COVID-19

The Impact of the COVID-19 Pandemic on Sexual Behaviors: Findings From a National Survey in the United States

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ABSTRACT

Background: Studies from the first months of the coronavirus disease 2019 (COVID-19) pandemic and the resulting lockdown and social distancing measures have shown that there have been decreases in sexual frequency and relationship satisfaction.

Aim: To evaluate the ongoing impact of the COVID-19 pandemic on sexual behavior, relationship satisfaction, and intimate partner violence in the United States using a large national convenience sample.

Methods: About 1,051 participants across the United States were recruited in October 2020 to complete a cross-sectional online survey.

Outcomes: Participants were asked to retrospectively report their sexual behavior frequency, relationship satisfaction, and intimate partner violence during the pandemic and prior to the pandemic

Results: There was a small but significant decrease in some retrospectively-reported partnered sexual activities, and men reported a small increase in masturbation and pornography use. There was no evidence for a change in relationship satisfaction or intimate partner violence, but both men and women reported a small decrease in sexual pleasure, and women reported a small decrease in sexual desire. The sexual behaviors with greatest reduction were casual sex, hookups, and number of partners, and the most diminished as aspect of sexual functioning was sexual enjoyment. Depression symptoms, relationship status, and perceived importance of social distancing emerged as predictors of these reductions. Less than half of individuals who engaged with casual sex partners before the start of the pandemic ceased this behavior completely after the start of the pandemic. Individuals waited on average 6—7 weeks before reengaging in casual sex.

Clinical Implications: These results inform public health response to the effects of the pandemic and add to our understanding of how the pandemic has continued to impact sexual behavior.

Strengths and Limitations: This is the first known study to evaluate sexual behavior several months into the COVID-19 pandemic using a large national sample. However, the results of this study are limited by its convenience sampling method and cross-sectional design.

Conclusion: These results indicate that the changes in sexual behavior observed in the early months of the pandemic have continued, with small but significant decreases in many partnered sexual behaviors and a small increase in men's solitary sexual behaviors. **Gleason N, Banik S, Braverman J, et al. The Impact of the COVID-19 Pandemic on Sexual Behaviors: Findings From a National Survey in the United States. J Sex Med 2021;18:1851—1862.**

INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was recognized in January 2020 as the agent responsible for the coronavirus disease (COVID-19), whose worldwide outbreak led to the declaration of a global pandemic by the World Health Organization (WHO) on March 11, 2020.[1] In response to the COVID-19 pandemic, governments across the globe have implemented strict measures limiting physical interpersonal contact to reduce the spread of the virus. Human sexual behavior is likely affected by such measures, which has raised concern among sexual health experts regarding the negative outcomes the pandemic may have on sexual health.[2] Specifically, sexual health professionals are concerned about increases in sexual dysfunction and relationship conflict, as well as a negative impact on access to sexual healthcare.[3] In addition, there is concern that quarantine measures and increases in relationship conflict may lead to an increase in intimate partner violence.[4,5]

Preliminary evidence has supported some of these experts' concerns. For instance, one recent national survey in the United States found that 34% of individuals in a relationship reported relationship conflict due to COVID-19, and couples with more conflict also reported greater decrease in solitary and partnered sexual activities.[6] Another survey of married individuals in the United States found that 32% of respondents reported COVID-19 was straining their marriage. However, 74% also reported feeling the pandemic was strengthening their relationship, and the impact on sexual frequency was mixed, with 32% reporting an increase and 20% reporting a decrease.[7] Interestingly, a recent longitudinal survey found that stress related to COVID-19 predicted both increased relationship satisfaction as well as decreased sex drive and sexual activity at both the within-person and between-person levels.[8]

Other preliminary evidence, from both the United States and other countries, has suggested that additional changes to sexual behavior are occurring, such as decreased casual sex[9,10] and increased use of pornography[11] and sexting/cybersex.[12] The pandemic may also facilitate experimentation with new ways of relating to others socially as well as sexually. For example, Lehmiller et al[12] found that engaging in novel sexual activities during the pandemic (such as new sexual positions, sharing fantasies, or using technology) was protective against the pandemic's deleterious effects on sexual satisfaction.

Nevertheless, there remain few studies examining the impact of the COVID-19 pandemic on sexual health in the United States, and many studies have methodological deficiencies including small convenience samples that overrepresent or are limited to certain demographics such as women[12] LGBTQ+ individuals[9,12,13] or married couples.[7] In addition, studies published to date were largely conducted in the first few months of the pandemic when lockdown measures were just starting to take effect.

Since the public health response to this pandemic also requires attention to sexual health as a fundamental pillar of physical and mental well-being, the aim of this study is to analyze the impact of COVID-19 on the sexual behaviors, sexual functioning, and intimate partner violence in the United States. This study adds to the findings of previous research by collecting a large national convenience sample and examining a wide variety of sexual behaviors several months into the pandemic. During this period (October 2020), individuals and government had been given numerous months to adapt to the novel circumstances, and many states in the United States had eased lockdown restrictions after summer surges in COVID-19 cases had subsided. Thus, collecting data in this period provides the opportunity to observe how COVID-19 continued to impact sexual behaviors after several months. Given the exploratory nature of this study and the limited prior research, specific a priori hypotheses were not generated. Rather, this study aimed to answer the question: How has the COVID-19 pandemic impacted the frequency of various partnered and solitary sexual behaviors, sexual functioning and satisfaction, relationship satisfaction, and intimate partner violence?

METHODS

Participants

Approval for this study was obtained from [sponsor institution's] IRB. Participants were recruited from the Amazon Mechanical Turk (Mturk) platform. This platform allows verified workers to accept tasks from requesters in exchange for payments to their Mturk accounts. A total of 1,474 surveys were started. Of these, 177 surveys were incomplete, 33 were eliminated due to participants taking the survey twice, 250 surveys were rejected due to incorrect responses to the attention check questions, and 23 were excluded from analysis because no sexual behaviors were reported. This resulted in a sample of 1,051 participants from 48 U.S. states. Full descriptive statistics for participant demographics are listed in Table 1.

Procedure

Mturk workers were recruited to complete the survey and were compensated $5 USD after completion of a valid survey. After giving consent, participants were asked questions about how frequently they engaged in various sexual behaviors before and after the start of the COVID-19 pandemic. When considering their behavior before and after the start of the pandemic, they were asked to use the reference date of March 11, 2020 as the start of the pandemic, as this was the date the World Health Organization declared COVID-19 a pandemic. Participants then completed the other study measures and demographics questions.

Table 1. Participant demographics

Participant characteristics	All participants		Men		Women		Other	
	N	%	N	%	N	%	N	%
Total	1,051	100%	602	57.30%	442	42.10%	7	0.70%
Age	M = 38.54 (SD = 10.56)		M = 37.19 (SD = 9.91)		M = 40.30 (SD = 11.10)		M = 33.14 (SD = 6.57)	
Sexual orientation								
Straight	982	88.30%	560	93.00%	368	83.30%	0	0%
Gay/Lesbian	36	3.40%	18	3.00%	17	3.80%	1	14.30%
Bisexual	66	6.30%	17	2.80%	48	10.90%	1	14.30%
Pansexual	12	1.10%	3	0.50%	6	1.40%	3	42.90%
Asexual	6	0.60%	2	0.30%	3	0.70%	1	14.30%
Other	3	0.30%	2	0.30%	0	0%	1	14.30%
Relationship status								
Single	351	33.40%	237	39.40%	110	24.90%	4	57.10%
In a relationship, living separately	130	12.40%	80	13.30%	50	11.30%	0	0%
Live-in partnership	148	13.10%	82	13.60%	64	14.50%	2	28.60%
Married	421	40.10%	203	33.70%	218	49.30%	0	0%
Multiperson partnership	1	0.10%	0	0%	0	0%	1	14.30%
Location								
Urban	328	31.30%	199	33.10%	126	28.50%	4	57.10%
Suburban	531	50.50%	312	51.80%	218	49.30%	1	14.30%
Rural	188	17.90%	89	14.80%	97	21.90%	2	28.60%
Other	3	0.30%	2	0.30%	1	0.20%	0	0%
U.S. Region								
Northeast	203	19.30%	116	19.30%	85	14.30%	1	14.30%
South	397	37.80%	220	20.60%	176	29.20%	1	14.30%
Midwest	209	19.90%	124	36.50%	83	13.80%	2	28.60%
West	242	23.00%	142	23.60%	97	16.10%	3	42.90%
Race								
White (non-Hispanic)	811	77.20%	456	75.70%	352	79.60%	3	42.90%
Black (non-Hispanic)	74	7.00%	42	7.00%	32	7.20%	0	0%
American Indian	2	0.20%	1	0.20%	1	0.20%	0	0%
Asian	77	7.30%	49	8.10%	27	6.10%	1	14.30%
2+ races (non-Hispanic)	24	2.30%	13	2.20%	10	2.30%	1	14.30%
Hispanic	63	6.00%	41	6.80%	20	4.50%	2	28.60%
Hispanic only	41	3.90%	28	4.70%	12	2.70%	1	14.30%
Hispanic and white	16	1.50%	9	1.50%	6	1.40%	1	14.30%
Hispanic and Black	5	0.50%	4	0.70%	1	0.20%	0	0%
Hispanic and 2+ races	1	0.10%	0	0%	1	0.20%	0	0%
Political affiliation								
Very liberal	193	18.40%	82	13.60%	105	23.80%	6	85.70%
Liberal	285	27.10%	177	29.40%	107	24.20%	1	14.20%
Slightly liberal	111	10.60%	66	11.00%	45	10.20%	0	0%
Moderate	177	16.80%	104	17.30%	73	16.50%	0	0%
Slightly conservative	84	8.00%	51	8.50%	33	7.50%	0	0%
Conservative	130	12.40%	76	12.60%	54	12.20%	0	0%
Very conservative	64	6.10%	41	6.80%	23	5.20%	0	0%
Other	7	0.70%	5	0.80%	2	0.50%	0	0%
Income								
Less than $10,000	35	3.30%	20	3.30%	14	3.20%	1	14.20%
$10,000−$19,999	72	6.90%	44	7.30%	27	6.10%	1	14.20%
$20,000−29,999	119	11.30%	62	10.30%	54	12.20%	1	14.20%
$30,000−$39,999	116	11.00%	73	12.10%	43	9.70%	0	0%
$40,000−$49,999	120	11.40%	72	12.00%	47	10.60%	1	14.20%

(continued)

Table 1. Continued

Participant characteristics	All participants		Men		Women		Other	
	N	%	N	%	N	%	N	%
$50,000–$59,999	132	12.60%	82	13.60%	50	11.30%	0	0%
$60,000–$69,999	100	9.50%	56	9.30%	43	9.70%	1	14.20%
$70,000–$79,999	103	9.80%	45	7.50%	58	13.10%	0	0%
$80,000–$89,999	39	3.70%	22	3.70%	17	3.80%	0	0%
$90,000–$99,999	62	5.90%	35	5.80%	27	6.10%	0	0%
$100,000–$149,999	107	10.20%	63	10.50%	44	10.00%	0	0%
$150,000+	46	4.40%	28	4.70%	18	4.10%	0	0%
Education								
Less than high school	6	0.60%	5	0.80%	1	0.20%	0	0%
High school/GED	140	13.30%	84	14.00%	56	12.70%	0	0%
Some college	215	20.50%	125	20.80%	89	20.10%	14.30%	14.30%
Professional degree	38	3.60%	19	3.20%	19	4.30%	0	0%
Associate's degree	128	12.20%	47	7.80%	78	17.60%	3	42.90%
Bachelor's degree	405	42.80%	280	46.50%	168	38.00%	2	28.60%
Graduate degree	74	7.00%	42	7.00%	31	7.00%	1	14.30%
Religious affiliation								
Christian	439	41.80%	244	40.50%	195	44.10%	0	0%
Jewish	10	1.00%	7	1.20%	3	0.70%	0	0%
Muslim	3	0.30%	2	0.30%	1	0.20%	0	0%
Hindu	8	0.80%	3	0.50%	5	1.10%	0	0%
Buddhist	16	1.50%	10	1.70%	5	1.10%	1	14.30%
Other	32	3.00%	15	2.50%	17	3.80%	0	0%
Agnostic	237	22.50%	140	23.30%	93	21.00%	4	57.10%
Atheist	207	19.70%	122	20.30%	83	18.80%	2	28.60%
None	99	9.40%	59	9.80%	40	9.00%	0	0%
Employment								
Employed	761	72.40%	459	76.20%	300	67.90%	2	28.60%
Unemployed	48	4.60%	25	4.20%	22	5.00%	1	14.30%
Self-employed	188	17.90%	96	15.90%	90	20.40%	2	28.60%
Student	13	1.20%	6	1.00%	7	1.60%	0	0%
Retired	15	1.40%	8	1.30%	7	1.60%	0	0%
Unable to work	7	0.70%	3	0.50%	3	0.70%	1	14.30%
Laid off or furloughed	19	1.80%	5	0.80%	13	2.90%	1	14.50%
Depression (PHQ-2)*								
Current	M = 3.35	SD = 1.71	M = 3.23	SD = 1.62	M = 3.50	SD = 1.80	M = 4.71	SD = 1.89
Prior to COVID	M = 3.14	SD = 1.54	M = 3.04	SD = 1.47	M = 3.25	SD = 1.61	M = 4.57	SD = 1.90
COVID-19 status								
Tested positive for COVID-19	13	1.20%	6	1.00%	7	1.60%	0	0%
Household member tested positive	19	1.80%	11	1.80%	8	1.80%	0	0%
Quarantined due to possible exposure	94	8.90%	50	8.30%	43	9.70%	1	14.30%
Financial difficulty due to COVID-19	245	23.30%	129	21.40%	113	25.60%	3	42.90%
Laid off or furloughed due to COVID-19	27	2.60%	10	1.70%	15	3.40%	2	28.60%
Perceived importance of social distancing guidelines								
Not at all important	30	2.90%	21	3.50%	9	2.00%	0	0%
Slightly important	62	5.90%	37	6.10%	25	5.70%	0	0%
Moderately important	207	19.70%	128	21.30%	77	17.40%	2	28.60%
Extremely important	752	71.60%	416	69.10%	331	74.90%	5	71.40%
Substance use (past year)								
Alcohol	813	77.40%	47.6	79.10%	331	74.90%	6	85.70%

(continued)

Table 1. Continued

Participant characteristics	All participants		Men		Women		Other	
	N	%	N	%	N	%	N	%
Cannabis	350	33.30%	191	31.70%	117	26.50%	4	42.90%
Recreational	333	31.70%	156	25.90%	93	21.00%	2	28.60%
Medical	58	5.50%	11	1.80%	11	2.50%	0	0%
Recreational & medical	41	3.90%	24	4.00%	13	2.90%	1	14.30%
Cocaine	20	1.90%	12	2.00%	8	1.80%	0	0%
Meth	9	0.90%	6	1.00%	3	0.70%	0	0%
Heroin	7	0.70%	5	0.80%	2	0.50%	0	0%
Nicotine/tobacco	225	24.30%	150	24.90%	104	23.50%	1	14.30%
Medications you were not prescribed	48	4.60%	26	4.30%	21	4.80%	1	14.30%
Other	18	1.70%	12	2.00%	5	1.10%	1	14.30%
Psychedelics	10	1.00%	6	1.00%	3	0.70%	1	14.30%

COVID-19 = coronavirus disease 2019; GED = General Education Development; PHQ-2 = Patient Health Questionnaire-2.
*Scores on the PHQ-2 range from 2 (no depression) to 8 (severe depression).

Measures

Sexual Frequency Questions. Participants were first asked to indicate which sexual behaviors they had engaged in during the past year (see Table 2 for a full list of sexual behaviors). For each behavior they endorsed, they were asked 2 questions about sexual frequency: "In the months since the start of the COVID-19 pandemic, how often have you [sexual behavior]?" and "In the year before the start of the COVID-19 pandemic, how often did you [sexual behavior]?" Participants responded to these 2 questions using a 7 item Likert scale (not at all, once a month or less, a few times per month, about once per week, multiple times per week, daily or nearly every day, multiple times each day). If they reported engaging in sex with someone they had never met before (ie, "hookups") or a casual partner, they were asked how many weeks after the start of the pandemic they first engaged in this activity (numeric response raining from 0 to 30) and how often they used a condom when engaging in this activity (5-point Likert scale ranging from "not at all" to "every time"). In addition, they were asked how many hookup partners they had met using a dating app or website (5-point Likert scale ranging from "none of them" to "all of them") and if they currently lived with their casual partner(s). Finally, all participants were asked how many different sexual partners they have had since the start of the pandemic and in the 6 months before the start of the pandemic (numeric response ranging from 0 to 25+).

Sexual and Romantic Satisfaction. Participants were first asked to rate their sexual desire on a 6-point Likert scale (*no desire, very weak desire, somewhat weak desire, moderate desire, somewhat strong desire, very strong desire*) for the months since the start of the COVID-19 pandemic and in the year before the pandemic. Next, participants were asked to rate their sexual enjoyment or pleasure before and during the pandemic on a scale adapted from the Changes in Sexual Functioning

Questionnaire.[14] Finally, if participants reported being married or in a relationship, they were asked to rate their satisfaction with their current romantic relationship before and during the pandemic using questions adapted from the Relationship Satisfaction Scale.[15]

Sexual and Physical Violence. Participants were asked a series of questions about experiencing and perpetrating sexual and physical violence adapted from a domestic violence risk assessment questionnaire.[16] First, participants were asked if a partner had physically threatened them or forced them to have sex since the start of the COVID-19 pandemic and in the year before the start of the pandemic. Those who reported any physical or sexual violence were asked if they had experienced an increase in sexual, physical, or emotional violence since the start of the COVID-19 pandemic. Finally, participants were asked if they had physically threatened a partner or forced a partner to have sex during the COVID-19 pandemic or in the year before the pandemic.

Demographic and COVID-19 Measures. Participants were asked to report relevant demographic, substance use, and COVID-19 exposure information (Table 1). In addition, participants completed an adapted version of the Patient Health Questionnaire-2 (PHQ-2),[17] which asked about depression symptoms in the past 2 weeks and in the year before the pandemic.

Attention Check Questions. The survey included 5 attention check questions. Participants were asked for their age twice during the survey to check for discrepancies and were asked 3 multiple choice questions with only one correct answer: i) "If you are reading this question, please select 'sometimes'"; ii) "what color is the sky?"; and iii) "how often is W the first letter of the alphabet?" (with the correct answer being "never").

Table 2. Frequency of sexual behavior before and during COVID-19 pandemic

Sexual behavior/functioning measure	N	%	M_2-M_1[†]	t-test[‡]	Cohen's d
Sex with current partner	680		−0.138	t(679) = 3.122, P = .002*	d = 0.113
Decreased	198	27.4%			
Stayed the same	372	54.7%			
Increased	122	12.9%			
Masturbation	907		0.105	t(906) = 3.516, P < .001*	d = 0.112
Decreased	127	14.0%			
Stayed the same	587	64.7%			
Increased	193	21.3%			
Porn use	817		0.095	t(816) = 2.993, P = .003*	d = 0.110
Decreased	112	13.7%			
Stayed the same	536	65.6%			
Increased	169	20.7%			
Sending sexual messages or photos	333		0.45	t(332) = 0.646, P = .519	d = 0.039
Decreased	91	24.3%			
Stayed the same	165	49.6%			
Increased	87	26.1%			
Socializing on apps or websites	201		−0.244	t(200) = 2.028, P = .044	d = 0.141
Decreased	84	41.8%			
Stayed the same	66	32.8%			
Increased	51	25.4%			
Hookups	68		−0.441	t(67) = 3.830, P < .001*	d = 0.462
Decreased	33	48.5%			
Stayed the same	25	36.8%			
Increased	10	14.7%			
Sex with casual partner	193		−0.710	t(192) = 7.69, P < .001*	d = 0.554
Decreased	103	53.4%			
Stayed the same	71	36.8%			
Increased	19	9.8%			
Affair[§]	18		-	-	-
Decreased	5	27.8%			
Stayed the same	7	38.9%			
Increased	6	33.3%			
Webcam/cybersex	98		0.153	t(97) = 0.958, P = .340	d = 0.095
Decreased	31	31.6%			
Stayed the same	30	30.6%			
Increased	37	37.8%			
Use of sex toys	375		0.027	t(374) = 0.458, P = .647	d = 0.018
Decreased	74	19.7%			
Stayed the same	224	59.7%			
Increased	77	20.3%			
Number of sex partners			−0.271	t(1,050) = −3.598, P < .001*	d = 0.220
Decreased	1,051				
Stayed the same	195	18.6%			
Increased	802	76.3%			
	54	5.1%			
Sexual desire	1,051		−0.112	t(1,050) = 3.598, P < .001*	d = 0.109
Decreased	262	24.8%			
Stayed the same	605	57.6%			
Increased	185	17.6%			
Sexual enjoyment/pleasure	1,051		−0.196	t(1,050) = −7.432, P < .001*	d = 0.222
Decreased	248	23.6%			
Stayed the same	699	66.5%			

(continued)

Table 2. Continued

Sexual behavior/functioning measure	N	%	M_2-M_1[†]	t-test[‡]	Cohen's d
Increased	104	9.9%			
Relationship satisfaction[¶]	678		−0.069	$t(677) = -1.519$, $P = .129$	$d = 0.059$
Decreased	127	18.7%			
Stayed the same	461	68.0%			
Increased	90	13.3%			

COVID-19 = coronavirus disease 2019.

[*]Significant at $P < .0038$ (Bonferroni correction applied).

[†]Mean differences were calculated by subtracting current frequency/ratings from frequency/ratings before the COVID-19 pandemic. Negative mean differences indicate a decrease in frequency/ratings, positive mean differences indicate an increase in frequency/ratings.

[‡]13 within-subjects t-test were conducted.

[§]Affair data were not included in the analyses due to low frequency.

[¶]Only participants that reported being in the same romantic relationship before and after the start of the COVID-19 pandemic were included in analysis.

Statistical Analyses

Descriptive statistics and effect sizes were calculated for sexual frequencies and measures of sexual and relationship functioning reported before and after the start of the COVID-19 pandemic Differences in these scores were also assessed with a series of within-subject t-tests. A Bonferroni correction was applied to account for familywise error in multiple statistical tests, resulting in a critical value of $P = .0038$. To assess demographic correlates of substantial changes in sexual frequency of functioning (ie, small effect sizes or larger), a series of multiple linear regressions were conducted. Demographic correlates included in the model were: gender (male vs female), sexual orientation (heterosexual vs non-heterosexual), age, relationship status (partnered vs nonpartnered), political affiliation, religion (religiously affiliated vs agnostic/atheist/none), whether they have children at home (yes vs no), financial difficulties due to COVID-19 (yes vs no), perceived importance of following social distancing guidelines, and depression symptoms (PHQ-2 score).

RESULTS

Differences in pre- and postpandemic sexual frequency and satisfaction scores, including effect sizes of retrospectively-reported changes, are displayed in Table 2. Because only 19 participants reported having sex with a romantic partner their current partner was not aware of (ie, an "affair"), this question was excluded from analysis. A series of within-subject t-tests indicated several significant but very small ($d < 0.2$) differences: a significant increase in frequency of masturbation and pornography use, and a significant decrease in frequency of sex with current partner and in ratings of sexual desire. Small significant decreases ($d > 0.2$) were noted for number of sex partners, frequency of hookups, and ratings of sexual enjoyment/pleasure, and a medium significant decrease ($d > 0.5$) was noted for frequency of sex with casual partners (Table 2). These analyses were repeated for men and women separately (Table 3) and some gender differences

were noted. Men reported very small ($d < 0.2$) but significant increases in pornography use and masturbation while women did not. In addition, women reported a very small ($d < 0.2$) but significant decrease in sexual desire, while men did not.

Three multiple linear regressions were run to assess demographic correlates of 3 sexual behavior changes that small to medium Cohen's D effect sizes in the series of within-subject t-tests (number of sexual partners, sexual enjoyment/pleasure, and sex with casual partners). Though changes in hookups demonstrated a small effect size ($d = 0.46$), the sample size (N = 68) was insufficient to include this variable in a multivariate analysis. Results are displayed in Table 4. Higher depression scores significantly predicted decreased sexual enjoyment/pleasure and casual partner frequency. Greater perceived importance of social distancing was associated with decreased casual partner frequency and being single was associated with a greater decrease in number of sexual partners.

To better understand how changes in sex with current partner differed based on relationship status, differences in means were compared for participants who were married, in a live-in relationship, and in a relationship but living separately. The mean difference for those in a relationship and living separately (N = 130) was $\Delta M = -0.445$, which was a small effect size ($d = 0.242$). The mean differences were much smaller for participants who were in a live-in relationship (N = 148; $\Delta M = -0.049$; $d = 0.054$) or married (N = 421; $\Delta M = -0.082$; $d = 0.095$). This indicates that the small but statistically significant reduction in sex with current partner was driven by those living separately from their partners.

Of participants who engaged in at least one hookup in the year before the start of the pandemic (N = 60), 24 (40.0%) did not engage in any hookups after the start of the pandemic. Participants who engaged in hookups during the pandemic (N = 42) reported waiting an average of 6.67 (SD = 5.85) weeks after the start of the pandemic before having sex with a new partner. Thirty individuals that engaged in hookups (44.1%)

Table 3. Frequency of sexual behavior before and during COVID-19 pandemic for men and women

Sexual behavior/functioning measure	Men				Women			
	N	M_2–M_1[†]	t-test[‡]	Cohen's d	N	M_2–M_1[†]	t-test[‡]	Cohen's d
Sex with current partner	355	−0.085	$t(354) = 1.419, P = .157$	$d = 0.080$	323	−0.192	$t(322) = 2.905, P = .004$	$d = 0.162$
Masturbation	548	0.111	$t(547) = 3.247, P = .001*$	$d = 0.139$	352	0.091	$t(351) = 1.650, P = .100$	$d = 0.088$
Porn use	539	0.132	$t(538) = 3.488, P = .001*$	$d = 0.150$	272	0.018	$t(271) = .309, P = .758$	$d = 0.019$
Sending sexual messages or photos	195	0.051	$t(194) = .629, P = .530$	$d = 0.045$	135	0.022	$t(134) = .177, P = .860$	$d = 0.015$
Socializing on apps or websites	146	−0.247	$t(145) = 2.008, P = .046$	$d = 0.166$	53	−0.302	$t(52) = 1.000, P = .046$	$d = 0.137$
Hookups	59	−0.424	$t(58) = 3.300, P = .002*$	$d = 0.430$	9	-	-	-
Sex with casual partner	126	−0.630	$t(125) = 6.019, P < .001*$	$d = 0.536$	66	−0.894	$t(65) = 4.745, P < .001*$	$d = 0.584$
Affair[§]	13	-	-	-	4	-	-	-
Webcam/cybersex	69	0.188	$t(68) = .1.052, P = .297$	$d = 0.127$	29	0.069	$t(28) = .205, P = .839$	$d = 0.038$
Use of sex toys	158	0.044	$t(157) = .483, P = .630$	$d = 0.038$	212	0.009	$t(211) = .122, P = .903$	$d = 0.008$
Number of sex partners	602	−0.246	$t(601) = −4.925, P < .001*$	$d = 0.201$	442	−0.305	$t(441) = −5.203, P < .001*$	$d = 0.247$
Sexual desire	602	−0.053	$t(601) = 1.487, P = .138$	$d = 0.061$	442	−0.190	$t(441) = 3.408, P = .001*$	$d = 0.162$
Sexual enjoyment/ pleasure	602	−0.169	$t(601) = −5.251, P < .001*$	$d = 0.214$	442	−0.233	$t(441) = −5.216, P < .001*$	$d = 0.248$
Relationship satisfaction[¶]	352	−0.094	$t(351) = −1.514, P = .131$	$d = 0.081$	324	−0.043	$t(323) = −0.637, P = .525$	$d = 0.035$

COVID-19 = coronavirus disease 2019.

*Significant at $P < .0038$ (Bonferroni correction applied). Those identifying as "other" gender were excluded due to low sample size.

[†]Mean differences were calculated by subtracting current frequency/ratings from frequency/ratings before the COVID-19 pandemic. Negative mean differences indicate a decrease in frequency/ratings, positive mean differences indicate an increase in frequency/ratings.

[‡]13 within-subjects t-test were conducted.

[§]Affair data were not included in the analyses due to low frequency.

[¶]Only participants that reported being in the same romantic relationship before and after the start of the COVID-19 pandemic were included in analysis.

Table 4. Multiple linear regression analyses of demographic characteristics and changes in sexual behavior/functioning

Demographic factors	Number of sexual partners (n = 1,051)			Sexual enjoyment/pleasure (n = 1,051)			Sex with casual partners (n = 128)		
	B	SE B	β	B	SE B	β	B	SE B	β
Gender	−0.136	0.081	−0.055	−0.055	0.056	−0.032	−0.279	0.213	−0.104
Sexual orientation	−0.007	0.126	−0.002	0.040	0.089	0.015	0.209	0.305	0.052
Age	0.004	0.004	0.034	−0.002	0.003	−0.030	0.009	0.011	0.061
Relationship status	0.588	0.087	0.225[†]	0.104	0.061	0.057	0.330	0.248	0.101
Political affiliation	0.008	0.024	0.012	−0.025	0.017	−0.055	−0.029	0.059	−0.040
Religion	0.075	0.084	0.030	−0.002	0.059	−0.001	0.373	0.199	0.143
Children at home	−0.077	0.088	−0.029	0.044	0.062	0.024	0.416	0.264	0.120
COVID-related financial difficulties	0.089	0.092	0.030	0.097	0.065	0.048	−0.110	0.225	−0.036
Importance of social distancing	0.029	0.057	0.017	0.078	0.040	0.066	0.370	0.138	0.211[†]
Depression symptoms	0.029	0.023	0.040	−0.078	0.016	−0.155[†]	−0.126	0.056	−0.169[*]
R2	0.049			0.040			0.119		
F	5.283[†]			4.288[†]			2.421[*]		

COVID-19 = coronavirus disease 2019.
[*]$P < .05$.
[†]$P < .01$.

reported using a condom every time, and 55 (80.9%) reported that they met at least some of their partners on a dating/hookup website or app. Similarly, of participants who engaged in sex with a casual partner at least once in the year before the start of the pandemic (N = 179), 65 (36.31%) reported no sex with a casual partner during the pandemic. Participants who reported engaging in sex with a casual partner during the pandemic (N = 125) reported waiting an average of 6.26 (SD = 6.89) weeks before engaging in sex with a casual partner. Seven of these

individuals (5.6%) reported that they currently live in the same household as their casual partner. Ninety-two individuals that reported sex with a casual partner (47.7%) reported using a condom every time. One hundred nineteen participants reported that they were currently in a relationship but living separately, and of these, 15 (12.61%) reported that they had not had sex with their partner during the pandemic.

The mean number of sex partners reported during the pandemic was M = 1.0 (SD = 1.46), compared to a mean of

Table 5. Sexual and physical violence

Reported Sexual or Physical Violent Act	All participants N = 1,051		Men N = 602		Women N = 442	
	N	%	N	%	N	%
A partner physically threatened you						
During COVID-19	20	1.90%	8	1.30%	12	2.70%
In the year before COVID-19	30	2.90%	14	2.30%	16	3.60%
A sexual partner forced you to have sex						
During COVID-19	25	2.40%	11	1.80%	14	3.20%
In the year before COVID-19	25	2.40%	12	2.00%	13	2.90%
You physically threatened a partner						
During COVID-19	11	1.00%	6	1.00%	5	1.10%
In the year before COVID-19	11	1.00%	7	1.20%	4	0.90%
You forced a partner to have sex						
During COVID-19	16	1.50%	9	1.50%	7	1.60%
In the year before COVID-19	16	1.50%	9	1.50%	7	1.60%
Experienced any sexual or physical violence	61	5.80%	29	4.80%	32	7.20%
Experienced more violence since start of pandemic[*]						
Yes	17	27.90%	9	31.00%	8	25.00%
No	44	72.10%	20	69.00%	24	75.00%

COVID-19 = coronavirus disease 2019.
[*]This question was asked to individuals who reported experiencing physical or sexual violence before or after the start of the COIVD-19 pandemic.

M = 1.27 (SD = 1.72) in the 6 months before the start of the pandemic. Participants that reported having multiple sex partners either before or during the pandemic (N = 209) reported an average of M = 2.16 (SD = 2.87) partners during the pandemic and an average of M = 3.27 (SD = 3.02) partners in the 6 months before the start of the pandemic. The effect size for the difference between these means was small (d = 0.441).

Sexual and physical violence was reported by a small number of participants (Table 5), and therefore statistical analyses were not conducted to determine differences in reported violence before and during the pandemic. Among those who reported being the victim of any sexual or physical violence before or during the pandemic (N = 61), 17 (27.9%) reported that they had experienced more physical, sexual, and emotional violence during the COVID-19 pandemic, while 44 (72.1%) did not report an increase.

DISCUSSION

This is the first known study to examine sexual behavior 6 months into the COVID-19 pandemic in the United States using a large sample. The observed small decreases in partnered sexual frequency and sexual functioning, as well as the small increase in solitary sexual frequency, are largely in line with studies conducted during the first months of the pandemic. It was also noted that less than half of participants who reported engaging in casual sex before the pandemic reported stopping this behavior completely during the pandemic. Those who continued to engage with outside sexual partners waited on average 6−7 weeks until after the start of the pandemic before they began engaging the behavior again. Thus, while casual sex may have declined sharply at the start of the pandemic, as was observed in previous studies,[9,10,12,13] frequency of these behaviors may have rebounded after a few months.

Sexual health, frequency, and satisfaction impacts relationship satisfaction and overall mental and physical well-being,[18−21] and thus the small and medium retrospectively-assessed changes in sexual behavior may indicate an emerging public health concern. However, from the research that has been conducted during the COVID-19 pandemic, it remains unclear whether reduced sexual satisfaction and pleasure are impacting mental health or whether poorer mental health is impacting sexual satisfaction. This study, for instance, found that depression symptoms are related to decreases in sexual enjoyment/pleasure and casual sex, though the direction and causality of this relationship is unclear. Mental and sexual health appear to have declined simultaneously during the COVID-19 pandemic,[22] and thus could be impacting each other or having a combined negative impact.

Overall, it is encouraging news that reduction in sexual desire and frequency among married and cohabiting partners was modest, given the strain the pandemic has caused on partners living and oftentimes working in the same space for long periods of time. Understandably, the negative impact was worse among partners living apart. While the methodological limitations of this study prevent a more detailed analysis of the data on sexual and domestic violence, it at least provides an encouraging, albeit tentative, indicator that it has not overwhelmingly increased, which was been feared and reported early on in the pandemic.[6] Since the social distancing requirements have been and may continue to be in effect for some time, the long-term impact on relationships is still unclear.

The reduction in sexual activity among non-partnered and young adults is also a matter of concern. Over the past several decades, sexual frequency among young adults has declined in the United States[23−27] and some other developed countries.[28] Whether this decline is associated with trends of poorer mental health among youth is not clear as there are other factors that have been implicated (eg, increased use of technology, reduced sleep).[26] It is not yet known whether the COVID-19 pandemic will exacerbate this trend, or whether its effect will be temporary or permanent.

LIMITATIONS AND FUTURE RESEARCH

Several limitations must be considered. First, the cross-sectional nature of the study limits the causal conclusions that can be drawn. Because individuals were asked to retrospectively report their sexual behavior from months prior to the survey, their answers may have been influenced by recall bias. Ideally, data would have been collected in the months before the pandemic began as a comparison. In addition, most variables were assessed with single-item measures that were developed for the purpose of the study, which limits the ability to compare these data to other studies conducted in different time periods and settings.

Second, while the sample represented a wide range of demographics, it was a convenience sample collected through Mturk panel and was not intended to be a fully representative sample. It was noted that compared to 2019 U.S. census estimates,[29] this sample had a larger proportion of males and white participants, and had fewer Hispanic and black participants. In addition, participants in this sample were more highly educated, less religious, and more politically liberal than the general U.S. population: 49.8% of our sample had obtained a bachelor's degree compared to 35.0% nationally,[30] 51.7% identified as religiously unaffiliated (eg, agnostic, atheist, or none) compared to 22.8% nationally,[31] and 56.0% identified as politically liberal compared to 26% nationally.[32] There were also a large portion of surveys (17.0%) that were excluded from analysis because of failed attention check questions, which is indicative of a well-documented problem with data quality on the Mturk platform.[33] However, other studies using Mturk to recruit participants for public health research have found the samples they recruited to be adequately representative of the wider U.S. population,[34] and the attention check questions used for this survey helped to ensure the final data used in analysis was valid.

Future research should further explore whether changes in sexual frequency were more pronounced or diminished among certain demographics such African American and Latino communities, which have experienced sharp disparities in rates of COVID-19 cases and deaths.[35] It would also be useful to further examine personality, sociocultural, and structural factors that may play a role in these changes. For instance, individuals with personality characteristics associated with high sexual frequency such as sexual compulsivity, sexual sensation seeking, or sexual disinhibition, may have experienced less reduction in sexual frequency compared to other individuals. In addition, sociocultural and structural factors that have come into play during the pandemic, such as financial hardship, discrimination, and geography, also likely had an impact on changes in sexual behavior. Collecting data on these factors would assist with targeted outreach to individuals who are most at risk of continuing unsafe behavior during the pandemic. Finally, the majority of research published to date has examined sexual behavior during the first few months of the pandemic, and our study found that 6 months into the pandemic, sexual behavior looked quite different. Continuing to track sexual behavior throughout the course of the pandemic will allow research to identify high-risk groups during pandemic and inform targeted public health interventions.

Future research should also address pandemic preparedness and response as it relates to sexual and reproductive health services. Because the COVID-19 pandemic may have long term implication on birth rate, postpandemic sexual behavior, and psychological health, research should examine ways to respond to and mitigate these negative outcomes. It is also important to consider strategies for training the next generation of sexual health therapists and healthcare providers, as they will be on the front lines of addressing these issues across different demographic groups and localities.

CONCLUSION

Sexual expression is a central aspect of human health; it is important for both the Public Health professionals and health care providers to be sensitized to and aware of the impact of COVID 19 on sexuality. This study indicates that the decline in partnered sexual activity and sexual satisfaction observed in the first months of the COVID-19 pandemic have continued several months into the pandemic, and this has worrisome public health implications. However, these declines have been moderate at best and, in the case of casual sex, appear to have shifted over time. Researchers should continue to monitor these trends to better understand the impact the COVID-19 pandemic is having on sexual health and to better understand factors that contribute to positive and negative sexual and reproductive health outcomes.

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STATEMENT OF AUTHORSHIP

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