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Changes in Solo and Partnered Sexual Behaviors following the First COVID-19 Wave: Data from an International Study of 26 Countries

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ABSTRACT

Objective: To determine individual- and country-level factors associated with self-reported changes in solo and partnered sexual behaviors in an international sample of adults during COVID-19. **Methods:** Data were from the International Sexual Health And REproductive Health during COVID-19 study (I-SHARE)—a cross-sectional, multi-country study ($N=26$ countries) assessing adult ($N=19,654$) sexual/reproductive health before and during the first wave of COVID-19. We examined self-reported changes (three-point scale: decreased, no change, increased) in solo masturbation, hugging/holding hands/cuddling with a partner, sex with a primary partner, sex with a casual partner, sexting with a partner, viewing sexually explicit media and partnered cybersex. Ordinal regression assessed the impact of individual (age, gender- and sexual-identity, romantic partnership status, employment and income stability, household change and content, mental well-being, changes in alcohol use, and changes in marijuana use) and country-level (e.g., Oxford Stringency Index, Human Development Index, and the Palma Ratio) factors on behavior change. **Results:** The most common behavior to increase was hugging, kissing, or cuddling with a partner (21.5%), and the most common behavior to decrease was sex with a main partner (36.7%). Household factors like job/income instability and having children over the age of 12 years were significantly associated with decreased affectionate and sexual partnered sexual behaviors; more frequent substance use was linked to significantly increased solo, partnered, and virtual sexual behaviors. **Conclusions:** Understanding changes in sexual behaviors—as well as the factors that make changes more or less likely among adults around the world—are important to ensure adequate sexual health support development for future public health emergencies.

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Background

Many countries worldwide implemented different COVID-19 behavioral mitigation measures—including “shelter in place” (e.g., lockdown), quarantine, and travel restrictions (Anderson et al., 2020)—as a means of slowing the transmission of the virus. By April 2020, more than a

third of the world’s population was experiencing some degree of business closure, social separation, restricted movement, and educational adaptation. Such measures, while necessary, introduced considerable disruption to people’s day-to-day lives, including their intimate relationships and sexual behaviors (Kumar et al., 2021).

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Some of the existing literature suggests that solo and partnered sex increased for some people, perhaps because their country or municipality enforced less stringent lockdown measures (Leffler et al., 2020), or because they had more unstructured time with the suspension of many leisure activities. Some people may have had greater access to a main partner either because they lived together because one or both were working from home (Bick et al., 2020), or because they chose to self-isolate in the same place (Lopes et al., 2020). Others may have had more time for a partner from whom they were physically separated, or they may have begun sexual relationships with new partners (e.g., a roommate). Some individuals in lockdown may have participated in sexual activity as a means of overcoming boredom or buffering adverse mental health outcomes like depression or anxiety (Gleason et al., 2023; Mollaioli et al., 2021). For some people, such proximity may have also increased partner closeness, which may have led to increased sexual activity (Gleason et al., 2023). In addition, physical distancing recommendations for unpartnered or separated individuals focused on participating in solo masturbation, sex toys, leveraging communication technologies like Zoom or Facetime (e.g. phone or cybersex), and text-messaging (e.g. sexting), as a means of meeting one's sexual and intimacy needs (Alpalhão & Filipe, 2020; American Sexual Health Association, 2020; Döring & Poeschl, 2020; Lopes et al., 2020; Turban et al., 2020; Watson et al., 2021).

For example, one multi-country study reported that half of the participants experienced increased sexual desire during the lockdown (Štulhofer et al., 2022), while a sample of adults in Turkey noted an increase in general "sexual frequency" during the COVID-19 pandemic (Yuksel & Ozgor, 2020). Two studies from the United States suggested that living with a partner was associated with more affectionate contact—like cuddling, hugging, holding hands, and kissing—compared to those not living with a partner (Burlinson et al., 2022; Luetke et al., 2020). Another study from the United States suggested that about 20% of adults reported increased affectionate contact, while an additional 10–15% noted an increase in in-person behaviors like

mutual masturbation, oral sex and penile vaginal sex, as well as in technology-mediated behaviors like sexting, phone/video sex and sexually explicit media consumption (Hensel et al., 2023). A Canadian study observed that partnered sexual behavior increased over time among adults without a primary live-in romantic partner (Brotto et al., 2022). A cohort of Australian adults, participants reported more kissing and vaginal sex with a primary partner (Coombe et al., 2021), while 20% of adults in a convenience sample in United States study reported trying new sexual behaviors (Lehmiller et al., 2021).

At the same time, other published studies have shown a decrease in solo and partnered sex. Many countries implemented more restrictive lockdown measures (Leffler et al., 2020), potentially making sexual activity more difficult among single individuals or among individuals living away from their partner (Culp, 2020). Adults living in the same house may have faced different day-to-day stressors (e.g., lack of privacy, economic concerns, teleworking stress, lack of child-care or child activities, helping children with online school) (Masoudi et al., 2022; Nelson et al., 2020; Pietromonaco et al., 2013)—that have been reported to interfere with the time and/or the desire for sex (Gleason et al., 2023). In addition, worries about ongoing unemployment or financial strain are associated with lower sexual desire (Balzarini et al., 2022), which in turn may have lowered sexual activity. Partners living in shared physical space may have had to isolate from each other because one fell ill, or because one was employed in a job with high transmission risk (e.g., medical personnel or other essential worker) (Denford et al., 2021). Outside of partnership and employment factors, adults who reported increased substance use during the pandemic—either due to more unstructured time, or as a coping mechanism—reported reduced frequency of sex (Firkey et al., 2022).

For example, studies from China (Li W et al., 2020; Li et al., 2020), France (Landry et al., 2020), Italy (Mollaioli et al., 2021), Indonesia (Kusuma et al., 2021), and Poland (Fuchs et al., 2020) demonstrate a decrease in broadly defined partnered "sexual behavior" or "sexual intercourse" among adults during COVID-19. Nearly

one-fifth of adults in the United Kingdom reported a decline in mutual masturbation and vaginal sex with both main and casual partners (Jacob et al., 2020). Adults in the United States comparably suggested decreased sex with casual partners (Gleason et al., 2021). These same studies also demonstrated *increased* solo masturbation, while research from Australia (Coombe et al., 2021) demonstrated a *decline* in solo masturbation. Canadian work observed that solo masturbation decreased over time among adults without a romantic live-in partner (Brotto et al., 2022). Research from the United States demonstrated that one in ten adults participated in mutual masturbation, oral sex, and vibrator use less frequently (Hensel et al., 2023). Two recent systematic reviews of sexual frequency during COVID-19 also generally support reduced activity (Delcea et al., 2021; Masoudi et al., 2022). Finally, a study from Kenya reported a decline in sexual satisfaction among married heterosexual partners (Osuri et al., 2021).

In the current study, we engage data from the International Sexual Health And REproductive (I-SHARE-1) Health Survey (Erasquin et al., 2021; Michielsen et al., 2021) to better understand the impact of the pandemic on solo and partnered sexual behaviors around the world, across multiple countries including low income countries (LICs); lower middle income countries (LMICs); upper middle income countries (UMICs); and high income countries (or HICs). We contribute to the existing literature in both measurement and sampling. From a measurement perspective, rather than broadly assessing changes using an item that lumps several sexual behaviors into one measure (e.g., change in “sexual behaviors”), our data join an ever-growing body of literature demonstrating the importance of assessing self-reported change in different behaviors—(1) hugging, kissing, holding hands with or cuddled with a main partner, (2) solo masturbation, (3) sex in the context of a committed relationship and (4) sex with a casual partner, (5) sexting, (6) viewing sexually explicit videos, and (7) performing/-watching sexual acts over the internet. This body of literature has noted that the ability to differentiate *what* changed (e.g., hugging/cuddling *vs.* sexting) and *how* they changed (e.g., increased *vs.*

stayed stable *vs.* decreased) is necessary to continue to adapt public health COVID-19 management in ways that are consistent with people’s fundamental rights to sexual health and well-being (Hussein, 2020; Tang et al., 2020). From a *sampling* perspective, the predominance of existing data documenting changes in sexual behavior comes from single-country studies. To date, very few studies have had appropriate data to enable multi-country comparisons of sexual behavior change (Michielsen et al., 2021), and studies have been disproportionately from high-income countries (Batz et al., 2022; Dema et al., 2022). Policymakers at the national and global levels have underscored the need for high-quality, multi-country studies that more robustly represent country-level differences in important factors, such as income or pandemic response.

Accordingly, the objectives of the current paper were 2-fold: (1) evaluate the country-level prevalence and significance of self-reported changes in solo and partnered sexual behaviors during the pandemic among a global sample of individuals from 26 countries; (2) examine changes in these behaviors by individual- and country-level factors.

Methods

Study design and participants

Data for the current study were drawn from a larger project, “International Sexual Health And REproductive Health during COVID-19” (I-SHARE-1)—a cross-sectional, online, 30-country study conducted between August 2020 and January 2021. The purpose of the study was to assess adult sexual and reproductive health before and during the first wave of the COVID-19 pandemic in respective countries. Research teams were initially identified through a UNDP/UNFPA/UNICEF/WHO/World Bank Special Programme of Research, Development and Research Training in Human Reproduction (HRP) crowdsourcing open call and additionally recruited affiliates of the Academic Network for Sexual and Reproductive Health and Rights (ANSER). Members of this group collaboratively partnered to develop and administer a common

survey instrument in English. Country research teams were responsible for adding any additional items based on country-level priorities, for translating the instrument into a country's local language, and managing the IRB approval process.

Participants were recruited via an online survey link that was disseminated through local, regional, and national networks (e.g., listservs of professional organizations and international health organizations, social media, etc.) of members of the research teams in each country. Individuals were eligible if they were 18 years or older, a resident of a participating country, capable of reading and understanding the survey language used in a given country. CAPTCHA or other fraud protection methods were included to prevent more than one response from a single IP address in most participating countries. All participants provided online informed consent, and data were de-identified before multi-country analyses. Additional details regarding the procedure and methods are available in Erausquin et al. (2021), Hlatshwako et al. (2021), and Michielsen et al. (2021). The institutional review board of Indiana University approved this research (#2005838659).

The final sample of participants was from Argentina, Australia, Botswana, Canada, China, Colombia, Czech Republic, Denmark, Egypt, France, Germany, Italy, Kenya, Latvia, Lebanon, Luxembourg, Malaysia, Mexico, Moldova, Mozambique, Nigeria, Panama, Portugal, Singapore, South Africa, Sweden, Spain, Uganda, United States, and Uruguay. From this larger sample, we cultivated an analytic sample by using countries that contributed at least $N=200$ cases. This threshold was chosen as a means of ensuring heterogeneity of responses. Five countries (Mozambique, Egypt, Lebanon, and South Africa) had fewer than 200 participants and these data were excluded from the analysis. Data from 26 countries were included, leaving an analytic sample of 19,654 respondents.

Measures

Outcome variables

Participants were asked: "Since the start of COVID-19, has the number of times you have done [the behavior] changed (all: increased, stayed the same,

decreased)?" We assessed seven different behaviors and provide the specific survey items where the shorthand wording in this paper differs from the survey stem. The behaviors were: (1) cuddling, hugging, kissing with main partner, (2) solo masturbation (defined for participants as "masturbating by yourself"), (3) sex with main partner (defined for participants as "any oral, vaginal or anal intercourse/touching"), (4) sex with a casual partner (defined for participants as "Had sex with someone who you are not in a long-term relationship with [a casual partner]), (5) sexting (defined for participants as: "Sent or received naked/semi-naked pictures, audio or videos," (6) viewing sexually explicit videos (added definition included "pornography"), and (7) performing/watching sexual acts over the internet.

Individual level predictor variables

Variables were: *age* (years—centered at 18 for analyses), *gender identity* (cisgender male, cisgender female, transgender male, transgender female, or something else), *sexual identity* (heterosexual vs. sexual minority [bisexual, gay, lesbian, questioning or unsure, asexual, pansexual, other]), *partnership status* (single/never partnered, single with a previous partner, in a relationship but not living together, living with a partner, widowed/divorced/separated, other), *change to family structure* (no change vs. any change), *any children at home* (no [zero children] vs. yes [1+ children 0–11 years]), *any teenagers at home* (no [zero children] vs. yes [1+ teens 12–17 years]), *overall mental health* (5-point Likert item; poor to excellent), *change in alcohol use* (decreased, stayed the same, increased) and *marijuana use* (decreased, stayed the same, increased). We also assessed any *change in employment and/or economic situation* (stable economic situation/stable job, stable economic situation/unstable job, unstable economic situation/stable job, unstable economic situation/unstable job). We constructed this measure by dichotomizing the original measures of job change (stable [no change, same work now at home, paid but unable to work] vs. unstable [normal hours reduced, changed jobs, temporarily unemployed, lost business or work, other]) and economic change (stable [stayed the same/improved] vs. unstable [became worse]).

Country-level predictor variables

Individual opportunities to engage in solo and partnered sex—even during a pandemic—are linked to the larger socio-cultural context in which people live (Wellings et al., 2006). We chose three country-level measures that could both immediately and more proximally impact access to sex.

First, countries differed substantially in the extent to which their governments imposed policies to restrict their citizens' movement. The *Oxford Stringency Index* has tracked 23 different indicators of country policy response (e.g., school closures, travel restrictions, vaccination policy, etc.) from 180 countries since January 1, 2020. These policies are summated on a scale to reflect extent of governmental action, with higher scores indicating greater restriction (Hale et al., 2021). For the current paper, we used the running mean of each country's score at the time data collection halted in each country.

Other country-level factors associated with income (Santelli, Song, et al., 2017) and social (Baumeister & Mendoza, 2011) inequality can also impact sexual behavior. Our second measure was a measure of income inequality called the *Palma Ratio*. This measure gauges the extent to which a country's income is focused at the very top and the very bottom of the income scale. Greater numbers indicate higher income inequality (Organization for Economic Cooperation and Development, 2019). We used the most recent data—from 2019—available at the time of analysis.

Our third measure was the *Human Development Index*. This measure assesses the extent of average human achievement across three dimensions: life expectancy, educational attainment, and standard of living. Such dimensions are importantly proxies for additional downstream structural issues like gender inequality and poverty. Higher scores indicate greater levels of development (United Nations Development Programme, 2019).

Statistical approach

To evaluate Objective 1, we used frequencies to establish the sample-level prevalence of self-reported change in each solo and partnered

sexual behavior. We then performed a Wilcoxon ranked sign test on each of the outcomes to establish whether the reported change was significantly different from stability, or no change. The Wilcoxon ranked sign test is the non-parametric equivalent of a one-sample test and evaluates whether the median of a given ordinal variable is different from a chosen comparison value (Rey & Neuhäuser, 2011). For these analyses, we coded “no change/stability” as zero and used the test to examine if the median for each variable was significantly different from this value. In other words, a significant finding would suggest that predictive models (e.g., Objective 2) should be used because our other categories—“increased” or “decreased”—are different from the “stability” category. Because seven total tests were conducted—one for each solo and partnered behavior—we applied Bonferroni corrections to adjust a standard p -value of 0.05 to a new threshold of 0.0071 (0.05/7) in determining significant outcomes.

To evaluate Objective 2, we used mixed effects random intercept ordinal regression (Stata, v.16) to evaluate the impact of individual- and country-level context variables on the likelihood of reported change—decreased to increased—in each sexual behavior. We conducted three models for each outcome: one with individual-level predictors only, one with country-level predictors only, and a model in which we retained all significance variables from the prior models. In all models, the intercept was allowed to vary across countries to adjust estimates for the clustering of participants in each country. All analyses were conducted using Stata, v.16.

Results

Participant characteristics

As shown in Table 1, the final analytic sample of participants ($N = 19,654$) was 65.2% cisgender female, 84.6% were a race/ethnicity majority in their country and had a mean age of 34.6 years ($SD = 13.2$ years; range: 18–97 years). Most were heterosexual (76.9%) and living in a semi-to-all-urban area (76.7%). The median education level was university or college education, and the

Table 1. Participant characteristics ($N = 19,187$) of an international sample of adults during COVID-19.

Variable	Mean (SD) or % (N)
Age (years)	34.6 (13.02)
Household size (number of children 0–17)	2.27 (1.39)
Household size (number of adults)	0.41 (0.82)
Birth-assigned sex	
Male	
Female	
Other	
Gender identity	
Cisgender male	29.4 (5178)
Cisgender female	65.2 (12,661)
Transgender male	2.5 (485)
Transgender female	2.8 (555)
Something else	0.3 (5)
Sexual identity	
Heterosexual	76.9 (14,792)
Sexual minority	23.1 (4425)
Gay	4.1 (778)
Lesbian	1.6 (303)
Bisexual	8.9 (1724)
Asexual	3.1 (609)
Pansexual	1.5 (284)
Questioning or unsure	2.2 (417)
Something else	1.6 (310)
Ethnicity	
Majority	84.6 (9174)
Minority	15.3 (1661)
Area living	
Semi to all rural	21.9 (4041)
Semi to all urban	76.7 (14,097)
Other	1.3 (243)
Education	
No formal education	0.34 (67)
Some main education	0.29 (57)
Completed main education	4.3 (844)
Some secondary education	3.6 (717)
Completed secondary education	18.3 (3612)
Some college/university	14.4 (2853)
Completed college/university	54.8 (10,841)
Other	3.8 (758)
Family changed composition during COVID-19 (yes)	16.5 (3097)
Any children (0–11 years) in home during COVID-19 (yes)	37.5 (7436)
Any teenagers (12–17 years) in home during COVID-19 (yes)	36.9 (7312)
Ever in isolation due to COVID-19 (yes)	24.1 (4740)
Ever tested for COVID-19	
No	67.5 (13,346)
Yes, and always tested positive	26.5 (5327)
Yes, but have not received results	0.25 (49)
Yes, tested positive at least once	5.2 (1049)
Economic and/or employment insecurity	
Stable job, steady economic situation	51.1 (9629)
Unstable job, steady economic situation	15.4 (2905)
Stable job, unsteady economic situation	16.8 (3165)
Unstable job, unsteady economic situation	16.5 (3111)
Relationship status	
Single, never partnered	8.6 (1704)
Single, previous partner	18.5 (3663)
In a relationship, not living with partner	24.1 (4752)
Living with partner (married or not)	42.8 (8406)
Widowed, divorced or separated	4.8 (959)
Other	1.3 (258)
Alcohol consumption habits during COVID-19	
Decreased	16.8 (1169)
Stayed the same	75.7 (5266)
Increased	7.6 (523)
Marijuana consumption habits during COVID-19	
Decreased	10.9 (2055)
Stayed the same	82.3 (15,755)
Increased	5.5 (1031)
Overall mental health	
Poor	8.7 (1451)
Fair	27.5 (5093)

(continued)

Table 1. Continued.

Variable	Mean (SD) or % (N)
Good	35.7 (6594)
Very good	21.8 (4020)
Excellent	6.8 (1270)
Country income level	
Low income	1.1 (212)
Lower middle income	2.4 (474)
Upper middle income	28.1 (5558)
High income	68.4 (13,573)
Country region	
Americas	32.3 (6298)
Africa	8.7 (1726)
Asia	5.6 (1127)
Europe	53.3 (10,566)
Overall behavior changes patterns ($N = 18,298$)	
Decrease only	3.3 (610)
Stability only	28.4 (5211)
Increase only	0.1 (18)
Decrease and stability only	36.8 (6732)
Decrease and increase only	3.4 (629)
Stability and increase only	5.6 (1033)
Decrease, stability, and increase	22.3 (4056)

majority had not yet been tested for COVID-19 (67.5%). The most common relationship form was living with a partner (42.8%) and half had a steady job and steady income during COVID-19. Around one-third (28.1%) were residents of an upper middle income country (28.1%), and half (53.3%) were from a European country. Most participants reported no change to alcohol (75.7%) or marijuana (82.3%) consumption during COVID-19 and the overall median perception of participants' mental health level was good (35.7%) whereas 36.2% of participants reported a mental health level that was less than good and 28.6% reported a mental health level that was better than good.

Objective 1: Sample prevalence and significance of self-reported changes in affectionate and partnered sexual behavior

Table 1 displays the sample level prevalence of overall patterns of change in sexual behaviors. Table 2 shows the sample prevalence of changes in each solo and partnered sexual behaviors for participants who had ever engaged in those behaviors.

Overall patterns across all behaviors

As shown in Table 1, about a third of participants reported no change (28.4%) in all seven behaviors or a combination of decreased and stable behaviors (36.8%). One-fifth of adults

experienced all three patterns (increase, decrease, and stability) in their sexual behaviors. Very few participants reported only decreased behavior (3.3%), increased and decreased behaviors (3.4%), or increased and decreased behaviors (5.6%).

Sample level change prevalence and significance in individual behaviors

As shown in Table 2, Wilcoxon rank sign tests confirmed that self-reported change in each individual behavior was significantly different from stability, or no change, at the sample-level in all four behaviors (all $p < .001$).

The most common increased behavior among participants was hugging, kissing, holding hands, or cuddling with a main partner (21.5%), and the least common behaviors to increase were sex with a casual partner (5.8%) and performing or watching sexual acts over the internet (5.5%). One-third of adults experienced a decrease in affectionate behaviors (30.4%) and in sex with a main partner (36.7%) while about ten percent noted less frequent sexting (14.5%), watching sexually explicit videos (13.9%) or performing or watching sexual acts over the internet with a webcam (5.8%). About half of all participants experienced stability—or no change—in affectionate behaviors (48%), in solo masturbation (47.6%), or in sex with a main partner (47.6%). Three-quarters reported stability in sex with a casual partner (74.4%), in sexting (72.5%), and in pornography consumption (68.6%). Nearly all

Table 2. Self-reported changes in solo and partnered sexual behaviors during the COVID-19 pandemic among a global sample of adults ($N = 19,817$).

	Percent	Wilcoxon Rank Sum	
		Z	Bonferroni corrected p -value
Hugged, kissed, held hands with, or cuddled with your steady partner ($N = 12,325$)			
Decreased	30.4	-10.71	<.001
Stayed the same	48		
Increased	21.5		
Solo masturbation ($N = 16,855$)			
Decreased	19.6	9.02	<.001
Stayed the same	47.6		
Increased	15.6		
Sex with a steady partner ($N = 12,310$)			
Decreased	36.7	104.51	<.001
Stayed the same	47.6		
Increased	15.6		
Sex with a casual partner ($N = 17,809$)			
Decreased	20	-31.87	<.001
Stayed the same	74.4		
Increased	5.5		
Sent or received naked/semi-naked pictures, audio, or videos to a partner ($N = 16,666$)			
Decreased	12.9	3.93	<.001
Stayed the same	72.5		
Increased	14.5		
Watched sexually explicit videos (pornography) ($N = 17,885$)			
Decreased	13.9	8.16	<.001
Stayed the same	68.6		
Increased	17.3		
Performed/watched sexual acts before a webcam ($N = 16,200$)			
Decreased	10.1	-13.67	<.001
Stayed the same	84.2		
Increased	5.8		

(84.2%) reported no change in how often they performed or watched sexual acts over the internet using a webcam.

Objective 2: Association of self-reported changes in solo and partnered sexual behaviors with individual- and country-level factors

Hugging, cuddling, kissing, and holding hands with a partner

At the *individual level* as shown in Table 3, hugging, cuddling, kissing, and holding hands with a partner significantly increased among older individuals ($OR = 1.01$), those with any children at home during the first wave of the COVID-19 pandemic ($OR = 1.19$) and those with better mental health ($OR = 1.24$). Formerly partnered ($OR = 1.3$) and those currently living with a partner ($OR = 1.29$) also experienced increased affectionate behaviors as compared to never partnered individuals. Increased alcohol ($OR = 1.67$) and marijuana ($OR = 1.51$) use was associated with significantly greater frequency of hugging, cuddling, kissing, and holding hands with a partner. Those with an unstable job and worse economic situation were less likely than those with

stable income and employment ($OR = 0.88$) to engage in hugging, cuddling, kissing, and holding hands with a partner. Having teenagers at home during COVID-19 was also linked to lower frequency of affectionate behaviors ($OR = 0.81$). At the *country-level*, higher national income inequality was linked to less frequent hugging, cuddling, kissing, and holding hands with a partner ($OR = 0.76$).

Solo masturbation

At the *individual level* as shown in Table 3, solo masturbation significantly *increased* in sexual minority adults ($OR = 1.33$) and individuals with teenagers at home during COVID-19 ($OR = 1.1$). Increased substance use (alcohol: $OR = 1.16$; marijuana: $OR = 1.58$) was also linked to significantly greater frequency of solo sex. Masturbation decreased among relationship forms compared to never partnered individuals ($OR = 0.75$ – 0.84), among cisgender women ($OR = 0.90$) and transgender women ($OR = 0.76$), among those who experienced changes to family composition ($OR = -0.83$) and those who had children at home during COVID-19 ($OR = 0.787$). At the *country-level*,

Table 3. Individual and country level factors associated with self-reported changes kissing, cuddling or holding hands with a partner and solo masturbation during the COVID-19 pandemic among a Global sample of adults (N = 19,817).

	Odds Ratios (95% CI)					
	Cuddling, hugging, kissing main partner			Solo masturbation		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Individual level predictors						
Age (years)	1.01 (1.00–1.02)**		1.01 (1.00–1.02)**	0.98 (0.97–0.99)***		0.98 (0.97–0.99)***
Gender identity						
Cisgender male (ref)	–		–	–		–
Cisgender female	1.06 (0.96–1.170)			0.93 (0.86–0.99)*		0.90 (0.84–0.97)**
Transgender male	0.87 (0.66–1.15)			1.28 (1.01–1.61)*		1.25 (0.99–1.57)
Transgender female	0.92 (0.73–1.16)			0.82 (0.66–1.01)		0.76 (0.63–0.92)**
Something else	0.27 (0.03–2.01)			1.30 (0.26–6.39)		1.31 (0.26–6.55)
Sexual minority (yes)	1.01 (0.91–1.11)			1.33 (1.23–1.44)***		1.36 (1.25–1.47)***
Partnership status						
Single, never partner (ref)	–			–		–
Single, previous partner	1.30 (1.09–1.56)**		1.32 (1.11–1.59)**	0.91 (0.80–1.06)		0.84 (0.73–0.97)*
In a relationship, not living together	1.09 (0.92–1.30)		1.15 (0.96–1.36)	0.91 (0.79–1.04)		0.83 (0.72–0.94)**
Living with a partner	1.25 (1.06–1.48)**		1.29 (1.09–1.52)**	0.83 (0.72–0.94)**		0.75 (0.66–0.86)***
Widowed, divorced, separated	1.15 (0.91–1.45)		1.21 (0.95–1.54)	0.88 (0.72–1.08)		0.81 (0.67–0.98)*
Other	1.24 (0.87–1.78)		1.27 (0.90–1.80)	0.92 (0.68–1.23)		0.81 (0.61–1.07)
Employment and economic change						
Stable job, economic situation same/better	0.77 (0.69–0.87)*		0.78 (0.70–0.87)*	1.01 (0.91–1.10)		
Unstable job, economic situation same/better	0.95 (0.85–1.05)		0.94 (0.85–1.04)	0.92 (0.84–1.01)		
Stable job, economic situation worse	0.88 (0.78–0.98)*		0.88 (0.80–0.98)***	0.96 (0.88–1.06)		
Unstable job, economic situation worse						
Change to family composition (yes)	0.96 (0.86–1.06)		0.96 (0.86–1.06)	0.83 (0.76–0.91)*		0.83 (0.76–0.91)*
Children at home now (yes)	1.19 (1.09–1.29)***		1.18 (1.09–1.29)***	0.78 (0.73–0.86)***		0.77 (0.72–0.83)***
Teenagers at home now (yes)	0.81 (0.75–0.89)***		0.81 (0.75–0.88)***	1.10 (1.02–1.19)***		1.11 (1.02–1.19)**
Mental well-being	1.24 (1.19–1.30)***		1.25 (1.20–1.30)***	0.97 (0.94–1.01)		
Alcohol						
Decreased	1.22 (1.12–1.33)*		1.21 (1.10–1.32)*	0.95 (0.88–1.02)		0.96 (0.89–1.04)
Stayed the same	1.67 (1.48–1.88)***		1.65 (1.46–1.86)***	1.16 (1.05–1.28)***		1.25 (1.02–1.25)***
Increased						
Marijuana use						
Decreased	1.01 (0.87–1.15)		1.02 (0.89–1.17)	1.16 (1.04–1.30)*		1.14 (1.02–1.28)*
Stayed the same	1.51 (1.22–1.86)***		1.44 (1.16–1.78)*	1.58 (1.32–1.88)***		1.63 (1.37–1.95)***
Increased						
Country level variables						
Oxford Stringency Index	0.99 (0.98–1.01)				1.01 (1.00–1.09)*	1.00 (0.99–1.01)
Human Development Index	1.46 (0.44–4.86)				6.67 (3.62–12.92)*	3.30 (1.34–8.10)**
Palma Ratio	0.81 (0.73–0.90)*		0.82 (0.74–0.92)***		1.15 (1.09–1.21)***	1.08 (1.01–1.14)*

Model 1: individual level predictors only, Model 2: country level predictors only, Model 3: All predictors significant in Models 1 and 2; * $p < .05$; ** $p < .01$; *** $p < .001$; CI: confidence interval. Higher odds ratio indicates movement toward increased activity and lower odds ratio indicates movement toward decreased activity.

adults living in nations with greater income inequality (OR = 1.15) and in nations with greater development (OR = 6.67) reported increased solo sex. At the *country-level*, adults living in nations with greater income inequality (OR = 1.08) and in nations with greater development (OR = 3.08) and reported increased solo sex.

Sex with a main partner

At the individual level as shown in Table 4, having children up to 11 years of age at home during COVID-19 (OR = 1.31), higher mental well-being (OR = 1.29), and increased substance use (alcohol: OR = 1.49; marijuana: OR = 1.39) were associated with increased sex with a main partner. Individuals with unstable jobs—regardless of economic situation—(OR = 0.97) and those with teenagers at home during COVID-19 (OR = 0.81) reported less frequent main partner sex. At the country level, living in a country with stricter lockdown measures (OR = 0.97), higher economic inequality (OR = 0.78), and greater development (OR = 0.08) predicted decreased sex with a main partner.

Sex with a casual partner

As shown in Table 4, increased substance use (alcohol: OR = 1.51; marijuana: OR = 2.8) was associated with increased sex with a casual partner. Being a sexual minority (OR = 0.83), living in a country with stricter lockdown measures (OR = 0.97) and greater income inequality (OR = 0.88) predicted decreased casual partner sex.

Sexting

As shown in Table 5, sexting became more frequent among sexual minority individuals (OR = 1.42), among those with teenagers at home during COVID-19 (OR = 1.11), and with increased substance use (alcohol: OR = 1.23; marijuana: OR = 2.72). Living in a country with stricter lockdown measures was also linked to greater sexting (OR = 1.01). Living with a partner (OR = 0.83), being widowed, divorced, or separated (OR = 0.80), and having children at home during COVID-19 (OR = 0.83) were associated with a decrease in sexting.

Sexually explicit media use

As shown in Table 5, sexually explicit media consumption increased among sexual minority individuals (OR = 1.38) and with increased substance use (alcohol: OR = 1.31; marijuana: OR = 2.12). Living in a country with higher income inequality (OR = 1.15) and with higher development (OR = 8.35) was also linked to greater sexually explicit media use. Cisgender females (OR = 0.81) and transgender males (OR = 0.71) reported decreased pornography consumption compared to cisgender males.

Performing or watching sex using a webcam

As shown in Table 6, at the individual level, being sexual minority (OR = 1.34), increased substance use (alcohol: OR = 1.38; marijuana: OR = 6.5), and having children at home (OR = 0.77) and were associated with increased performative or consumptive sex over the internet. At the country level, living in a country with higher income inequality (OR = 1.05) and higher human development index (OR = 3.86) were associated with more frequent cybersex.

Discussion

The COVID-19 pandemic introduced considerable disruption around the world to people's intimate and sexual lives. The purpose of this paper was to add to examine self-reported changes in solo and partnered sexual behaviors during COVID-19 among a large global sample of adults across 26 different low, middle, and high income countries. We found that *all* behaviors—affectionate (e.g., hugging, holding hands, cuddling), solo (e.g., masturbation), partnered (e.g., sex with a main or with a casual partner), and technology-based (e.g., sexting, pornographic use, and phone/video sex) showed some significant amount of change for adults around the world during the pandemic. Below we situate these findings within the existing extant literature and conclude with a discussion of their clinical/public health implications.

Our data highlight the importance of instability of household factors—such as income/employment status and family composition—on sexual decision making. Issues like losing a job or

Table 4. Individual and country level factors associated with self-reported changes kissing, cuddling or holding hands with a partner, and solo masturbation during the COVID-19 pandemic among a global sample of adults ($N = 19,817$).

	Odds Ratio (95% CI)					
	Sex with a main partner			Sex with a casual partner		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Individual level predictors						
Age (years)	1.00 (1.00–1.01)			0.99 (0.98–1.01)		
Gender identity						
Cisgender male (ref)	–			–		
Cisgender female	1.04 (0.94–1.15)			1.06 (0.95–1.16)		
Transgender male	0.93 (0.71–1.24)			0.98 (0.74–1.29)		
Transgender male	0.95 (0.75–1.20)			0.84 (0.67–1.08)		
Something else	0.91 (0.09–9.06)			1.98 (0.22–17.32)		
Sexual minority (yes)	0.92 (0.84–1.01)			0.83 (0.75–0.90)**		0.81 (0.74–0.88)**
Partnership status						
Single, never partner (ref)	1.16 (0.97–1.39)			0.99 (0.85–1.16)		
Single, previous partner	1.02 (0.86–1.21)			1.02 (0.87–1.18)		
In a relationship, not living together	1.07 (0.91–1.26)			1.03 (0.89–1.33)		
Living with a partner	1.02 (0.80–1.29)			0.90 (0.71–1.14)		
Widowed, divorced, separated	0.95 (0.66–1.37)			0.93 (0.68–1.35)		
Other						
Employment and economic change						
Stable job, economic situation	0.79 (0.70–0.89)**		0.79 (0.71–0.89)**	0.92 (0.82–1.02)		0.92 (0.83–1.02)
Unstable job, economic situation same/better	0.94 (0.86–1.04)		0.94 (0.85–1.04)	1.01 (0.91–1.12)		1.02 (0.92–1.13)
Stable job, economic situation worse	0.86 (0.77–0.97)*		0.87 (0.77–0.97)*	0.85 (0.77–0.95)**		0.85 (0.75–0.93)**
Unstable job, economic situation worse						
Change to family composition (yes)	0.89 (0.81–1.00)		1.29 (1.19–1.41)**	0.92 (0.89–1.09)		
Children at home now (yes)	1.31 (1.20–1.46)**		1.29 (1.19–1.41)**	1.07 (0.91–1.12)		
Teenagers at home now (yes)	0.81 (0.75–0.89)**		0.81 (0.73–0.87)**	1.07 (0.98–1.16)		
Mental well-being	1.29 (1.24–1.34)**		1.30 (1.25–1.35)**	1.04 (0.99–1.08)		
Alcohol						
Decreased	1.31 (1.19–1.44)**		1.31 (1.19–1.44)**	1.50 (1.37–1.63)**		1.51 (1.39–1.65)**
Stayed the same	1.49 (1.32–1.69)**		1.47 (1.30–1.67)**	1.51 (1.34–1.63)**		1.45 (1.31–1.63)**
Increased						
Decreased	1.06 (0.26–1.21)		1.08 (0.94–1.24)	2.55 (2.27–1.87)**		2.48 (2.21–2.78)**
Stayed the same	1.39 (1.12–1.69)**		1.29 (1.03–1.60)**	2.80 (2.35–3.14)**		2.51 (2.06–3.05)**
Increased						
Oxford Stringency Index		0.97 (0.96–0.98)**	0.97 (0.96–0.98)**		0.97 (0.96–0.98)**	0.97 (0.97–.98)**
Human Development Index		0.08 (0.03–0.27)*	0.21 (0.05–0.96)*		1.19 (0.47–3.02)	
Palma Ratio		0.78 (0.69–0.86)*	0.83 (0.74–0.93)**		0.88 (0.81–0.96)**	0.91 (0.84–0.97)**

Model 1: individual level predictors only, Model 2: country level predictors only, Model 3: All predictors significant in Models 1 and 2; * $p < .05$; ** $p < .01$; *** $p < .001$; CI: confidence interval. Higher odds ratio indicates movement toward increased activity and lower odds ratio indicates movement toward decreased activity.

Table 5. Individual and country level factors associated with self-reported changes in sexting and sexually explicit media use during the COVID-19 pandemic among a global sample of adults ($N = 19,817$).

	Odds Ratio (95% CI)					
	Sexting			Sexually explicit media use		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Individual level predictors						
Age (years)	0.98 (0.97–0.99) ***		0.98 (0.97–0.99) ***	0.98 (0.97–0.99) ***		0.98 (0.97–0.99) ***
Gender identity						
Cisgender male (ref)						
Cisgender female	0.94 (0.83–1.01)			0.83 (0.75–0.91) *		0.81 (0.75–0.88) *
Transgender male	0.87 (0.65–1.15)			0.94 (0.76–1.18)		0.92 (0.74–1.14)
Transgender female	0.79 (0.63–1.01)			0.71 (0.56–0.89) **		0.71 (0.58–0.87) **
Something else	0.80 (0.12–1.55)			1.38 (0.23–7.85)		1.42 (0.24–8.50)
Sexual minority (yes)	1.42 (1.29–1.56) ***		1.40 (1.28–1.53) ***	1.38 (1.27–1.50) ***		1.35 (1.23–1.46) *
Partnership status						
Single, never partner (ref)						
Single, previous partner	0.90 (0.77–1.06)		0.89 (0.76–1.04)	0.93 (0.80–1.06)		0.92 (0.80–1.06)
In a relationship, not living together	0.96 (0.82–1.11)		0.94 (0.81–1.08)	0.94 (0.83–1.08)		0.93 (0.81–1.07)
Living with a partner	0.83 (0.70–0.96) *		0.81 (0.70–0.94) **	0.84 (0.74–0.97) *		0.84 (0.74–0.96) **
Widowed, divorced, separated	0.87 (0.70–1.10)		0.82 (0.66–1.02)	0.77 (0.62–0.95)*		0.80 (0.65–0.98) *
Other	1.27 (0.91–1.78)		1.22 (0.88–1.71)	1.05 (0.77–1.44)		0.99 (0.73–1.36)
Employment and economic change						
Stable job, economic situation same/better	–			–		
Unstable job, economic situation same/better	1.04 (0.93–1.15)			1.03 (0.93–1.13)		
Stable job, economic situation worse	0.95 (0.85–1.04)			0.94 (0.85–1.03)		
Unstable job, economic situation worse	0.94 (0.84–1.04)			1.02 (0.92–1.12)		
Change to family composition (yes)	0.99 (0.89–1.09)			1.03 (0.93–1.13)		
Children at home now (yes)	0.83 (0.76–0.91) ***		0.82 (0.76–0.91) ***	0.74 (0.711–0.82) ***		0.77 (0.73–0.830) ***
Teenagers at home now (yes)	1.11 (1.01–1.21) *		1.11 (1.01–1.21) *	1.06 (0.98–1.15)		
Mental well-being	0.98 (0.94–1.03)		0.91 (0.94–1.01)	0.99 (0.92–1.12)		
Alcohol						
Decreased						
Stayed the same	1.05 (0.96–1.15)		1.04 (0.96–1.14)	1.03 (0.96–1.12)		1.07 (0.98–1.16)
Increased	1.23 (1.10–1.37) ***		1.20 (1.07–1.34) ***	1.31 (1.18–1.45) ***		1.28 (1.15–1.42) ***
Marijuana use						
Decreased						
Stayed the same	1.84 (1.61–2.09) ***		1.88 (1.66–2.14) ***	1.44 (1.28–1.62) ***		1.40 (1.25–1.57) ***
Increased	2.72 (2.24–3.31) ***		2.76 (2.27–3.34) ***	2.12 (1.77–2.54) ***		2.11 (1.76–2.54) ***
Oxford Stringency Index		1.01 (1.00–1.03) **	1.01 (1.00–1.02) **		1.01 (1.00–1.02) **	
Human Development Index		16.12 (5.14–50.25) ***	2.70 (0.82–8.82)		8.35 (4.59–15.18) ***	
Palma Ratio		1.10 (0.99–1.22)			1.15 (1.09–1.21) ***	

Model 1: individual level predictors only, Model 2: country level predictors only, Model 3: All predictors significant in Models 1 and 2; * $p < .05$; ** $p < .01$; *** $p < .001$; CI: confidence interval. Higher odds ratio indicates movement toward increased activity and lower odds ratio indicates movement toward decreased activity.

Table 6. Individual and country level factors associated with self-reported changes in performing and/or watching sex from a webcam during the COVID-19 pandemic among a global sample of adults ($N = 19,817$).

	Odds Ratio (95% CI)		
	Performed/watched sex from a webcam		
	Model 1	Model 2	Model 3
Individual-level variables			
Age (years)	0.99 (0.98–1.01)		
Gender identity			
Cisgender male (ref)			–
Cisgender female	0.94 (0.83–1.06)		
Transgender male	0.91 (0.65–1.26)		
Transgender male	0.83 (0.62–1.12)		
Something else	0.41 (0.05–3.26)		
Sexual minority (yes)	1.34 (1.18–1.49)***		1.27 (1.13–1.43)***
Partnership status			
Single, never partner (ref)			
Single, previous partner	0.98 (0.82–1.19)		
In a relationship, not living together	1.07 (0.89–1.29)		
Living with a partner	0.94 (0.78–1.12)		
Widowed, divorced, separated	0.79 (0.60–1.05)		
Other	1.15 (0.76–1.78)		
Employment and economic change			
Stable job, economic situation same/better	–		
Unstable job, economic situation same/better	0.96 (0.83–1.09)		
Stable job, economic situation worse	0.92 (0.81–1.05)		
Unstable job, economic situation worse	0.88 (0.77–1.00)		
Change to family composition (yes)	1.06 (0.95–1.21)		
Children at home now (yes)	0.77 (0.70–0.86)***		0.76 (0.68–0.84)***
Teenagers at home now (yes)	1.06 (0.95–1.18)		1.08 (0.97–1.21)
Mental well-being	1.01 (0.96–1.07)		
Alcohol			
Decreased			
Stayed the same	1.13 (1.01–1.27)*		1.13 (1.02–1.26)*
Increased	1.38 (1.19–1.59)***		1.34 (1.15–1.60)***
Marijuana use			
Decreased			
Stayed the same	3.57 (3.09–4.14)***		3.53 (3.05–4.09)***
Increased	6.50 (4.75–7.72)***		5.99 (4.68–7.67)***
Country-level variables			
Oxford Stringency Index		1.00 (0.99–1.02)	1.00 (0.98–1.01)
Human Development Index		23.67 (6.32–88.96)*	3.86 (1.84–8.08)*
Palma Ratio		1.10 (1.04–1.16)**	1.05 (1.01–1.11)*

Model 1: individual level predictors only, Model 2: country level predictors only, model 3: All predictors significant in Models 1 and 2; * $p < .05$; ** $p < .01$; *** $p < .001$; CI: confidence interval. Higher odds ratio indicates movement toward increased activity and lower odds ratio indicates movement toward decreased activity.

expected income and having teenagers in the home were linked in our sample to a reduction in solo and partnered solo and partnered behaviors. Depending on the extent to which unemployment (e.g. person already searching for job) or parenting factors (e.g., one parent already staying home with children, a parent already doing virtual work, or a child already doing home- or online school), it is possible that searching for a job (Martino et al., 2022) or covering child-related needs (e.g. supervision, remote schooling, meals) (Nelson et al., 2020; Pietromonaco et al., 2013) could have disrupted the usual time availability or privacy that adults had for participation in sex (Griffin et al., 2022; Ibarra et al., 2020). The literature is also clear that financial/employment concerns (Balzarini

et al., 2022; Beach et al., 2021) and added parental responsibilities (Bevan et al., 2023) added stress and conflict to relationships, both of which were associated with lower sexual desire (Brotto et al., 2022) and decreased sexual activity (Luetke et al., 2020). In addition, while we did have a measure of general mental well-being, it will be important for future work to explore how financial/employment or parenting stressors exacerbate aspects of adverse mental health (e.g., depression, loneliness, or anxiety) that are also associated with decreased participation in sex (Luetke et al., 2020; Nicolosi et al., 2004; Zhang et al., 2020).

We observed that sexual minority individuals reported more frequent solo masturbation, sex with a casual partner, sexually explicit media, and cybersex as compared to heterosexual

participants. These data align with some work that found an increase in solo masturbation and in pornography use in sexual minority men (Nelson et al., 2020) but are contrary to other studies that found no difference in between sexual minority and heterosexual individuals in changes to the frequency of solo masturbation, pornography use or casual partner sex (Wood et al., 2022) and that generally demonstrated decreased sex more lesbian women (Fuchs et al., 2020) and gay or bisexual men during the pandemic (McKay et al., 2020). While we were not able to assess participants' motivations for any changes in specific sexual behaviors, it is possible that individuals turned to solo masturbation or technology aided sources for sex like pornography or cybersex as different means to fulfill needs in the absence of a partner (Alpalhão & Filipe, 2020; American Sexual Health Association, 2020; Döring & Poeschl, 2020; Lopes et al., 2020; Turban et al., 2020; Watson et al., 2021) or because they found partnered sex too risky (Hammoud et al., 2020).

Substance use and mental health have been frequently implicated—sometimes separately, but often together—as important considerations in people's behavior choices during COVID-19. In examining the main effects, we found that increased alcohol use and increased marijuana use were both associated with increased frequency of all solo and partnered behaviors, whereas general mental well-being was linked to increased affectionate behaviors—kissing, cuddling, holding hands with a partner—as well as with main partner sex. However, in exploratory models, we found no interaction effects between mental well-being and alcohol or marijuana—either when they were isolated as the only predictors in the model or when they were evaluated in the larger models (data not shown; all *ns*). Specific to mental health, it is possible that some adults experiencing fewer COVID-19 (Masoudi et al., 2022; Nelson et al., 2020; Pietromonaco et al., 2013) or daily stressors (e.g., commuting to work) (Green et al., 2020) had a greater desire for intimate and sexual contact. On the other hand, it is also plausible that some adults proactively chose intimate contact as a means of buffering themselves against the commonly reported

adverse mental health outcomes during lockdown (Debrot et al., 2013; Mollaioli et al., 2021). Pertaining to substance use, One possibility is that substance use and sexual activity occurred dually, rather than causally, as people newly initiated use or increase usual frequency of use during the pandemic (Ornell et al., 2020), possibly to alleviate their boredom during lockdown (Lehmiller et al., 2021; Roberts et al., 2021) or cope with pandemic-related stressors (McKnight-Eily et al., 2021). A second possibility is that substance use and specific sexual activities were already paired pre-pandemic as part of a couple's usual behaviors and simply continued during the pandemic (Graves & Leigh, 1995).

In partial support of existing work, we found that cohabiting with a partner was associated with less frequent sexting and sexually explicit media consumption as compared to those without partners. Literature has demonstrated that individuals with immediate partner availability—either because of being physically separated from a partner or being unpartnered—had less need to use technology as a substitute for partnered sex (Tan et al., 2021). In opposition to other studies (Burlison et al., 2022; Coombe et al., 2021; Hensel et al., 2023; Luetke et al., 2020), we did not observe an association between partnership status and sex with a main or casual partner. Due to survey constraint space, we were only able to assess general sexual activity, rather than investigating specific in-person behaviors (e.g. oral-genital sex *vs.* vaginal sex). This measurement approach may have confounded observed effects.

A final contribution of this work is our inclusion of country-level factors as influences on changes in sexual behaviors. These factors reflect different socio-cultural factors that uniquely impact the extent to which individuals have opportunities to engage in solo and partnered sex (Wellings et al., 2006). For example, we found that the Oxford Stringency Index (Hale et al., 2021)—a marker of how strict a country's social mitigation policies were (e.g., such as school closures, travel restrictions, vaccination policy)—was weakly associated with decreased main and casual partner sex, and with increased sexting. While we did not assess the extent to which or the consistency with which participants followed their

country restrictions, it seems plausible that cities are more likely to enforce policies around extra-household activities—such as travel to see a partner or seeking a new partner—would be linked to decreased overall partnered activity. Individuals residing in such municipalities may have substituted electronic communication when in person sexual activity was not available.

We additionally observed that higher country-level income inequity—as indicated by The Palma Ratio (Organization for Economic Cooperation and Development, 2019)—and higher country-level development—as measured by the Human Development (United Nations Development Programme, 2019)—were both linked to increased solo masturbation, decreased main and casual partner sex and increased electronic sexual behavior (e.g., sexting, sexually explicit media use, and cybersex). Country-level income is associated with higher individual fear of COVID-19 acquisition while moving about outside one's household (e.g. while walking outside or using public transportation) (Barbieri et al., 2021), while higher country-level development is linked to both a greater COVID-19 infection rate (Abul-Fadl & Sarhan, 2020) and with more frequent technology during the early and mid-points of the pandemic (Kovacevic & Jahic, 2017). Fear of infection or actual infection may have prevented people's access to partners, possibly motivating adults to engage solo masturbation or electronic substitutes for in person sex. Qualitative work would be well-suited to better understand how structural factors like socioeconomic status and education helped informed the choices people made about sex during the pandemic.

Implications

Our data collectively highlight an important point: sexuality and sexual behavior remain a fundamental human experience, even during a global pandemic (Hall et al., 2020). Although both the types and frequency of behaviors chosen may change, ensuring people's access to safe, wanted, and satisfying sexual experiences should be as much of a public health priority as virus mitigation (Banerjee & Rao, 2020). A core lesson

learned during HIV and other sexually transmitted infection (STI) public health responses is that recommending sexual abstinence as a means of virus transmission control is both implausible and unreasonable (Newman & Guta, 2020). For those who choose, intimate contact serves many purposes (Meston & Buss, 2007) and is a bolster to mental and physical health (Diamond & Huebner, 2012). A key role of both clinical/public health and education efforts during a pandemic, then, is working with patients and clients to ensure ongoing sexual wellness, including if and/or how they can participate in sex. Although not fully articulated in this paper, such efforts are particularly important among the multiple marginalized communities—gender and sexual minorities, people of color, those with disabilities, young people, refugees and immigrants, sex workers, populations, people experiencing poverty/financial hardship and more—who experience disproportionately more barriers to good sexual and reproductive health outcomes (de la Rocha et al., 2022; Hall et al., 2020).

One important piece in supporting sexuality during a pandemic is being able to inform individuals of the most up-to-date evidence-based behavior modifications when a person and/or their partner is exposed to the virus or has contracted the virus. Guidelines have changed multiple times through the pandemic and bear important implications, for example, on if and/or how long a person must isolate or the extent to which intimate contact is possible if someone is asymptomatic. This information can also help providers correct virus misinformation and/or facilitate conversations about risk tolerance within partnerships.

Increasing sexual access can also include assessing the extent to which pandemic-associated situational barriers interfere with desired sexual outcomes and devising tailored solutions around these barriers. For example, individuals separated from partners likely need help in reimagining forms of intimacy that do not require physical touch, such as engaging digital technology (Alpalhão & Filipe, 2020; American Sexual Health Association, 2020; Döring & Poeschl, 2020; Lopes et al., 2020; Turban et al., 2020; Watson et al., 2021) for sexting, sharing

photographs and videos, partnered “solo” masturbation or sharing sexual fantasies (Lopes et al., 2020). Additionally, both partnered and unpartnered individuals could be counseled on the benefits of solo masturbation (e.g. sexual gratification, stress release/relaxation, body exploration, sexual function treatment (Herbenick et al., 2023) or setting healthy boundaries for consumption of sexually explicit media (Litsou et al., 2021). Some individuals may need help talking through literal new spaces and times for sex with a cohabiting partner around pandemic-associated responsibilities or stressors (e.g. economic concerns, teleworking stress, lack of childcare or child activities, helping children with online school, partners as essential workers (Balzarini et al., 2022; Denford et al., 2021; Gleason et al., 2023; Masoudi et al., 2022; Nelson et al., 2020; Pietromonaco et al., 2013).

COVID-19 provided interruptions to wide ranging sexual health services (e.g., safe abortion, fertility services, pre/post-natal care, preventative care visits, physical/occupation therapy, mental health care, etc.), goods (e.g. lubricant, sex toys, male/female condoms, hygiene-related items, etc.) and medications (e.g., hormonal or prescription barrier contraception, sexual function medication, HIV or STI prescriptions) that directly impact people’s ability to control when they want to have sex, to make sex more enjoyable, and to reduce and/or avoid risk behaviors when sex occurs (Tang et al., 2020). These interruptions increase people’s downstream exposure to adverse outcomes like sexual violence, unintended pregnancy, and STIs, as well as the mental and sexual health consequences of unwanted abstinence (Larki et al., 2021; Santelli, Kantor, et al., 2017). Some solutions enacted—like the move to virtual mental and physical health care visits—will remain an important piece of preparedness for future public health emergencies. Clinicians and educators need to lobby for their local and national health care infrastructure to be strengthened to provide the breadth and depth of care (e.g. adequate supplies of tests and vaccines, less time consuming and burdensome paperwork for testing/treatment processes) needed (Golden & Wasserheit, 2022), as well as proactively obtain as much medication in advance as feasibly possible

to soften any supply issues. When care access is challenging, medical practices can collaborate to develop online resources that provide both the most up-to-date and accurate information about the pandemic, as well as provide local resources that patients and clients can use.

Strengths and limitations

Our research had several limitations. We were unable to clinically confirm the self-reported COVID-19 infection status of any participant, any of their sexual partner(s), or household members, and we did not assess the extent to which a participant or anyone around them had exhibited COVID-19 symptoms in the past month. Positive COVID-19 tests and/or COVID-19 symptoms could change the ways in which people had access to and/or time for sexual activities. As the number of people recovering from “long COVID-19” increases (Garg et al., 2021), there are also important questions to be answered about how prolonged illness or symptoms impact people’s ability or desire to participate in sex.

While we queried participants’ self-reported changes in seven different solo and partnered sexual behaviors, but due to survey space constraints, we were not able to separately inquire about some behaviors separately (e.g. asking about oral, vaginal, and/or anal sex with a main partner) or provide definitions for partnership types. In addition, the different wording of questions (e.g., survey items for main vs. casual partner sex) may have impacted how participants responded. In addition, we were not able to offer specific definitions of terms (e.g. providing expanded wording for terms or defining partner type). Some of the factors we examined (e.g. household context, mental health, or partnership status) could have impacted the selection of one behavior relative to another. In addition, while we examined the use of electronic technology as platforms for sex, we did not ask assess participants’ reasons for choosing such technologies. It could be possible that some unpartnered individuals used these platforms to interact within casual partnerships they had established pre-pandemic or that unpartnered individuals were meeting new partners during the pandemic. It will be

important—particularly in preparation for future pandemic events—for future studies to understand how technology can be leveraged to facilitate safe and satisfying sex for people who don't have access to in person partners.

Additionally, this survey assessed self-reported sexual behavior changes at one point during the pandemic. Because the survey was open for several months, it is likely that we collected data from participants during types of local infection periods (e.g. “stable” vs. “surge”), which could have influenced their recollection of any behavior change. It is worthwhile to note, however, that while retrospective and/or self-reported data—especially when assessing sensitive behaviors like sexual activity—can be subject to social desirability or recall bias, electronically collected methods can increase data security and anonymity, and by extension, augment the reliability and validity of participant reports (Burkill et al., 2016). These same time-based limitations also apply to our country-level measurements of COVID-19 strictness, income inequality, and human development. We used different approaches to approximate large time frames in a single measure for each of these variables. It is possible that some participants were assessed less accurately in this manner.

In addition, the cross-sectional data, classifying sexual behaviors broadly as “increased,” “stable,” or “decreased,” does not permit us to disentangle the causal order of the variables chosen in our analyses. They also do not allow for evaluation of participants' usual sexual behaviors before the pandemic, nor do they allow understanding of how earlier pandemic experiences (e.g. early vs. later social distancing practices) could change behavioral practices later in the pandemic. For example, people's sexual behaviors may have been decreasing before COVID-19, and the pandemic accelerated—rather than caused—these effects. It will be important for future pandemic-associated work to link alteration of behavior more fully to typical “frequency.” In addition, these cross-sectional data asked participants to retrospectively assess how they perceived their sexual behavior had changed. We do not have access to data collection approaches (e.g., repeated measures) that permit us to assess actual

change. Future studies should seek to implement longitudinal studies to build on these results.

It is also important to note that while we were able to examine the link between partnership type and self-perceived changes in solo and partnered sexual behavior, we did not assess how the characteristics of the partnerships themselves (e.g., quality, communication, sexual satisfaction, desire, and length) may have served to mediate how sexuality was organized in these relationships. It will be important for research to explore the nuance in how issues like these during stay-at-home order provide or constrain opportunities for sex. We also need to acknowledge the high proportion of sexual minority participants in the sample—while their inclusion is not a direct limitation to our data, we are unable to comment on how different recruitment methods may have “over-sampled” individuals from this population. From this perspective, our data may not be representative of all sexual minority individuals.

These limitations are balanced with several methodological and substantive strengths of this study. From a methodological perspective, our use of a large, multinational sample expands the boundaries of what is currently available in the COVID-19 and sexual health literature. Another methodological strength is online data collection, which facilitates survey completion in a setting of the participant's choosing, thereby increasing data confidentiality and participant comfort with answering questions about potentially sensitive topics, like sexual behavior. Online data collection additionally permitted a safe and feasible way to ensure ongoing research during the pandemic when many studies with in person recruitment had to be halted so as not to increase participant COVID-19 risk (Luetke et al., 2020).

Conclusions

As the world enters its third pandemic year, emerging sexual health research should continue to improve understanding of how adults manage opportunities and constraints to their sexual lives. While many aspects of social life look more “normal,” (e.g., many people have returned to their in-person offices and children are largely back in school) and COVID-19 burden is relatively

modest, influenza and other respiratory viruses could still impact daily living. Lessons learned from the pandemic need to include sexual health planning to be able to respond appropriately to future public health emergencies.










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