Original Paper

Willingness to Use Digital Health Screening and Tracking Tools for Public Health in Sexual Minority Populations in a National Probability Sample: Quantitative Intersectional Analysis

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affected sexual minority adults' willingness to use digital health tools for screening and tracking and whether there were also intersectional disparities based on age, gender, and racial or ethnic categories.

Methods

Overview

This study was conducted and reported in accordance with the "Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE) guidelines [49,50]. Specific study methods are provided in subsequent sections.

Data

The COVID Impact Survey (CIS) is a national probability survey of US households designed to provide estimates for preventative behaviors and the impact of the COVID-19 pandemic; the data are publicly available [51]. The author used data from the last of 3 waves of cross-sectional data collection in the CIS, which occurred from May 30 to June 8, 2020 (n=2047). All 3 waves occurred between April 20 and June 8, 2020. These data were collected using the AmeriSpeak Panel, a probability-based panel distributed by NORC (formerly the National Opinion Research Center) at the University of Chicago.

US households were sampled with a known, nonzero probability of selection based on the NORC National Sample Frame, which was extracted from the US Postal Service Delivery Sequence File. Households were contacted by US mail, email, telephone, and field interviewers. The data are representative of noninstitutionalized adults who reside in the United States when weighted using sampling weights provider by the CIS. The CIS was funded by the Data Foundation. The NORC Institutional Review Board approved the CIS protocol to protect human participants (FWA00000142).

Measures

Willingness for Public Health Digital Screening and Tracking for COVID-19

Participants responded to questions asking about their likelihood of COVID-19–related testing (ie, "Testing you for COVID-19 infection using a Q-tip to swab your cheek or nose" and "Testing you for immunity or resistance to COVID-19 by drawing a small amount of blood") and digital screening and tracking (eg, "Installing an app on your phone that asks you questions about your own symptoms and provides recommendations about COVID-19" and "Installing an app on your phone that tracks your location and sends push notifications if you might have been exposed to COVID-19"). Response options ranged from (1) "extremely likely" to (5) "not at all likely." Items were reverse-coded such that higher scores reflected a greater perceived likelihood for screening and tracking. Participants had the option to respond with (88) "Already done this," and these cases were excluded using listwise deletion.

In a sample that included mostly heterosexual participants from Wave 2 of the CIS (manuscript under review), the measure showed construct validity in its positive correlations with participants having engaged in other protective behaviors to prevent COVID-19 infection (eg, "worn a face mask" and "avoided public or crowded places"). Additionally, participants who engaged in more frequent digital communications with friends and family before the public health response to the COVID-19 pandemic in the United States in March 2020 scored higher in willingness to use pandemic-related mHealth tools than participants who used digital communications with friends and family less frequently. The measure also showed measurement invariance across age groups, genders, and categories of race or ethnicity based on Wave 3. Based on Wave 1 of the CIS, the measure has demonstrated high internal consistency (Cronbach α=.90).

Demographic Characteristics

Participants self-reported their sexual orientation identity (ie, gay, lesbian, or bisexual, straight, something else, and I don't know). Sexual orientation identity was dichotomized to reflect heterosexual status and nonheterosexual sexual-minority status, respectively. The following additional demographic characteristics were assessed for measurement invariance: age, gender, and race or ethnicity. Additionally, participants reported their current age, which the CIS categorized (ie, 18-24 years, 25-34 years, 45-54 years, 55-64 years, 65-74 years, and ≥75 years) to help anonymize the data set; gender (female coded 1, male coded 0); and self-identified race or ethnicity (eg, Black or African American, Hispanic or Latino, White, multiple other races and ethnicities, such as Asian, Indian, and Native Hawaiian). Transgender and nonbinary identities were not options on the CIS.

Data Analysis Plan

This study tested the extent to which heterosexual and sexual minority adults differed in their willingness to use digital health tools for public health screening and tracking, a latent variable, and whether sexual minority adults' willingness to use these COVID-19–related digital health

of measurement invariance—configural, metric, and scalar—were tested to determine if the 5-item measure was invariant across sexual-orientation categories. For ordinal variables and weighted least squares estimation methods with Delta parameterization, configural invariance (ie, pattern invariance), the least strict form of invariance, shows that each group has the same indicators loading onto the same factors in the

an outcome for a relatively disadvantaged group that otherwise disproportionately and systematically experiences worse health outcomes and greater health risks would not meet established definitions of a disparity [61,62].

Given the complex nature of these survey data, analyses were adjusted using a sampling weight based on the inverse of the probability of selection in the sample. These analyses also accounted for stratification using pseudostrata based on census tracts. The data producer, NORC, used pseudostrata to preserve confidentiality. Per NORC, they did not include cluster variables because there were negligible cluster effects, and excluding these variables better preserved confidentiality (personal communication; Jennifer Benz, May 14, 2021). Descriptive statistics for the present sample accounted for weighting and stratification to reflect the complex survey design and national representativeness of the sample along key raking variables (ie, age, gender, and race or ethnicity). Latent factor mean differences (ΔM) and regression coefficients (*b*) are presented with their 95% CIs. Missing data, which were up to 3.7% missing across analyses, were handled using listwise deletion.

Ethical Considerations

Temple University's institutional review board determined that the present analyses, which used deidentified publicly available data, did not require institutional approval for human participants research (contact the corresponding author for documentation).

Results

Sample Characteristics

Of the total sample of 1928 adults, 161 were sexual minority individuals. Other sample characteristics are listed in Tables 1 and 2. The sample size was reduced from 2047 due to missing data on sexual orientation (6.2%).

Table 1. Descriptive statistics based on raking variables (ie, age, gender, and race or ethnicity) given complex design and weighting and sexual orientation identities represented in the sample (N=1928). Proportions may not sum to 1, and percentages may not sum to 100 due to rounding. Subcategories (eg, sexual orientation subcategories) may not sum to 1928 due to missing data. Sexual orientation was significantly associated with age group; the pattern of results indicates that younger adults were more likely to self-identify as sexual minority individuals than older adults.

Variable	Total				Estimated proportion		Comparison linearized SE	*P* value
	n	Estimated proportion (%)	Linearized SE	Design effect	Heterosexual	Sexual minority		
Age (years)								<.001
18-29	311	0.211	0.015	2.48	0.882	0.118	0.025	
30-44	594	0.263	0.013	1.62	0.916	0.085	0.015	
45-59	435	0.238	0.013	1.74	0.945	0.055	0.012	
≥60	588	0.288	0.013	1.675	0.966	0.034	0.008	
Gender								.19
Male	914	0.478	0.015	1.82	0.940	0.060	0.009	
Female	1014	0.522	0.015	1.82	0.921	0.079	0.012	
Race or ethnicity								.72
Asian or Asian American	62	0.056	0.008	2.47	0.956	0.044	0.027	
Black or African American	227	0.124	0.010	1.83	0.920	0.080	0.026	
Hispanic or Latino	324	0.166	0.012	2.01	0.919	0.081	0.019	
White or European American	1127	0.623	0.015	1.84	0.934	0.066	0.010	
Other races and ethnicities	103	0.031	0.004	0.892	0.906	0.095	0.029	
Sexual orientation								—[a]
Homosexual	58	3.0	—	—	—	—	—	
Bisexual	69	3.6	—	—	—	—	—	
Heterosexual	1767	91.7	—	—	—	—	—	
Other: “Something else”	25	1.3	—	—	—	—	—	
Other: “I don’t know the answer”	9	0.5	—	—	—	—	—	

[a]Not available.

Table 2. Descriptive statistics based on sexual orientation and willingness to use mHealth tools for pandemic-related digital screening and tracking ("If these options were available to you, how likely would you be to participate in them?"; N=1928). Proportions may not sum to 1, and percentages may not sum to 100 due to rounding. Subcategories (eg, sexual orientation subcategories) may not sum to 1928 due to missing data. Sexual orientation was significantly associated with willingness to install "an app on your phone that tracks your location and sends push notifications if you might have been exposed to COVID-19"; the pattern of results indicates that sexual minority adults reported being more likely to install such an app than heterosexual adults. Additionally, sexual orientation was also significantly associated with willingness to "use a website to log your symptoms and location and get recommendations about COVID-19"; the pattern of findings indicates that sexual minority adults reported being more likely to use such a website than heterosexual adults.

Variable	Total				Estimated proportion		Comparison linearized SE	*P* value
	N	Estimated proportion (%)	Linearized SE	Design effect	Heterosexual	Sexual minority		
Installing an app on your phone that asks you questions about your own symptoms and provides recommendations about COVID-19								.06
Extremely likely	146	0.075	0.008	1.75	0.866	0.134	0.044	
Very likely	212	0.110	0.010	1.95	0.898	0.102	0.028	
Moderately likely	373	0.203	0.013	2.04	0.927	0.073	0.018	
Not too likely	404	0.219	0.013	1.85	0.937	0.063	0.014	
Not likely at all	757	0.377	0.015	1.73	0.950	0.050	0.009	
Already done this	27	0.017	0.004	1.89	0.893	0.107	0.062	
Installing an app on your phone that tracks your location and sends push notifications if you might have been exposed to COVID-19								<.001
Extremely likely	171	0.086	0.008	1.69	0.826	0.174	0.045	
Very likely	232	0.130	0.011	1.88	0.889	0.111	0.029	
Moderately likely	365	0.202	0.013	1.95	0.947	0.053	0.011	
Not too likely	342	0.180	0.013	2.17	0.958	0.042	0.012	
Not likely at all	790	0.394	0.015	1.71	0.943	0.057	0.010	
Already done this	15	0.007	0.002	1.54	0.948	0.052	0.052	
Using a website to log your symptoms and location and get recommendations about COVID-19								.008
Extremely likely	129	0.074	0.009	2.40	0.842	0.158	0.048	
Very likely	216	0.112	0.009	1.72	0.906	0.095	0.025	
Moderately likely	441	0.240	0.014	2.00	0.917	0.083	0.016	
Not too likely	403	0.204	0.012	1.72	0.953	0.047	0.014	
Not likely at all	710	0.631	0.012	1.73	0.949	0.051	0.010	
Already done this	15	0.009	0.003	1.81	1.00	0.000	0.000	

Psychometric Properties of Measure of Willingness to Use Digital Health Tools for COVID-19–Related Screening and Tracking

The measure of willingness to use digital health tools for COVID-19–related screening and tracking showed internal consistency and reliability (Cronbach α=.89 and coefficient ω=0.93). Additionally, as shown in Table 3, the measure was invariant by sexual orientation. Configural invariance was indicated by all factor loadings being significant and in the expected direction for each group. The configural model had no global fit statistics, as it was a fully saturated model. Next, the author tested a metric invariance model with factor loadings constrained to be equal across groups, and metric invariance was evident (ΔCFI<0.01; $\Delta\chi^2_2$=2.30; *P*=.32). Thus, the metric model had an equivalent model fit with the configural invariance model; the nonsaturated metric model fit the data, per the RMSEA, CFI, and SRMR (Table 3). Finally, the author tested a scalar invariance model, and scalar invariance was shown (ΔCFI<0.01; $\Delta\chi^2_8$=6.44; *P*=.60).

Table 3. Measurement invariance by sexual orientation for a measure of pandemic-related psychological distress (N=1928). Sexual orientation categories are heterosexual and sexual minority. The measure showed measurement in variance based on the criterion of ΔCFI<.01 [54] between the configural and the metric model and between the metric and the scalar model.

	Fit index				
	Chi-square (*df*)	*P* value	RMSEA[a]	CFI[b]	SRMR[c]
Invariance models					
Configural	0.00 (0)	<.001	0.00	1.00	0.00
Metric	2.30 (2)	.32	0.01	1.00	<0.01
Scalar	8.51 (10)	.58	<0.01	1.00	0.01

[a]RMSEA: root-mean-square standard error of approximation.

[b]CFI: comparative fit index.

[c]SRMR: standardized root-mean-square residual.

Mean Difference by Sexual Orientation on Willingness to Use Digital Health Tools for COVID-19–Related Screening and Tracking

Given scalar invariance, factor means for willingness to use COVID-19–related digital screening and tracking tools differed between heterosexual and sexual minority adults. Specifically, willingness to use digital health tools was nearly half an SD greater for sexual minority adults than for heterosexual adults (ΔM=0.46, 95% CI 0.15-0.77).

Associations Between Demographic Characteristics and Willingness to Use Digital Health Tools for COVID-19–Related Screening and Tracking Among Sexual Minority Adults

Within the population of sexual minority adults, no differences were detected by age group, gender, or race or

terms, the main effects of being African American, Hispanic or Latino, and another racial or ethnic identity reached statistical significance. Specifically, among heterosexual adults, being Black or African American was associated with 41% of an SD greater willingness to use digital health screening and tracking tools (*b*=0.41, CI 0.19-0.62), being Hispanic or Latino was associated with 36% of an SD greater willingness to use these tools (*b*=0.36, CI 0.18-0.55), and being of another racial or ethnic minority group was associated with 54% of an SD greater willingness to use these tools (*b*=0.54, CI 0.31-0.77).

Table 5. The independent associations of age, gender, and race or ethnicity and their respective interactions by sexual minority status with willingness to use digital health tools for public health screening and tracking (latent variable) in separate structural equation models in a national probability sample of sexual minority people (N=1928).

Variable	Structural equation models

questions and the lack of sexual orientation measures that distinguish different sexual orientation groups beyond sexual minority status by gender (ie, sexual minority men, including gay and bisexual men, and women, including lesbians and bisexual women, which were accounted for in this study). As a result, the analyses were not more nuanced regarding gender and sexual orientation identity.

Implications

This study has several research and applied implications. For instance, additional research can oversample sexual minority adults to provide balanced samples for comparisons between heterosexual and sexual minority adults. Additionally, studies can examine sexual minority individuals' willingness to use digital health tools for other non-COVID-19–related health issues beyond HIV, including specific mental health diagnoses (eg, depression and substance use) and chronic illnesses (eg, diabetes and hypertension). These studies should consider intersections of identities among sexual minority people, such as underrepresented racial and ethnic minority people among sexual minority populations. Recently, monkey pox has emerged among sexual minority men, in particular [73], and digital health approaches may be useful in such circumstances. Additionally, studies are needed to further examine the decision-making process of White heterosexual adults regarding their use of digital health tools in response to public health emergencies.

Regarding applied implications, public health professionals and clinicians should consider screening sexual minority adults for their

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RMSEA: root-mean-square standard error of approximation
SRMR: standardized root-mean-square residual
STROBE: Strengthening the Reporting of Observational Studies in Epidemiology

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