in Illinois and 81% in Ohio).[38,39] The study did, however, achieve a multi-regional diversity in education, age, and gender identity.

5 | CONCLUSIONS

The CoBQ is the first documented reliable and valid tool that measures the negative impact of the COVID-19 pandemic on individuals' health behavior. This tool could be used as a standard measure in the US to explore COVID-19 or similar outbreaks. It could also be adapted to examine the impact on populations outside of the US who are still experiencing high infection rates of COVID-19. The CoBQ has the ability to inform healthcare systems and policymakers to best support patients' health behaviors.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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