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Sexual Health During COVID-19: A Scoping Review



Nana Ernst Toldam, RM, MA,^{1,2} Christian Graugaard, MD, PhD,¹ Rikke Meyer, MD,³ Louise Thomsen, MLIS,⁴ Sabine Dreier, MLIS,⁴ Emmanuele A. Jannini, MD,⁵ and Annamaria Giralardi, MD, PhD, FECSM, IF^{2,6}

ABSTRACT

Introduction: The COVID-19 pandemic impacted profoundly on the wellbeing and social interactions of the world population, and all dimensions of sexual health were potentially affected by globally implemented preventive measures.

Objectives: The scoping review aimed to compile existing research investigating possible effects of COVID-19 lockdowns on adult sexual health, that is, sexual behavior, functioning, and satisfaction. Further, studies on the interplay between mental health and sexual well-being during the pandemic were reviewed.

Methods: The review was conducted in accordance with guidelines established by the Joanna Briggs Institute and the Extension for Scoping Reviews (PRISMA-ScR) Checklist. On October 11–12, 2021, PubMed, Embase, PsycInfo, Cinahl, Cochrane, Sociological Abstracts and Scopus were systematically searched for relevant peer-reviewed papers employing quantitative methodology. Additionally, unpublished (“grey”) research studies on the subject were retrieved. The screening, data extraction, and analysis of evidence were conducted by 4 independent reviewers using an iterative approach.

Results: Based on 107 studies included, the scoping review showed that the pandemic had had a wide impact on all dimensions of sexual health. Except for solo sex activities, mainly negative COVID-19 implications were identified, although findings were, in sum, characterized by complexity and unpredictability. Thus, sexual behavior, functioning, and satisfaction during the pandemic appeared to be mitigated by a broad range of

Abbreviations: ASEX, Arizona sexual experiences scale; ATN, the adolescent medicine trials network for human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) interventions; BAI, Beck anxiety inventory; BDI, Beck depression index; BDS, Beck depression scale; BISF-W/M, brief index of sexual functioning for women/men; BSI, brief symptom inventory; BSS, brief sexuality scale; CAS, coronavirus anxiety scale; CDS, chronic disease status; CES-D, Center for Epidemiologic Studies Depression Scale; CSFQ, changes in sexual functioning questionnaire; CSI, couples satisfaction index; CUSI, coping using sex inventory; CYPAT, cyber pornography addiction test; DAS, dyadic adjustment scale; DASS, depression anxiety stress scales; DERS, difficulties in emotion regulation scale; DISCs, depression intensity scale circles; ED, erectile dysfunction; EPDS, Edinburgh postnatal depression scale; FESP-K, Fragebogens zum Erleben von Sexualität in Engen Partnerschaften; FSDS, female sexual distress scale; FSFI, female sexual function index; FSQ, female sexual questionnaire; GAD, generalized/general anxiety disorder; GHQ, general health questionnaire; GRISS, Golombok-Rust Inventory of Sexual Satisfaction; GSI, global severity index; HADS, hospital anxiety and depression scale; HAM, Hamilton anxiety rating scale; HCP, health care professional; HIV, human immunodeficiency virus; IDS9-SF, internet disorder scale-short form; IES, impact of event scale; IES-R, revised impact of event scale; IGDS9-SF, internet gaming disorder scale-short form; IIEF, international index of erectile function; IIEF-OS, international index of erectile function overall satisfaction; ISS, index of sexual satisfaction; JOV-Q, juvenile victimization questionnaire; MAT, marital adjustment test; MGH-SFQ, Massachusetts general hospital-sexual functioning questionnaire; MPATL, moderate physical activity time lost; MSM, men who have sex with men; MSQ, male sexual questionnaire; MSS, marital satisfaction scale; NSC, negative sexual cognitions; NSE, negative sexual emotion; NSSS, new sexual satisfaction scale; PEDT, premature ejaculation diagnostic tool; PHQ, patient health questionnaire; PrEP, pre-exposure prophylaxis; PSE, positive sexual emotions; PSS, perceived stress scale; PTSD, post-traumatic stress disorder; RAS, relationship satisfaction; SAS, Zung self-rating anxiety scale; SCIRS, sexual

coercion; SCL, symptom check list; SCS, sexual compulsivity scale; SD, sexual desire; SDBQ, sexual dysfunctional beliefs questionnaire; SDI, sexual desire inventory; SDS, Zung self-rating depression scale; SDSS, sexual double standards scale; SF-12, short form health survey; SF-36, short form – 36 quality of life scale; SHIM, sexual health inventory for men; SI, sexual intercourse; SIF, sexual intercourse frequency; SMQ, sexual mode questionnaire; SOI-R, revised sociosexual orientation inventory; SQOL-M/F, sexual quality of life questionnaire-male/female; STAI, state-trait anxiety inventory; STI, sexually transmitted infections; SUPPS-P, short UPPS-P impulsive-behavior scale; TAS, Toronto alexithymia scale; TIPI, ten-item personality inventory; TSMF, total sexual and masturbatory frequency; UCLA LS, University of California, Los Angeles loneliness scale; VASP, visual analog scale for pain; VPATL, vigorous physical activity time lost; WFH, impact of work from home; WSW, women who have sex with women; ZIP, Zufriedenheit in Paarbeziehungen.

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¹Center for Sexology Research, Department of Clinical Medicine, Aalborg University, Denmark;

²Sexological Clinic, Mental Health Center, Copenhagen, Copenhagen University Hospital – Mental Health Services CPH, Copenhagen, Denmark;

³Clinical Pharmacology Unit, Zealand University Hospital, Roskilde, Denmark;

⁴Aalborg University Library, Aalborg, Denmark;

⁵Department of System Medicine, University of Rome Tor Vergata, Italy;

⁶Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

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sociodemographic and contextual factors. Finally, sexual health seemed deeply entwined with overall mental health.

Conclusion: The scoping review revealed a broad range of COVID-19-related effects on sexual health, including an overall decline in partnered sex and a concurrent increase in solo sex activities. It also emphasized a need for future research to shed light on possible long-term consequences of the pandemic in various population groups and on all aspects of sexual health. **Toldam NE, Graugaard C, Meyer R, et al. Sexual Health During COVID-19: A Scoping Review. *Sex Med Rev* 2022;10:714–753.**

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Key Words: Sexual Health; COVID-19; Sexual Function; Sexual Dysfunction; Sexual Behavior

INTRODUCTION

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was first discovered in China in December 2019, and it rapidly spread throughout the world. The accompanying respiratory tract disease (COVID-19) was declared a pandemic by the World Health Association (WHO) on March 11, 2020, and this prompted most countries to introduce extraordinary preventive measures to reduce community transmission and safeguard public health institutions and vital societal functions.

For the first time since the highly lethal influenza pandemic of 1918–1920 (the “Spanish flu”), governments all over the world introduced recommendations, injunctions, or statutory restrictions on individual behavior and social interactions, and protective approaches such as hand sanitizers, face masks, body temperature screening, routine testing, physical distancing, travel and assembly bans, confinement, quarantines, and regional or national lockdowns soon became the order of the day.

Although transnational health policy dissimilarities gradually became apparent, the global corona crisis imposed a previously unseen range of limitations on the world population, who abruptly had to cope with new stressors in somatic, psychological, relational, socioeconomic, political, work-related, logistic, and overall existential domains.¹ Experiences from previous epidemics (eg, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome, Ebola, and pandemic influenza) had indicated that transmission-reducing initiatives could lead to severe mental health strains, and reports suggested that long-term physical distancing and social isolation might cause or exacerbate mental morbidities such as anxiety, depression, confusion, posttraumatic stress, or even suicidal ideation. Further, it seemed clear that symptoms of mental distress could persist well into the post-epidemic era.^{2,3}

Evidently, COVID-19 restrictions also entailed new frameworks for dating, romantic relationships, cohabitation, physical intimacy, sexual activities, and sexual health-care services, and some health authorities even issued explicit precautions to avoid corona exposure during sex.^{4,5} Initially, the impact of public health requirements on sexual and relational behavior and well-

being was not fully recognized, but within months after the WHO had declared COVID-19 a global health crisis, the first scientific reports on sexual and relational health implications of the pandemic surfaced in a range of high-impact international journals.

Among the earliest investigators were Li et al,⁶ who collected online survey data from young Chinese individuals from May 1 through 5, 2020. Indeed, this preliminary report suggested that the respondents’ sexual, relational, and reproductive health was adversely affected by COVID-19 lockdowns, as decreases in sexual desire, coital activity, and partnership satisfaction were quite common among respondents. Since then, the number of related studies has increased almost exponentially, and by the end of May 2022, nearly 1,800 studies could be identified on PubMed when combining the search terms “COVID-19” and “Sexuality”.

At the outset of the pandemic, surveys on the sexual ramifications of COVID-19 were inherently small, descriptive, cross-sectional, and based on convenience sampling among distinct patient groups or narrow segments of the population. While probability-sampled, longitudinal cohort studies are still very scarce (eg,^{7,8}), examples of scoping/narrative reviews,^{9–13} systematic reviews,^{14,15} and even meta-analyses¹⁶ have gradually emerged to improve overview and evidence on different aspects of sexual health. Further, a growing number of studies using qualitative or mixed-methods techniques have been undertaken.^{17–20} For example, Rothmüller²¹ examined sexual behavior during the pandemic among 4,709 men, women, and non-binary persons combining quantitative questionnaire data with text analysis of the survey’s open-ended responses.

As the pandemic gradually recedes, and restrictive measures are subsequently lifted, the scientific focus will no doubt shift from the acute ramifications of societal lockdowns to their potentially protracted effects and to the role of COVID-19 sequelae on various aspects of sexuality, romanticism, and partnership. Future studies will most likely reveal whether the pandemic has had any long-term consequences for our sexual health and, if so, identify groups at particular risk of post-pandemic adversity.

Given these concerns, we offer a scoping review seeking to shed light on possible implications of COVID-19 lockdowns on

(i) sexual behavior, (ii) sexual functioning, (iii) sexual satisfaction, and on (iv) the interplay between mental health and sexual well-being. The review is based on quantitative, peer-reviewed articles in English that included adult samples, and were published before October 12, 2021. Nearly all selected studies used a purely observational, cross-sectional questionnaire approach to investigate dimensions of sexuality during COVID-19 lockdowns with no possibility of differentiating between various contributing determinants or pinpointing the exact causal mechanisms underlying changes in sexual health. The scoping review format was chosen as it provides a broader and more comprehensive overview than a systematic review.²²

MATERIALS AND METHODS

A scoping review methodology was selected to review existing literature on sexuality during COVID-19 lockdowns. This design was considered appropriate to summarize the evidence in a rapidly evolving area and to identify knowledge gaps that should be addressed by future research.²² The review was planned and conducted in accordance with the guidelines developed by Joanna Briggs Institute and the Extension for Scoping Reviews (PRISMA-ScR) Checklist.^{22,23} A review protocol was conducted prior to completing the search and registered through Open Science Framework on October 6, 2021 (<https://osf.io/ua9mb/>).

Eligibility Criteria

The review's scope was 4 dimensions of sexuality and sexual health: (i) behavior (including sexual practices, frequency, pornography consumption, and virtual practices), (ii) functioning (including sexual function, dysfunction, and desire), (iii) satisfaction, and (iv) the interplay between mental health and sexual well-being (including the impact of COVID-19-related stress, anxiety, and depression on sexual thriving).

Because of the recency of the COVID-19 pandemic, the context of the review was limited to original and peer-reviewed papers published from 2019 and onwards. Further inclusion criteria were: English language, quantitative study design, and participants aged ≥ 18 years (or adult participants readily extractable). Exclusion criteria were: Papers not explicitly investigating sexual activity, behavior and/or function, qualitative or mixed-method designs, and all types of literature reviews.

Search Strategy

The search was developed and conducted by 2 medical librarians (S.D. & L.T.). The systematic search strategy was informed by the JBI 3-step search strategy for systematic scoping reviews,²⁴ which includes searches for published as well as for unpublished ("grey") literature.

As preparation for the systematic search, a set of initial search terms were identified to guide preliminary searches in the bibliographic databases PubMed and PsycInfo (September 29, 2021). Based on these search efforts, additional search terms were identified from titles, abstracts, and index terms of relevant articles, resulting in a final set of free-text search terms covering 2 aspects: (i) Sexuality and (ii) COVID-19. Finally, the following databases were searched: PubMed, Embase, PsycInfo, Cinahl, Cochrane, Sociological Abstracts, and Scopus. In addition, to identify unpublished ("grey") literature, the following sources were searched: Google Scholar (5 first pages included), OpenGrey, Mednar, MedRxiv.org, Clinicaltrials.gov, and the WHO COVID-19 database Global Literature on Coronavirus Disease. The searches were conducted on October 11 and 12, 2021. The search strings were tailored individually to each database and consisted of free-text terms and index terms when available. For a complete list of search terms and strings for each database, see [Appendix 1](#).

Based on poster abstracts or study protocols emerging from the searches, a small number of authors were contacted by email to identify any published papers that could not be located. This resulted in one additional study.²⁵ Further, one study²⁶ was located through colleagues' recommendation.

Study Selection

As stated in the review protocol, the evidence screening and selection followed 3 consecutive phases: (i) After removing duplicates manually, the titles and abstracts of 1,612 articles were blindly reviewed by 2 independent reviewers (N.E.T. & R.M.) (October 18–25, 2021), (ii) full-text versions of potentially relevant papers were retrieved for further review, and (iii) in cases of disagreement, papers were reviewed by 2 additional authors (A. G. & C.G.) until consensus was reached.

As depicted in the flow diagram ([Figure 1](#)), we examined a total of 1,612 titles and abstracts, and a total of 140 papers were retrieved for further consideration. Ten papers could not be retrieved and, finally, a total of 130 papers were screened using a full-text version. We excluded 23 articles in accordance with our in- and exclusion criteria. One paper classified as a mixed-method study²⁷ was included, as its quantitative data were readily extractable. In sum, 107 studies met the criteria for inclusion in the review.

Data Extraction and Analysis

Four independent reviewers (N.E.T., C.G., R.M. & A.G.) read the full-text versions of the included articles and extracted key data for [Table 1](#). The table underwent iterative corrections as the data charting process progressed.

The descriptive analysis of data derived from the included 107 studies followed an agile approach and involved a thematic categorizing based on the 4 pre-formulated domains of interest, using

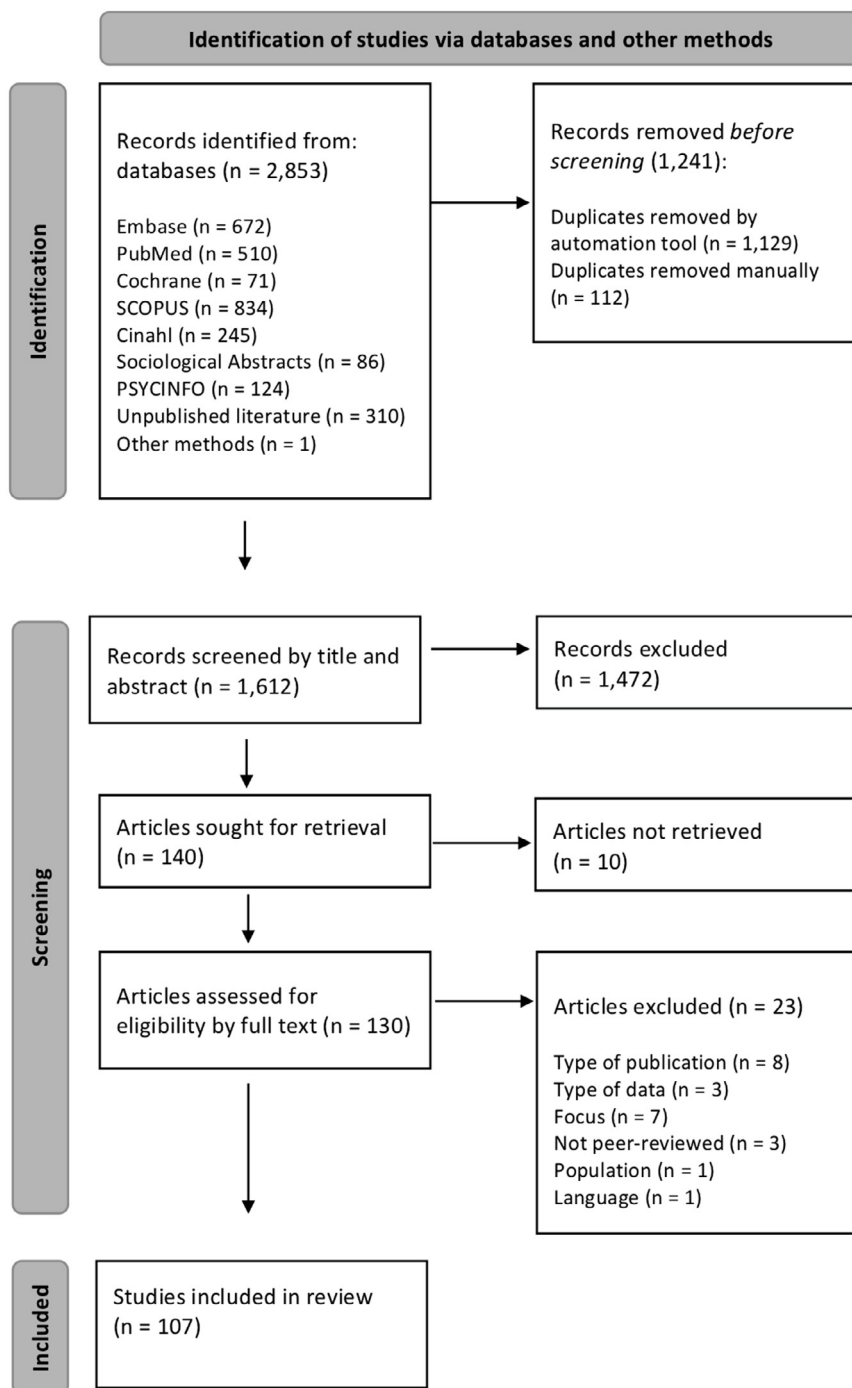


Figure 1. The Prisma Flow Chart depicting reports identified, screened, and included.²⁸

Excel Spreadsheet. Hence, the analysis developed gradually, and relevant subtopics were consecutively incorporated based on the content of the included literature. The final data synthesis and presentation of results were formulated by 3 authors (N.E.T., C. G. & A.G.).

RESULTS

The results of the literature review were organized into 4 overall domains: sexual behavior, sexual functioning, sexual

satisfaction, and the interplay between mental health and sexual well-being. In addition, relevant thematic subheadings were applied.

Sexual Behavior

The vast majority of identified papers covered aspects of sexual behavior, that is, sexual frequency and practices, pornography consumption, virtual sexual activities, and sexual risk taking in relation to COVID-19.

Table 1.

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Albertella et al (2021) Australia ²⁹	To study the association between impulsive and compulsive traits and problematic addictive and compulsive behaviors during COVID-19.	Online survey	N = 878 Age: Adults Gender: Men, women	In-house created questions Various validated scales	COVID-19-related distress was associated with greater addictive and compulsive behaviors, including pornography use.	Younger age, higher number of COVID-19 events, and greater pre-COVID-19 problematic pornography use were associated with higher lockdown problematic pornography use.
Amerio et al (2021) Italy ³⁰	To explore the impact on sexual activity by COVID-19 lockdown measures in the general adult population.	Cross-sectional online survey	N = 6,003 Age: 18–74 Gender: Men, women	In-house created questions on sexual activity	35.3% reported changes in sexual activity. 8.4% reported an increase, 26.9% a decrease.	Mostly men, young aged 18–35, and singles reported changes in sexual activity. Decreased sexual activity was higher in non-cohabiting subjects.
Asiamah et al (2021) Ghana ³¹	To assess behavioral outcomes of COVID-19 social distancing protocols and their influences on mental health.	Online survey	N = 621 Age: 18–64; 36 (mean) Gender: Men (65%), women (35%)	MPATL VPATL CDS In-house created questions on behavior and sexual activity	20% reported a decrease in sexual activity, 12% an increase.	Those with increased sexual activity had better mental health compared with those with no change in sexual activity.
Ballester-Arnal et al (2020) Spain ³²	To analyze sexual behavior during 99 d of confinement.	Online survey	N = 1,448 Age: 18–60; 31.9 (mean) Gender: Women (67.5%), men (32.5%) Sexual orientation: Heterosexual (78.3%), bisexual (9.9%), homosexual (8.7%), other (2.7%) Relationship: Steady partner (43.8%), single (31.6%)	In-house created questions on sexual desire, sexual activity, frequency, and more	47.7% reported unaffected sexual life, 37.9% worsening and 14.4% improvement 61% reported masturbation, 40% reported sexual relationship with partner and 28.4% online sexual activities.	One-third reported that sexual desire increased (mostly women); one-third reported decreased sexual desire (mostly men); one-third reported no change.
Baran et al (2021) Turkey ³³	To evaluate changes in sexual behavior of men after the COVID-19 outbreak.	Cross-sectional online survey	N = 536 Age: 38.6 (mean) Gender: Men Sexual orientation: Heterosexual	In-house created questions IIEF-5	Significant decrease in the total IIEF-5 scores from 19.90 ± 5.1 before the pandemic to 19.31 ± 5.88 after. No significant change in IIEF-5 domains of sexual satisfaction and self-confidence.	29.5% stated that their partner did not agree to sexual intercourse because of COVID-19 fear in different periods of the pandemic.
Bhaambhvani et al (2021) USA ³⁴	To assess the impact of COVID-19 on female sexual function and frequency.	Follow-up survey on a pre-pandemic survey	N = 91 Age: 43.1 (mean) Gender: Women Relationship: In a relationship/ married (82.4%)	FSFI PHQ-4 PHQ-2 GAD-2 In-house created questions on COVID-19 related items	Significant decrease in total FSFI (28.82 to 27.22). Significant decrease in desire, arousal, lubrication, and satisfaction domains. Women who developed risk of FSD during the pandemic had higher PHQ-4 anxiety and depression scores.	The total FSFI score decreased, but mean was still in the functional area. Increased risk of FSD according to cut-off scores.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Brotto et al (2021) Canada ⁸	To evaluate various facets of sexual health across phases of the COVID-19 pandemic.	Prospective online survey	N = 1,019 Age: 19–81; 30.2 (mean) Gender: Women, men, non-binary Sexual orientation: Heterosexual, gay/lesbian Relationship: Single (31%), living with partner (37%), in romantic relationship (69%)	In-house created questions on COVID-19 related stress Frequency of sexual behaviors Sexual compliance SDI - solitary SDI - dyadic SCIRS RAS	Higher COVID-19 related stress predicted: - higher baseline dyadic sexual desire - lower relationship satisfaction - higher desire for solitary sexual behavior - higher likelihood of experiencing sexual coercion (people with partner).	Dyadic sexual desire and pandemic-related stress decreased with time. Solitary sexual behavior decreased. Dyadic sexual behavior increased over time (among people cohabiting with a partner).
Bulut et al (2021) Turkey ³⁵	To determine the prevalence and severity of PTSD-related ED among HCP working in COVID-19 units.	Cross-sectional survey	N = 159; HCP 200 controls Age: 32 (HCP, median); 34 (controls, median). Gender: Men	IES-R IIEF-5	82.4% of HCP had ED, 50.5% of controls. In HCP, 78.4% of physicians and 89.5% of nurses had ED. A moderate inverse correlation between IIEF-5 score and IES-R score.	HCP working with COVID-19-patients had higher occurrence of ED. This was associated with PTSD symptoms. Being a nurse or working with diagnosed COVID-19 patients were risk factors for severe ED.
Camargo et al (2021) Brazil ³⁶	To analyze factors associated with MSM's low mental well-being during COVID-19.	Online survey	N = 2,646 Age: >17 Gender: Men Sexual orientation: MSM	In-house created questions	8% reported low mental well-being, which was associated with having multiple sex partners, a reduction of sex partners and engaging in group sex.	Mental health of MSM was negatively affected by COVID-19. Low mental health was associated with several sexual behavior variables, eg, being in a polyamorous relationship and having a higher number of sexual partners.
Carvalho et al (2021) Portugal ³⁷	To test the relationship between COVID-19 confinement levels and sexual functioning in men and women.	Online survey	N = 662 Age: >18 Gender: Women, men Sexual orientation: Heterosexual	IIEF FSFI Likert Scale on confinement BSI	Mean FSFI 27.67 (SD 6.16). Mean IIEF 58.99 (SD 15.71).	Psychological adjustment mediated association between confinement levels and most sexual functioning domains in men, but not women. Psychological adjustment predicted lower sexual functioning in both women and men.
Cascalheira et al (2021) UK ²⁷	To examine the perceived impact of social lockdown on sexual fantasy and solitary sexual behavior.	Cross-sectional online survey	N = 565 Age: 18–32; 25.4 (mean); Gender: Cisgender women (59.8%), cisgender men (38.9%), other (1.23%) Sexual orientation: Heterosexual (78.9%), bisexuals (9.2%), other Relationship: Serious (60.4%), single (32.6%), casual (6.7%)	In-house created questions on solitary sexual behaviors, sexual fantasies, and pornography consumption	34.3% reported increase of sexual fantasizing (43.8% cisgender men, 55.2% cisgender women). 30.44% reported increase in at least one solitary sexual behavior (52.9% cisgender men, 45.3% cisgender women). 59.5% watched pornography during lockdown (64.8% cisgender men, 33.3% cisgender women).	More women than men reported increase in sexual fantasizing. 19% reported increase in pornography use (more men than women). Living arrangement, gender and relationship status predicted shifts in sexual fantasizing and solitary sexual practices.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Chen et al (2021) USA ³⁸	To examine changes in male sexual function during the COVID-19 pandemic and to evaluate associated demographic variables.	Retrospective cohort study Online survey	N = 76 Age: 48.3 (mean) Gender: Men Relationship: Married/cohabiting partnership (63.2%), in a relationship (19.7%), single (17.1%) Other characteristics: Adults visiting a partner cannabis dispensary	IIEF PHQ-4 GAD-2	No significant changes in the overall IIEF score or any subdomain score. Half had the same or increased overall IIEF score (mean change: 4.44 (SD 6.0)); half a decreased overall IIEF (mean change: -3.97 (SD 3.03)). 23.7% screened positive for anxiety and 17.1% for depression.	Increase in sexual frequency following the pandemic was seen. 25% reported 10+ sexual encounters in the past 4 wk pre-pandemic; the numbers increased to 45.5% during the pandemic.
Chone et al (2021) Portugal ³⁹	To determine factors associated with chemsex among MSM during COVID-19.	Online survey	N = 1,301 Age: 18–66 (mean: 31) Gender: Men Sexual orientation: MSM	In-house created questions	20.2% engaged in chemsex during COVID-19. Associations of chemsex were seen with, eg, unprotected sex, PrEP, and previous COVID-19 testing.	Chemsex with casual partners was frequently performed during COVID-19.
Cito et al (2021) Italy ⁴⁰	To evaluate how individual and couple's sexuality had changed during COVID-19 quarantine.	Online survey	N = 1,576 Age: 66% 31–46 years Gender: Women (64.6%), men (35.4%) Sexual orientation: Homosexual, heterosexual Relationship: Stable relationship (96.8%) Other characteristics: Min. 1 child (78.1%), COVID-19 negative	Sexual Intercourse Sexual Desire	Mean number of sexual intercourses decreased. 71.3% had no reduction in sexual desire. 61.2% did not report a reduction in autoerotism practice.	Positive correlation between well-being scores and sexual intercourse. Positive association between sexual desire and sexual intercourse. Correlation between numbers of hours spent at home with partner and numbers of intercourses.
Coombe et al (2021) Australia ⁴¹	To understand the impact of COVID-19 on sexual health during lockdown.	Cross-sectional online survey	N = 965 Age: 18–29 (66.3%), 30+ (33.7%) Gender: Women (70%), men (25.7%), gender diverse (4.4%) Sexual orientation: Heterosexual (65.7%), MSM (8.8), WSW (20.5), other (5.0%) Relationship: Cohabiting (36%), not cohabiting (25.8%), single (34%), other (3.4%)	In-house created questions on sexual activity, sexual practices, and dating app use	53.3% reported less sex than in 2019 (mostly MSM). 14.3% reported having more sex than in 2019 (mostly cohabiting relationship). 26.6% reported masturbating more. Dating app use decreased significantly during lockdown.	Sexual activity declined during lockdown compared to 2019. More people reported solo sex (eg, masturbating or using sex toys). Use of dating apps declined, but of those still using apps chatting and virtual dating activity increased.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Costantini et al (2021) Italy ⁴²	To perform a survey analysis on the changes in couples' sex lives during COVID-19 lockdown.	Multicenter cross-sectional telematics survey analysis	N = 2,149 Age: 43.07 (mean) Gender: Men (48.3%), women (51.7%) Sexual orientation: Heterosexual (94%), homosexual (4%), bisexual (10%)	FSFI-19 IIEF-15 HAM In-house created questions	FSFI-19: 28.5 (median). IIEF-15: 33.5 (mean). HAM: 5.1 (mean). 49% reported improved sex life (mostly women). 29% reported deteriorated sex life (mostly unmarried).	Women who reported deteriorated sex life had higher anxiety, tension, fear, and insomnia. Men who reported worsened sex life had mild ED, orgasmic dysfunction, and low sexual satisfaction.
Craig-Kuhn et al (2021) USA ⁴³	To assess changes in the way young men interacted with sex partners caused by stay-at-home orders.	Cross-sectional online survey, sub study	N = 111 Age: 18–24; 21.3 (average) Gender: Men Other characteristics: Black men who have sex with women	In-house created questions on sexual behavior	76.6% viewed pornography (33.3% viewed more than before). 42.3% reported virtual sex. 52.3% did not engage in vaginal sex. 9.9% reported increase in vaginal sex, 18.9% no change, and 16.2% a decrease.	Overall decline in sexual activity was seen. Vaginal sex decreased from 96.4% to 47.8%. Multiple sex partners declined from 45% to 14.4%. Sexual abstinence increased from 3.6% to 38.7%.
Culha et al (2021) Turkey ⁴⁴	To examine health professionals' changes in their sexual lives due to the COVID-19 outbreak.	Cross-sectional survey	N = 185 Age: 18–53; 30.65 (mean) Gender: Women, men Relationship: Married or in a regular sexual relationship	IIEF FSFI STAI In-house created questions on sexual desire, weekly sexual intercourse/ masturbation number, and more	IIEF-OS: 6.19 (mean). FSFI: 19.13 (mean).	Sexual desire, number of intercourses, and foreplay time decreased. Sexual positions changed to less face-to-face activity. Sexual dysfunctions were more common in men than women.
De Rose et al (2021) Italy ⁴⁵	To investigate the effect of the COVID-19 lockdown on sexuality and depressive symptoms among hospital workers and their relatives and friends.	Online survey	N = 544 Age: 27–45; 31 (median) Gender: Women (52.2%), men (47.8%)	IIEF-15 FSFI BDI	IIEF-15: 25 (median). FSFI: 16 (median).	Higher proportion of hospital workers had low sexual desire (more females than males). Predictors of low sexual desire were children at home, living with partner, and low sexual satisfaction.
De Sousa et al (2020) Brazil, Portugal ⁴⁶	To determine factors associated with chemsex among MSM during COVID-19.	Online and app-based survey	N = 2,361 Age: 18–66 (mean: 31) Gender: Men Sexual orientation: MSM	In-house created questions	38.9% engaged in chemsex with predominantly casual partners.	Chemsex with casual partners was performed by more than one-third, and associations of chemsex were seen with, eg, engaging in casual sex during lockdown, using PrEP, and not having symptoms of COVID-19.
De Sousa et al (2021) Brazil, Portugal ⁴⁷	To study unsafe sex among MSM during COVID-19.	Online survey	N = 2,361 Age: >17 Gender: Men Sexual orientation: MSM	In-house created questions	53% had had casual sex during lockdown. 13% had taken PrEP.	High prevalence of sexual activity and high-risk sexual behaviors despite COVID-19.
De Sousa et al (2021) Brazil, Portugal ⁴⁸	To study unsafe sex among MSM during COVID-19.	Online survey	N = 2,934 Age: >17 Gender: Men Sexual orientation: MSM	In-house created questions	29% had had at-risk sexual exposure for COVID-19. Risk was highest in Brazil.	Sexual practices that increase HIV transmission risk also seemed to increase COVID-19 transmission.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Deng et al (2021) China ⁷	To investigate the effect of COVID-19-related stress on sexual compulsivity symptoms.	Longitudinal cross-lagged online survey	N = 2,998 Age: 20.5 (mean); 17–24 Gender: Men (24.3%), women (75.7%) Sexual orientation: Heterosexual (99.87%), gay/homosexual/bisexual/same gender loving/MSM (0.13%)	In-house created questions on psychological behaviors regarding COVID-19-related stress SDS SAS SCS	COVID-19 related stress, depression, and anxiety affected individuals' sexual compulsivity symptoms at both periods.	The higher the COVID-19-related stress, the higher the SCS score. Long-lasting effects were associated with anxiety among undergraduates.
Dincer et al (2021) Turkey ⁴⁹	To determine the changes in sexual functioning and alexithymia levels in patients with type 2 diabetes during the COVID-19 pandemic.	Cross-sectional survey	N = 162 Age: 56.3 (mean) Gender: Women (55.6%), men (44.4%) Relationship: Married (80.2%), single (19.8%) Other characteristics: Diabetes, other chronic disease (56.7%)	TAS HADS In-house created questions on sexual function, desire, frequency, satisfaction, and more	69.8% reported decrease in sexual desire. 67.9% reported decrease in sexual intercourse frequency. 67.3% reported decrease in duration of sexual intercourse. 67.9% reported decrease in sexual satisfaction level. 81.5% did not report changes in sexual functions to healthcare staff. 77.8% did not find solutions to changes in sexual functions.	Anxiety, depression, and alexithymia scores of those who had decreased sexual functioning before and during the pandemic period were significantly higher than among those with no changes. 77.1% stated stress/anxiety experienced during COVID-19 as reasons for sexual problems.
Duran et al (2021) Turkey ⁵⁰	To investigate variation in the presentations of male patients with sexual and reproductive health problems in 12 outpatient urological clinics during the COVID-19 pandemic.	Retrospective evaluation of patients pre- and during COVID-19	N = 4,488 (pre-COVID-19) Age: 51.6 (mean, women), 55.3 (mean, men) Gender: Men (72%), women (28%) N = 2,142 (COVID-19 period) Age: 49.3 (mean, women), 50.6 (mean, men) Gender: Men (80%), women (20%)	Data from patient records	Diagnoses pre-COVID-19/ COVID-19 period: ED: 6.6%/8.7%. Male Sexual health disease: 8.6%/10.8%. Premature ejaculation: 1.4%/1.5%. Peyronie's disease: 1.1%/0.9%. Andrological disease: 13.2%/17%.	Significant increase in ED, andrological diseases, and male sexual health diseases during the COVID-19 period compared to pre-pandemic period. No change in premature ejaculation and Peyronie's disease.
Effati-Daryani et al (2021) Iran ⁵¹	To investigate the relationship between sexual function and mental health during the COVID-19 pandemic in pregnant women.	Descriptive cross-sectional	N = 437 Age: 29.7 Gender: Women Relationship: Married Other characteristics: Pregnant	FSFI DASS-21	Total FSFI = 20.0 (mean). Significant relationship between sexual function and stress, spouse's occupation, income sufficiency, place of residence, marital satisfaction, and gestational age.	Mean FSFI was in the dysfunctional area in pregnant women.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Eserdag et al (2021) Turkey ⁵²	To evaluate sexual activities of pregnant women during the COVID-19 restrictions.	Prospective cross-sectional	N = 294 and 294 male spouses Age: 27.2 (mean, women), 30.7 (mean, spouses) Gender: Women (pregnant), men	ASEX	Significant increase in ASEX from before pandemic to during pandemic in women 13.5/17.0 and spouses 12.1/14.5 indicating decreased sexual function. ASEX \geq 11 (indicating sexual dysfunction) before/during pandemic in 64.2/80.3 % of women and 51.7/63.6% of spouses.	Pregnant women and their partners had a significant increase in total ASEX. In pregnant women, a significant increase in dysfunctions (based on cut-off values) was seen, but not in spouses.
Fang et al (2021) China ⁵³	To investigate the changes in sexual life and sexual function during the COVID-19 epidemic.	Online survey	N = 612 Age: 28 (mean) Gender: Men Relationship: Unmarried (52.6%), married (45.8%)	In-house created questions IIEF-5 PEDT GAD-7 PHQ-9	IIEF-5 significantly decreased with a mean difference of -1.13. GAD-7 score significantly improved (mean difference 0.88) and PHQ-9 (mean difference 1.27). No significant changes in PEDT scores.	The mean frequency of sexual life (per month) was unchanged during the pandemic. 83.5% reported no changes in erectile function, and 82.8% reported no changes in ejaculation control ability.
Feng et al (2021) China ⁵⁴	To analyze the influence of sociodemographic characteristics, family function, and changes in sexual behavior on male-female intimacy.	Cross-sectional online survey	N = 284 Age: <20 (12%), 21–30 (72%), 31–44 (15.8%) Gender: Men (47.2%), women (52.8%) Sexual orientation: Heterosexual Relationship: Married (41.5%), cohabiting (58.5%)	In-house created questions on sexual behaviors, sexual desire, satisfaction, and more	17.6% reported a reduction in numbers of sexual partners. 43.3% reported a reduction in frequency of intercourse, 15.5% reported an increase. 25% reported a reduction in desire, 19% an increase. 21.5% reported a reduction in satisfaction, 32.4% reported an increase.	The degree of male-female intimacy and family functioning decreased during the COVID-19 period.
Firkey et al (2021) USA ⁵⁵	To assess substance use, sexual behavior, and general well-being since the onset of COVID-19.	Online survey	N = 212 Age: 22.1 (mean) Gender: Women (50.5%), men (49.5%) Relationship: Monogamous (50.9%)	ATN questionnaire In-house created questions on COVID-19-related impacts on general well-being, substance use, and sexual behavior	55.2% reported a decrease in opportunities to have sex. 57.5% reported a decrease in frequency of sexual activity. 54.5% males reported decrease in number of sexual partners. 72.2% females reported no change in number of sexual partners.	Most students reported a decrease in sexual activity. Participants in monogamous relationships were more likely to report an increase in sexual activity compared to those in non-monogamous relationships.
Fuchs et al (2020) Poland ⁵⁶	To investigate the association between COVID-19 pandemic, associated anxiety or stress and impact on female sexual health.	Prospective, observational, non-interventional	N = 764 Age: 25.1 (mean) Gender: Women	FSFI In-house created questions on influence of COVID-19 on sexual family and work life	Total FSFI before pandemic 30.1; during 25.8. Total FSFI score <26.55 before pandemic in 15.3% and during in 34.3%. Decrease in frequency of intercourse during pandemic.	Significant increase in women at risk of sexual dysfunctions during the pandemic compared to before, especially in women isolated from partner. Reasons included isolation from partner, lack of desire due to stress, conflicts with partner, and fear of contracting the virus.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Gabster et al (2021) Panama ⁵⁷	To describe changes in sexual behavior (including sexting/cybersex) and access to HIV/STI testing and care during COVID-19.	Online survey	N = 960 Age: ≥18 (mean: 23) Gender: Men, women, non-binary/other Other characteristics: Various ethnicities	In-house created questions	28.8% reported decreased casual sex. 58.0% of participants in need could not access HIV/STI testing. 38.5% reported increased virtual sex. 86.7% reported decreased virtual sex.	Both physical and virtual sex behaviors were altered during COVID-19, and the access to condom use and HIV/STI testing/care was seriously compromised.
Gassó et al (2021) Spain ⁵⁸	To study the prevalence of sexting and online sexual victimization behaviors during COVID-19.	Online survey	N = 293 Age: 18–73 (mean: 30.3) Gender: Men, women	In-house created questions JOV-Q	Sexting engagement and online sexual victimization decreased during lockdown despite increased internet use.	Sexting and digital victimization decreased during COVID-19 lockdown.
Gil-Llario et al (2021) Spain ⁵⁹	To analyze the extent to which the sexual behavior of people with intellectual disabilities was affected during the lockdown.	Online survey	N = 73 Age: 39.6 (mean) Gender: Women (41%), men (59%) Sexual orientation: Heterosexual (83.5%), homosexual (11%), asexual (5.5%)	In-house created questions on sexual appetite, sexual behavior, online sexual activity, sexual abuse	38% experienced increased sexual appetite Sexual activity consisted of oneself (88%), viewing pornography (83.6%).	Especially young and sexually experienced people increased their sexual appetite in the form of online sexual behaviors.
Gillespie et al (2021) UK ⁶⁰	To examine the effects of social distancing, loneliness, difficulties in emotion regulation, and self-regulation on participants self-reported coping using sex during lockdown.	Online survey	N = 789 Age: 18–59 Gender: Women (66.2%), men (33.8%)	UCLA Loneliness Scale CUSI DERS-16 In-house created questions on social distancing, loneliness, and emotion regulation	30% reported increased coping using sex, 29% reported a decrease. 41% reported no change.	No overall increase in coping by using sex during lockdown compared to before lockdown. Being younger and male were associated with reporting increased coping using sex.
Gleason et al (2021) USA ⁶¹	To evaluate the impact of the COVID-19 pandemic on sexual behavior, relationship satisfaction, and intimate partner violence.	Online survey	N = 1,051 Age: 38.5 (mean). Gender: Men (57.3%), women (42.1%) Sexual orientation: Heterosexual (88.3%), homosexual (3.4%), bisexual (6.3%), other (2%) Relationship: Single (33.4%), relationship living separately (12.4%), live-in partnership (13.1%), married (40.1%), multi-person partnership (0.1%)	In-house created questions on sexual behaviors, use of condom, sexual partners, sexual desire, and more	27.4% reported decreased sex with current partner. 21.3% reported an increase in masturbation. 20.7% reported an increase in porn use. 53.4% reported a decrease in sex with casual partners. 24.8% reported a decrease in sexual desire.	Increase in frequency of masturbation and pornography use (significant for men only). Decrease in frequency of sex with current partner, sexual desire, number of sex partners, frequency of hookups, frequency of sex with casual partners, and ratings of sexual enjoyment/pleasure.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Gouvernet and Bonierbale (2021) France ⁶²	To study the impact of COVID-19 lockdown on cognitions and emotions felt during sexual intercourse.	Online survey	N = 1,079 Age: 31 (median) Gender at birth: Men (31.3%), women (68.7%) Relationship: In couple (79.3%), single (20.7)	Items from SMQ: NSC NSE PSE In-house created questions on sexual intercourse and sexual satisfaction	43.5% reported no change in physical intercourse. 82.7 reported no change in digital intercourse. 33.7% reported decrease in physical sex. Increase in the frequency of physical sex was associated with a decrease in NSE and NSC and an increase in PSE.	Women appear to be more vulnerable to lockdown than men. Changes in NSC, NSE, and PSE had a significant effect on sexual satisfaction.
Grover et al (2021) India ⁶³	To evaluate the impact of lockdown on sexual functioning, relationship with the partner, and mental health.	Online survey	N = 450 Age: 22–77, 41.5 (mean) Gender: Men (85.6%), women (14.4%) Relationship: Married and living together (86.4), married and living apart (7.8%)	CSFQ PHQ-4 In-house created questions on partner relationship and frequency of sexual intimacy	Less than half of the participants reported "much" or "great" enjoyment or pleasure in their sexual activity. No change in use of pornography/reading erotic material, or frequency of masturbation, or sexual self-pleasuring acts.	Reduction in frequency of sexual intercourse. Depression and anxiety were associated with lower sexual functioning in all the domains.
Grubbs et al (2021) USA ⁶⁴	To analyze pornography use before and during COVID-19 among American adults.	Online survey	N = 2,518 (baseline August 2019); 1,269 (October 2020) Age: Adults Gender: Men, women (868 participants completed all 5 waves)	PHQ-9 and GAD-7 In-house created questions	For both men and women pornography consumption (including problematic use) trended downward during the pandemic.	No signs of an increase of pornography use during COVID-19.
Gül (2021) Turkey ⁶⁵	To investigate the effects of the COVID-19 outbreak on depression and sexual dysfunction in patients with epilepsy.	Follow-up online survey	N = 116 / (98 in ASEX) Age: 33 (median) Gender: Men, women Relationship: Single (44.8%), married (51.7%) Other characteristics: Diagnosed with epilepsy before COVID-19	ASEX BDS	Total ASEX male score: 12.65 (mean) (12.14 before COVID-19). Total ASEX female score: 15.78 (mean) (14.78 before COVID-19). 24.5% men reported sexual dysfunction (22.4% before COVID-19). 46.9% women reported sexual dysfunction (38.8% before COVID-19).	Increase in tendency to depression in epilepsy patients with a negative effect on sexual function.
Güzel and Döndü (2021) Turkey ⁶⁶	To investigate impact of health care workers' long-term exposure to the COVID-19 outbreak on sexual habits and functions.	Cross-sectional online survey	N = 240 Age: 40.2 (mean) Gender: Men (51.7%), women (48.3%)	FSFI IIEF BAI	FSFI-total: 20.26 (mean). IIEF-OS: 7.74 (mean).	Sexual desire, weekly sexual intercourse frequency, foreplay duration, and coitus duration decreased. Sexual dysfunctions higher in female health-care workers.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Hammoud et al (2020) Australia ⁶⁷	To study the impact of physical distancing measures on sexual behavior of MSM.	Online survey in an ongoing cohort study	N = 940 Age: 40 (mean) Gender: Men Sexual orientation: MSM	In-house created questions	16% of those reporting casual partner sex prior to COVID-19 continued this behavior after learning about the pandemic.	A decrease in casual sexual contacts was observed among MSM.
Hernández-Torres et al (2021) Mexico ⁶⁸	To quantify the impact on the use and type of online sexual material, and to determine the predictors of online sexual activity in people in preventive social isolation due to COVID-19.	Cross-sectional online survey	N = 385 Age: 27 (mean) Gender: Men (31.7%), women (68.3%) Relationship: Single (41.6%), married (23.1%), in a dating relationship (23.1%), other (12.2%)	In-house created questions on type of sexual material and online sexual activities	Type of sexual material: internet pages: 1–14 d of quarantine: 47.5% vs ≥15 d of quarantine: 83.8%. Mobile chat app: 1–14 d of quarantine: 45.1% vs ≥15 d of quarantine: 121.8%. Online sexual activity: Masturbation: 1–14 d of quarantine: 43.1% vs ≥15 d of quarantine: 87.2%. Excitation: 1–14 d of quarantine: 34.7% vs ≥15 d of quarantine: 75.8%.	Internet pages and social networks were the main platforms for use of online sexual material, and its consumption was more frequent in those who had more days of social isolation. Masturbation was the most frequent sexual activity after 15 d of quarantine.
Hille et al (2021) Germany, Switzerland, Austria ⁶⁹	To investigate changes in sexual behavior during of the COVID-19 pandemic and physical distancing measures in single and partnered participants.	Cross-sectional online survey	N = 2,515 Age: 31–40 (median) Gender: Cisgender women, cisgender men Sexual orientation: Mixed	SOI-R ZIP FESP-K In-house created questions on sexual activities and practices	70.6% reported no and 19.5% reported additional sexual activity. Frequencies of all sexual activities decreased, except for anal intercourse.	Frequency of a range of sexual activities declined significantly for both singles and partnered participants.
Holloway et al (2021) USA ⁷⁰	To study the impact of COVID-19 on MSM.	Online survey	N = 10,079 Age: >17 Gender: Men Sexual orientation: MSM	In-house created questions	Participants practicing physical distancing had higher odds of current sex life dissatisfaction.	Physical distancing impacted negatively on sexual satisfaction.
Howarth et al (2021) UK ⁷¹	To study sexual behavior and healthcare need/use during COVID-19.	Online survey	N = 2,018 Age: 16–77; 40 (median) Gender: Men (cis/trans), transwomen, gender-diverse people Sexual orientation: MSM	In-house created questions	17% had multiple condomless anal sex partners. 25% had unmet need for STI testing. Compared to similar 2017 survey, participants were less likely to report new male partners or multiple condomless anal sex partners.	Although still high (17%), the prevalence of multiple condomless anal sex partners had decreased since previous survey in 2017.
Hu et al (2021) China ⁷²	To evaluate psychological distress and erectile function in men recovered from COVID-19.	Prospective observational study	N = 67/30 (first visit/follow-up). Age: 31.7/30.5 (mean) Gender: Men Relationship: Married (67%/70%)	IIEF-5 SCL-90	ED: 45% at first visit, 30% at follow-up 3 mo later. GSI was an indicator of overall psychological health, an independent risk factor for ED at first visit.	At first visit post COVID-19 men had higher levels of ED and psychological distress than norm among Chinese men. At follow-up, both ED and overall psychological distress was at same level as Chinese norms.

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Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Hyndman et al (2021) UK ⁷³	To study the impact of COVID-19 on MSM.	Online survey	N = 814 Age: 40 (mean) Gender: Men Sexual orientation: MSM	In-house created questions	76% had been sexually active. 75% had had fewer sex partners. 73% had discussed COVID-19 risks with sex partners. 76% implemented ≥ 1 changes to their sexual behavior. 30% had met difficulties accessing STI/HIV testing or treatment.	COVID-19 had considerable impacts on sexual health and behavior of MSM.
Ilgen et al (2021) Turkey ⁷⁴	To determine the COVID-19 pandemic's effect on female sexual function among a group of Turkish women.	Follow-up on a cross-sectional survey	N = 99 Age: 35.1 (mean) Gender: Women	FSFI BDI BAI	No significant change in FSFI score before COVID (21.8) and during COVID (21.0). Significant increase in BAI from before to during COVID-19 (11.2/13.3) and BDI (10.0/13.7). Decreased FSFI scores with increased BAI scores. No correlation between BDI and FSFI.	No change in sexual function score from before to during COVID-19. In pregnant women low FSFI score was associated with being university graduate, multiparous and with unplanned pregnancy.
Jacob et al (2020) UK ⁷⁵	To investigate levels and correlates of sexual activity during COVID-19 self-isolation/social distancing.	Cross-sectional online survey	N = 868 Gender: Men (36.9%), women (63.1%) Relationship: Single/separated/divorced/widowed (44.7%), married/in a cohabiting partnership (55.3%) Other characteristics: Self-isolating/social-distancing 0–5 d (25.5%), 6–10 d (45.2%), ≥ 11 d (29.3%)	In-house created questions on sexual activity, ie, sexual intercourse, masturbation, petting, or fondling	Prevalence of sexual activity at least once/wk: self-isolation 0–5 d (33.5%), 6–10 d (37.7%), ≥ 11 d (47.0%). Mean number of sexual activities/wk: 3.23 (males), 0.88 (females).	39.9% reported engaging in sexual activity at least once/wk during self-isolation. Sexual activity was significantly associated with being male, younger age (25–34 years), being married/in a cohabiting partnership, current alcohol consumption, and a higher number of days in self-isolation.
Jongen et al (2021) The Netherlands ⁷⁶	To study PrEP use, condom use, and sexual behavior among MSM during COVID-19.	App-based survey with day-to-day data gathering	N = 136 Age: >17 Gender: Men Sexual orientation: MSM	In-house created questions	Decrease of casual partner sexual activity. Increase in sex with steady partners. Condom use with steady partners decreased.	COVID-19-related decrease in casual partner sex seen initially, while condom use with steady partners decreased.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Karagöz et al (2020) Turkey ⁷⁷	To investigate changes in sexual lives of married and co-habiting couples in a Turkish sample during the COVID-19 pandemic period.	Cross-sectional study Face-to-face interviews and online survey	N = 245 Age: 35.9 (mean) Gender: Men (60.4%), women (39.5%) Sexual orientation: Heterosexual Relationship: Married or co-habiting couples living together	GAD-7 PHQ-9 PSS IIEF-15 FSFI In-house created questions on general sexual tendencies and approaches	Total FSFI score decreased from 26.02 to 24.87. Significant decrease in IIEF-15 in the erectile and orgasmic function, intercourse satisfaction, and overall satisfaction scores. 12.8% of males and 4.1% of females reported an increase in solitary sexual activity.	The frequency of sexual intercourse reduced significantly in both men and women compared to the period before the pandemic. 19.6% of males and 38.1% of females reported behavior to avoid sexual closeness with partner due to concern of spreading COVID-19.
Karakas et al (2021) Turkey ⁷⁸	To evaluate the level of sexual function during the COVID pandemic in pregnant women.	Cross-sectional survey	N = 180; pregnant N = 135 (N = 45 in each trimester); controls N = 45 Age: 34 (mean) Gender: Women	FSFI	FSFI <26.55 in 87.4% of pregnant women, 68.9% of controls. Significant lower total median FSFI in pregnant women: 22.2/controls 23.4.	Higher prevalence of women at risk of FSD among pregnant women than controls during COVID-19. Median of total FSFI decreased from 1st to 3rd trimester.
Karsiyakali et al (2021) Turkey ⁷⁹	To evaluate the effects of the COVID-19 pandemic on the sexual functioning of individuals with no COVID-19 disease.	Online survey	N = 1,356 Age: 33.7 (mean) Gender: Women (50.5%), men (49.5) Relationship: Regular sexual partner (66.8%)	In-house created questions on sexual functioning based on IIEF and FSFI	Number of sexual intercourses decreased from 1.86 (mean) before COVID-19 to 1.35 (mean) during COVID-19. 40.8% reported reduction in the number of weekly sexual intercourses. Masturbation frequency increased from 1.25 (mean) to 1.57 (mean). 31.5% reported lower sexual desire.	Decline in sexual functioning and in mean number of sexual intercourses, but increase in mean masturbation frequency. Living in a metropolitan area was associated with a decline in sexual intercourse frequency and sexual desire.
Kaya et al (2020) Poland ⁸⁰	To investigate the effect of COVID-19 on sexual dysfunction in women.	Cross-sectional	N = 15 Age: 33.3 (mean) Gender: Women Relationship: Having a regular sexual relationship Other characteristics: Recruited from patients hospitalized with COVID-19	FSFI SF-36	Frequency of sexual intercourse before/after COVID-19: 2.9/2.0 /wk. Total FSFI (mean) before/after COVID-19: 24.8/23.0.	Small decrease in frequency of sexual intercourse after COVID-19 infection. No significant change in overall FSFI score. Decrease in pain score of SF-36 after COVID-19. No changes in other scores.
Ko et al (2020) Taiwan ⁸¹	To examine changes in sex life during the pandemic and the factors affecting such changes.	Online survey	N = 1,954 Age: 37.9 (mean) Gender: Women (66.8%), men (33.2%) Sexual orientation: Heterosexual (72.7%), sexual minorities (28.3%)	In-house created questions on changes in sex life during the pandemic, satisfaction, activity, risk perception of COVID-19, and general anxiety	Satisfaction with sexual life: unchanged (84.7%), decreased (13.4%) and increased (1.9%). Frequency of sexual activity: unchanged (83.6%), decreased (13.5%) and increased (2.9%). Frequency of sex-seeking activity: unchanged (91.4%), decreased (6.7%) and increased (1.9%).	Risk perception of COVID-19 was significantly and negatively associated with frequencies of sexual and sex-seeking activities. Higher general anxiety was negatively associated with satisfaction of sex life and frequencies of sexual and sex-seeking activities.
		Case-control				

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Kumar et al (2021) India ⁸²	To assess sexual functioning in a population of health care workers who had worked in a COVID-19 hospital in North India.		N = 200 Age: 32 (cases), 32.3 (controls) (mean) Relationship: Married and living with partner	CSFQ-14 PHQ-9	Global sexual dysfunction: cases (mean 48.5, controls (50.2). PHQ-score: cases (mean 6.7), controls (5.2). Prevalence of global sexual dysfunction (score <48) was 31 in the cases and 16 in the controls. Prevalence of moderate and above severity of depressive symptomatology (PHQ score >10) was 24 in the cases and 11 in the controls.	No significant differences between cases and controls in pleasure, sexual frequency, interest, arousal, or orgasm.
Kusuma et al (2021) Indonesia ⁸³	To investigate the difference in mood and sexual activity before and during the COVID-19 pandemic.	Cross-sectional online survey	N = 131 Gender: Men (51.5%), women (48.9%) Sexual orientation: Heterosexual (96.2%) Relationship: Married (72%) Other characteristics: Sexually active	DISCs In-house created questions on mood status, behavior, frequency of sexual intercourse before and during COVID-19, and more	Decrease in routine sexual activities before/during COVID-19: 80.2%/67.9%. 53.8% reported the pandemic affected their sexual activity; 46.2% said it did not.	Slight decrease in sexual frequency and subjective experienced sexual frequency.
To document people's sexual lives in the time of COVID-19 by exploring changes in the sexual behavior patterns since the pandemic began.	Online survey	N = 1,559 Age: 34.1 (mean) Gender: Women (71.1%), men (23.4%), nonbinary/other (4.5%) Sexual orientation: Heterosexual (52.7%), bisexual (19.5%), queer (7.8%), pansexual (7.3%), gay/lesbian (7.0%), other (5.7%)	Modified version of FSFI on desire In-house created questions on sexual behavior, sexual activity, frequency, and more	43.5% reported a decline in the quality of their sex life, 42.8% reported no change, and 13.6% reported an improvement. 20.3% reported making additions to sex life.	Nearly half of the sample reported a decline in their sex life. One in 5 reported expanding their sexual repertoire by incorporating new activities. Those who made additions to their sex life more often reported that their sex life had improved since the pandemic.	
Lemenager et al (2021) Germany ⁸⁵	To investigate changes of online media consumption during the lockdown.	Online survey	N = 3,245 Age: 18≥55 Gender: Women (63.9%), men (35.8%), diverse (0.3%)	In-house created questions on online media consumption	Consumption of erotic online application: 7.8% reported consistently high usage before and during lockdown. 86.7% reported consistently low usage before and during lockdown. 4.1% reported increased usage during lockdown.	Users of online pornography showed a consistent, low usage. Males reported significantly higher use of online erotic activities than females, and participants between 18 and 24 years showed significantly highest increase in usage of erotic platforms.

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Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Li et al (2020) China ⁶	To obtain a preliminary understanding of the changes in people's sexual behavior, as a result of the pandemic, and explore the context in which they manifest.	Online survey	N = 459 Age: 18–45 Gender: Men (59%), women (41%) Sexual orientation: Heterosexual Other characteristics: Living with parents (72%)	In-house created questions on changes in sexual behavior	1.4% reported decreased usage during lockdown. 44% reported a decrease in number of sexual partners. 37% a decrease in sexual frequency. 32% men and 39% women reported decrease in sexual satisfaction.	Men were more likely to report a decrease in sexual partners than women (53% vs 30%). Women reported more sexual dissatisfaction.
López-Bueno et al (2021) Spain ⁸⁶	To investigate levels and correlates of sexual activity during COVID-19 self-isolation/social distancing.	Cross-sectional online survey	N = 536 Gender: Men (27.2%), women (72.8%) Relationship: Single/separated/divorced/widowed (66.8%), married/in a cohabiting partnership (33.2%)	Sexual activity, defined as sexual intercourse, masturbation, petting, or fondling	81.5% of men and 67.4% of women, 65.4% of singles/separated/divorced/widowed and 83.1% of married/in a cohabiting partnership reported at least one sexual intercourse/wk on average. Mean number of sexual activities/wk: 2.49 (men), 2.36 (women).	Higher sexual activity levels observed than, eg, UK (71.3% vs 39.9%).
To evaluate the relation between sexual function and depressive symptoms in puerperal women during the pandemic period.	Online survey in 3 parts	N = 50 Age: 25 (median) Gender: Women Relationship: Living with partner (83.8%), not living with partner (16.7%) Other characteristics: Puerperal	FSFI EPDS	FSFI: 48 h of puerperium: 25.1 (mean); 3 mo after birth (beginning of pandemic): 21.7 (mean); 6 mo after birth (peak pandemic): 22.9 (mean).	No significant difference between FSFI index before, in the beginning, and during the pandemic. Worsening in sexual response is secondary to the higher prevalence of depressive symptoms in the puerperium.	
Luetke et al (2020) USA ⁸⁸	To assess the association between COVID-related relationship conflict and changes in intimate and sexual behaviors and experiences.	Cross-sectional Online survey	N = 742 Age: 18–29 (16.7%), 30–39 (20%), 40–49 (15.6%), 50–59 (19.4%), 60–69 (16.3%), 70+ (12%) Gender: Men (49%), women (51%) Relationship: Married/living with partner (81%), never married (11.3%), separated/divorced/widowed (7.7%)	UCLA 3-item Loneliness Scale CES-D-10 In-house created questions on changes in frequency of intimate, sexual behaviors, orgasm, and emotionally connection during sexual activities	Those experiencing frequent coronavirus-related conflict were 3.2, 4.6, 6.7, and 4.1 times more likely to report decreased frequency of solo masturbation, partnered masturbated or touching of each other's genitals, giving/receiving oral sex, and penile-vaginal intercourse, respectively.	COVID-19-related conflict tended to decrease experience of orgasm and feeling emotionally close to partner at last sexual event in the last month compared to those not experiencing conflict.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Mahanty et al (2020) India ⁸⁹	To evaluate the impact of the COVID-19 pandemic on sexual and mental health, its associated lifestyle habits, and the quality of sex life.	Online survey	N = 262 Gender: Men (62%), women (38%)	In-house created questions on changes in sexual behavior, quality of sex life, sexual health, and mental well-being	28.4% had ≥ 10 points in CES-D-10 indicating a depression. Frequency of sexual intercourse decreased in men from 39% before to 32% during the pandemic, increased in women from 43% before to 61% during the pandemic. The frequency of watching porn increased more in women (from 33% before to 50% during COVID-19) than in men (30% to 34%).	Frequency of sexual intercourse increased in women compared to men. Desire for parenthood, work from home, and disconnect from social media led to better sexual satisfaction among women.
McKay et al (2021) USA ⁹⁰	To study sexual behavior of MSM during COVID-19.	Online survey	N = 728 Age: >17 Gender: Men Sexual orientation: MSM	In-house created questions	Nearly half of participants had fewer sexual partners than before COVID-19. Casual partner activity reduced. No-contact sex increased.	Partner-related sexual activity decreased during the first wave of COVID-19.
Mercer et al (2021) UK ²⁵	To investigate physical and virtual sexual activity, frequency, and satisfaction in 4-mo following lockdown in Britain compared to pre-lockdown.	Web-panel survey “NATSAL-COVID Study”	N = 6,654 Age: 39 (median); 18–59 Gender: Men (49.8%), women (49.9%), trans (0.8%) Sexual orientation: Heterosexual (96%), gay/lesbian (1.8%), bisexual (1.4%), other (0.8%)	In-house created questions on sexual history, frequency, and satisfaction	86.7% reported some form of sex (mostly in a steady relationship). 83.7% reported physical sexual activities. 52.6% reported virtual sexual activities. 43.2% reported pornography use (men: 61.5% vs women: 21.1%). 61.1% reported no change in masturbation frequency.	Most participants reported sex following lockdown. Two-thirds reported no change in sexual satisfaction. Decline in sexual satisfaction and frequency was associated with relationship informality and younger age.
Meunier et al (2021) USA ⁹¹	To study the impact of COVID-19 on sexual and gender minority individuals with recent collective sex venues experience.	Online survey, including open-ended questions	N = 342 Age: 34 (median) Gender: Various (minority) Sexual orientation: Sexual minority individuals Other characteristics: With sex venue experience	In-house created questions	18% felt comfortable attending a sex venue during COVID-19, with increased odds among frequent sex venue users, substance users, and individuals who had tested positive for coronavirus infection.	Sex venue attendance was high despite of COVID-19.
Mirzaei et al (2021) Iran ⁹²	To assess the impact of COVID-19 on mental health of pregnant and lactating women.	Comparative cross-sectional	N = 604 (Pregnant N = 200; lactating N = 203; controls N = 201) Age (mean): Pregnant 29.7, lactating 30.2, controls 32.6. Gender: Women Relationship: Married Other characteristics: Having	FSFI HADS SF-12	Total FSFI: Pregnant 22.7, lactating 22.7, controls 26.2. Total HADS: Pregnant 12.1, lactating 12, controls 9.8. Total SF-12: Pregnant 68.3, lactating 74.2, controls 79.0.	Pregnant and lactating women had a lower sexual function score compared to controls and lower QoL, higher level of anxiety/depression compared to controls.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Mollaioli et al (2021) Italy ⁹³	To evaluate the impact of the community-wide containment and consequent social distancing on the intrapsychic, relational, and sexual health through standardized psychometric tools.	Case control online survey	intercourse within the last 4 weeks N = 6,821 Age: 32.8 (mean) Gender: Men (38.8%), women (61.2%)	GAD-7 PHQ-9 DAS IIEF-15 FSFI Orgasmometer (from VASP) SHIM	38.2% reported being sexually active during lockdown (mostly married or cohabitant). 61.8% reported no sexual activity during lockdown (mostly living alone, without partner). FSFI (in sexually active group): 28.68 (mean). Erectile function (in sexually active group): 27.41 (mean).	Sexual activity had a protective effect in both men and women on lockdown's impact on psychological, relational, and sexual health. Lack of sexual activity during lockdown was associated with a significantly higher risk of developing anxiety and depression. Anxiety and depression scores were significantly lower in subjects sexually active during lockdown.
Mumm et al (2021) Germany ⁹⁴	To evaluate the effect the COVID-19 pandemic and nationwide German lockdown had on the sexual behavior of cismen.	Online survey	N = 414 Age: 18–46+ Gender: Cisgender men Sexual orientation: Heterosexual (59.9%), homosexual (23.4%), bisexual (16.7%) Relationship: In a relationship (62.1%), single (37.9%)	Questions from Sexual Behavior Questionnaire	Percentage of cismen who had sexual intercourse more than 3 times a week increased from 7.8% before pandemic to 37.5% since confinement Satisfaction level with frequency of sexual intercourse increased in all groups Increase in mean sexual arousal scores during quarantine.	Frequency of sexual intercourse, masturbation and mean sexual arousal increased in all groups (based on age and sexuality).
Nawaz et al (2021) Pakistan ⁹⁵	To determine the impact of COVID-19 on the sexual performance of females.	Longitudinal study survey	N = 300 Age: 39 (mean) Gender: Women	FSFI	Total FSFI before COVID-19: 28.16 (mean). Total FSFI 60 d after COVID-19: 24.43 (mean).	Significant decline in sexual function of females, who contracted COVID-19 infection.
Neto et al (2021) Brazil ⁹⁶	To evaluate the impact of the pandemic on sexual function in healthcare professionals and medical students at a reference center in the treatment of COVID-19.	Online survey	N = 1,314 Age: 37 (mean) Gender: Women (71%), men (29%) Sexual orientation: Heterosexual (89.2%), homosexual (7.5%) Other characteristics: Health professionals and medical students; isolated from partner (31.5%), infected with COVID-19 (24%)	TSMF FSQ MSQ In-house created questions on sexual activity	MSQ = 75.3 (mean); 17.6 (SD). FSQ = 67.8 (mean); 17.6 (SD). 37% reported lower libido. 44.5% reported lower sexual satisfaction.	Worsening of sexual satisfaction reported by 44.5% with associating factors such as lower libido, missing nightlife, and isolation from partner.
Cross-sectional						

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Ogras and Yildirim (2021) Turkey ⁹⁷	To investigate the relationship of psychogenic ED developing during the COVID-19 pandemic.		N = 60 Age: Cases 39.7 (mean) controls 41.0 (mean) Gender: Men	IIEF-5 CAS	Mean IIEF-5 score: Cases 15.9, controls 24.3 CAS score: Cases 7.5, controls 0.4.	A negative correlation between ED and anxiety for contracting corona virus was found in men with psychogenic ED.
Omar et al (2021) Egypt ⁹⁸	To study the effect of COVID-19 pandemic on sexual satisfaction of females and males and to evaluate possible predictive factors.	Online survey	N = 696 Gender: Women, men	GAD-7 PHQ-9 FSFI IIEF-5 ISS In-house created questions on sexual performance satisfaction	91.2% of men were satisfied with sexual performance before COVID-19; 70.5% were satisfied during lockdown. 73.5% of women were sexually satisfied before lockdown; 52.2% during lockdown.	Pandemic was associated with lower sexual satisfaction in both women and men. Women suffered more anxiety and depression than men.
Osur et al (2021) Kenya ⁹⁹	To determine how perceived and experienced sexual satisfaction changed with the advent of COVID-19 among heterosexual married individuals.	Cross-sectional online survey	N = 194 Age: 18–30 (12.4%), 31–40 (35.3%), 41–50 (41.8%), >50 (10.8%) Gender: Men (60.8%), women (39.2%) Relationship: Married 3–10 years (30.9%), 11–20 years (38.1%).	Questionnaire adapted from the Index of Sexual Satisfaction	73.4% were satisfied with their marital sex before COVID-19, 58.4% after COVID-19. 63.3% wanted sex more frequently before COVID-19, 4.1% less often. During COVID-19 pandemic these proportions were 57.8% and 21.1% respectively.	Before COVID-19, 73.4% were overall satisfied with sex, during COVID-19 the proportion dropped to 58.4%.
Pampati et al (2020) USA ¹⁰⁰	To study sexual behavior and access to sexual health services during COVID-19.	Online survey	N = 56 (cohort 1); 78 (cohort 2) Age: 18–34 (cohort 1) Gender: Men Sexual orientation: MSM Other characteristics: Using PrEP	In-house created questions	Number of sex partners and unsafe sex decreased initially, followed by a significant increase. Access to PrEP and HIV/STI testing challenged by a quarter of participants.	Fluctuations in sexual activity and safe sex use. One-quarter of participants experienced challenges when trying to access PrEP and HIV/STI testing.
Panzeri et al (2020) Italy ¹⁰¹	To examine whether the Italian population's sexuality changed since the spread of the COVID-19 infection, and if so, how it changed.	Online survey	N = 124 Age: ≤34 (61.5%), 35–50 (31.1%), ≥50 (7.4%) Gender: Men (26.6%), women (73.4%) Sexual orientation: Heterosexual (94.4%), bisexual (4.0%), homosexual (1.6%) Relationship: Living with partner during the lockdown	BISF-W or BISF-M SDI DASS-21	24.2% men/30.8% women reported decrease in frequency of sexual intercourse during lockdown. 18.2% men/26.4% women reported a decrease in sexual desire. 15.2% men/20.9% women observed an increase in arousal. 6.1% men/17.6% women experienced more difficulty in reaching orgasm.	Most participants reported no changes in sexual desire (men: 69.7%; women: 54.9%), arousal (men: 72.7%; women: 58.2%), and orgasm (men: 78.8%; women: 79.1%) during lockdown.
Prabowo et al (2021) Indonesia ¹⁰²	To assess the impact of work from home (WFH) during the COVID-19 pandemic on	Online survey	N = 348 Age: 29 (mean) Gender: Women Relationship:	GHQ-12 SIF per week In-house created questions on contraception use,	Average SIF per week before WFH: 3.38 (mean). Average SIF per week during WFH: 2.99 (mean).	Significant decrease in sexual intercourse frequency from before WFH policy to during.

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Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
	the mental health and reproductive health.		Married living with their spouse Other characteristics: Premenopausal, sexually active	menstrual patterns, and desire for having children		
Reyniers et al (2021) Belgium ¹⁰³	To study impact of COVID-19 on casual partner sex and changes in PrEP use among MSM.	Online survey	N = 694 Age: >17 Gender: Men Sexual orientation: MSM	In-house created questions	Casual partner sex reduced from 59.1% to 8.9% during first weeks of lockdown. Among PrEP users 47.0% stopped using PrEP.	Substantial reduction of casual partner sex activity.
Rodrigues and Lehmillier (2021) USA ¹⁰⁴	To examine how the COVID-19 pandemic was associated with relation dynamics.	Online survey	N = 303 Age: 31.4 (mean) Gender: Men (58.1%), women (41.9%) Sexual orientation: Heterosexual (84.5%), gay or lesbian (9.6%), bisexual (5.9%)	In-house created questions on sexual functioning, relationship functioning, and reactions to COVID-19	Sexual desire: 3.66 (mean). Changes in sex life: 4.26 (mean). Lifestyle changes caused by COVID-19 were associated with negative changes in one's sex life.	Sexual desire was associated with positive changes in sex life and wanting to spend time with partner. Men reported more sexual desire than women.
Rodríguez-Domínguez (2021) Spain ¹⁰⁵	To explore the impact of the situation generated by COVID-19 on the sexuality.	Online survey	N = 201 Age: 18–45 Gender: Women (70.1%), men (29.9%) Sexual orientation: Heterosexual (85.6%) Relationship: In an intimate relationship (66.2%) (cohabiting/non-cohabiting)	BSS subscale on sexual self-esteem MGH-SFQ item on maintenance of the ability to become aroused In-house created questions on sexual practices	27.4% reported a decrease in their ability to become aroused, 41.3% reported no change, and 31.3% reported an increase.	Reduction of sexual self-esteem and a decrease in number of interpersonal sexual relations was found. No change in masturbation frequency. Men presented higher sexual self-esteem than women.
Rogers et al (2021) USA ¹⁰⁶	To study impact of COVID-19 on sexual health of MSM in PrEP care.	Phone-based survey	N = 177 Age: 37 (median) Gender: Men Sexual orientation: MSM Other characteristics: Under PrEP care	In-house created questions	Mean sex partner decrease: 2.6.	Reduced number of sex partners.
Rosenberg et al (2021) USA ¹⁰⁷	To estimate the prevalence of depression and loneliness during the US COVID-19 response and examine their associations with frequency of social and sexual connections.	Online survey	N = 1,010 Age: 48 (median); 18–94 Gender: Women (51.1%), men (48.9%) Relationship: Living alone (18.8%), living together (81.2%)	CES-D-10 UCLA 3 In-house created questions on social and sexual connections	Those who endorsed the most frequent partnered sex exposure were 57% less likely to report depressive symptoms. Few endorsed very frequent remote sex or dating app use, but they tended to have higher rates of depression and loneliness.	Frequent in-person sexual connections trended toward associations with lower prevalence of depression and loneliness as opposed to remote sexual connections.

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Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Roy et al (2021) Bangladesh, India, Nepal ¹⁰⁸	To assess the effects of the COVID-19 pandemic and lockdown on married people's emotional bonding and sexual relationship in 3 South Asian Countries.	Cross-sectional online survey	N = 120 Age: 35.4 (mean) Gender: Women, men Relationship: Married, living with their spouse	In-house created questions on sexual behavior and emotional bonding	45% reported that lockdown had impacted their sexual lives. 53.8% women reported being sexually active. 41% men reported being sexually active.	No significant difference between men and women in sexual activity and emotional bonding.
Sallie et al (2021) UK, USA and more ¹⁰⁹	To assess how COVID-19 social isolation affected online gaming and pornography viewing in the general population.	Cross-sectional online survey	N = 1,344 Age: 28.9 (mean) Gender: Men (75%), women (24%), other (1%) Relationship: Single (58%), married/committed (39%), divorced/separated/widowed (3%)	IGDS9-SF CYPAT TIPI HADS SUPPS-P In-house created questions on online gaming, porn viewing, and COVID-19 related stress factors	Weekly change of porn use 0.08 h (mean), average porn use severity during quarantine was 8.55 (mean); including 386 subjects who did not use porn. Of those who engaged in porn use, hours of porn viewing minorly increased from 2.74 h to 2.82 h (mean) during quarantine.	Minor increase in pornography viewing. Males showed a greater increase in amount of porn use relative to females. Porn viewing severity was related with younger individuals and males.
Sanchez et al (2020) USA ¹¹⁰	To study impact of COVID-19 on sexual health of MSM.	Online survey	N = 1,051 Age: 35 (median) Gender: Men Sexual orientation: MSM	In-house created questions	51.3% had fewer sex partners. 0.9% had more sex partners. 92.9% had no change in condom use.	Half had fewer sex partners. No increase of unsafe sex for vast majority.
Sansone et al (2021) Italy ¹¹¹	To investigate the prevalence of ED in men with COVID-19 infection and possible association between ED and COVID-19.	Cross-sectional online survey Subsample of a larger cohort	N = 100 (25 who had tested positive for COVID-19, 75 controls) Age: Cases 39.0 (mean), controls 41.0 (mean) Gender: Men Other characteristics: Sexually active	SHIM (IIEF-5)	28% of cases had ED, 9.3% of controls. OR of 5.7 for ED if previously infected with COVID-19. OR of 5.3 for having had COVID-19 infection if having had ED.	Higher risk of ED if tested positive for COVID-19, but also significantly higher risk of having COVID-19 if having ED, indicating that viral inflammation may play a role.
Schiavi et al (2020) Italy ¹¹²	To assess the impact of social distancing on sexual function and QoL.	Observational study	N = 89 Age: 39 (median) Gender: Women Relationship: Living with a partner Other characteristics: Sexually active	FSFI FSDS SF-36	Sexual intercourse (mean) before pandemic: 6.3/mo; during pandemic: 1.9/mo. Total FSFI (mean) before pandemic: 29.2; during 19.2. Total FSDS (mean) before pandemic: 9.3; during 20.1. Mean total SF-36 before pandemic: 82.2; during 64.2.	Significant decrease in number of intercourses, sexual function, and QoL. Increase in sexual distress during the pandemic compared to before. Working outside home, university degree, and having ≥1 child predicted lower sexual function (FSFI).
Shilo et al (2020) Israel ¹¹³	To study sexual behavior and mental health of MSM before and during COVID-19.	Online survey	N = 2,562 Gender: Men	Mental Health Inventory In-house created questions	39.5% had casual sex partners, but risk behavior generally reduced.	Risk behavior was reduced under COVID-19 and casual sex was associated with mental distress.

(continued)

Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
			Age: 37 (mean) Sexual orientation: MSM		Digital dating and porn use increased from pre- to post-COVID-19. 3.2% would have sex with a person with COVID-19, 30.1% would have sex with a person with HIV.	
Sotiropoulou et al (2021) Greece ¹¹⁴	To identify whether the quarantine influenced the quality of sexual function and whether anxiety was increased due to the pandemic and subsequently affected sexual function.	Online Survey	N = 299 Age: 18–28 (21.2%), 29–36 (24%), 37–44 (27.4%), 45–74 (27.4%) Gender: Men (28.8%), women (71.2%) Sexual orientation: Heterosexual	IIEF FSFI In-house created questions on sexual activity, anxiety, and mood	IIEF: 22.7% of the men had a possible erectile dysfunction, 77.3% had no indication of sexual dysfunction. FSFI: 17.6% demonstrated risk of sexual dysfunction and 81.9% demonstrated no risk.	No change in sexual activity. 32.8% experienced more sexual fantasies and thoughts. 37.5% agreed that intercourse with their partner was more enjoyable. 61.8% did not masturbate more frequently. No change in mood, but an increase in anxiety.
Starks et al (2020) USA ¹¹⁵	To compare marijuana use, other illegal drugs use, and sexual behavior with casual partners among sexual minority cisgender men active on social networking and dating applications before and during the COVID-19 epidemic.	Cohort-control study, online survey	N = 910 Age: 40.5 (average) Gender: Cisgender men Sexual orientation: Gay (77%), bisexual (18.1%), other (4.8%) Relationship: Single (77.3%), partnered (22.7%) Other characteristics: Marijuana users (40.1%), other illegal drugs users (16.9%), positive HIV status (24.3%)	In-house created questions on drug use, number of casual male sex partners, and condomless anal sex with casual male partners	Casual sex partners per month: Before COVID-19: 1.59 (mean) vs during COVID-19: 1.53 (mean). The unweighted probability of reporting condomless anal sex with a casual partner declined significantly from 71.6% pre-COVID to 26.4% during COVID.	Weighted number of casual sex partners did not differ significantly before and during COVID-19, whereas condomless anal sex declined significantly.
Stephenson et al (2021) USA ¹¹⁶	To study MSM's sexual behavior and HIV prevention during COVID-19.	Online survey	N = 518 Age: >18 Gender: Men Sexual orientation: MSM	In-house created questions	Mean increase in sex partners: 2.3. Mean increase in anal sex partners: 2.1.	Increase in sexual activity during COVID-19 was associated with increase in substance use.
Suen et al (2021) China ¹¹⁷	To study sexual desire and activity among gay and bisexual men during COVID-19.	Online survey	N = 376 Age: >15 Gender: Men Sexual orientation: Gay, bisexual	In-house created questions	Sexual desire remained prevalent, but COVID-19-barriers were common.	Sexual behavior was a result of a complex balance between desire and COVID-19-related barriers.
Szuster et al (2021) Poland ¹¹⁸	To investigate the association of COVID-19 outbreak and mental, physical, and sexual health.	Cross-sectional online survey	N = 1,644 Age: 23 (median) Gender: Women Relationship: Single (17%)	FSFI BDI In-house created questions on sexual activity	Decrease in frequency of sexual activity. FSFI (mean) 27.0, BDI (mean) 11. Negative correlation between FSFI and BDI scales,	Small decrease in sexual frequency after COVID-19. Depressive symptoms, fear of contracting infection, chronic disease, and fear of health condition had a negative impact on sexual function.

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Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Tan et al (2021) Singapore ¹¹⁹	To characterize levels of individual and interpersonal sexual behaviors and investigate how lockdown had impacted such behaviors; to determine how levels of sexual satisfaction had changed.	Cross-sectional online survey, part of “I-Share”	N = 338 (whom ever had a sexual experience out of N = 562) Age: 28 (median) Gender: Men (56.2%), women (43.8%) Sexual orientation: Heterosexual (57.5%), asexual (12.6%), bisexual (10.8%), queer/questioning (6.3%), gay/lesbian (8.4%), pansexual (4.5%)	In-house created questions on sexual behavior and satisfaction	FSFI and comorbid chronic disease, intensity of fear of infection, fear of health condition, perceived loneliness, and being up to date with media news. During COVID-19, participants who were single or not cohabiting experienced a greater decrease in sexual activities with steady/casual partners, but a greater increase in masturbation, sexting, and watching pornography in relation to those cohabiting.	Those not cohabiting with their partner were more likely to experience a decline in sexual satisfaction; those living with their partner were less likely to experience a decline in sexual satisfaction.
Tribowo et al (2021) Indonesia ¹²⁰	To evaluate the alteration of sexual behaviors in married men and women during the COVID-19 pandemic.	Cross-sectional online survey	N = 201 Age: 37 (mean) Gender: Men (54.7%), women (45.3%) Relationship: Married for at least 10 months, living together	In-house created questions on change in sexual behavior	62.2% reported the frequency of sexual intercourse being 2–4 times/wk before pandemic. 43.3% 1 time/wk during the pandemic.	Tendency to masturbate 2–4 times/wk was 2 times higher during the pandemic.
Ugurlucan et al (2021) Turkey ¹²¹	To evaluate the effect of COVID-19 on sexual function in women treated for genito-pelvic pain/penetration disorder (vaginismus).	Follow-up survey	N = 77 Age: 30.2 (mean) Gender: Women	FSFI GRISS BDI Frequency of sexual intercourse	Significant increase from before to during pandemic in FSFI total (21.6/24.2). No significant change in total GRISS score (30.6/25.1). Significant worsening in GRISS dissatisfaction (3.5/6.0) and anorgasmia (3.7/5.4). Significant increase in BDI (6.1/12.3).	Increase in sexual function (FSFI), while GRISS satisfaction and anorgasmia worsened, and women reported more depressive symptoms. No change in sexual frequency.
van Bilsen et al (2021) The Netherlands ¹²²	To study impact of COVID-19 restrictions on sexual behavior and STI acquisition in MSM.	Online survey	N = 683 Age: 47 (median) Gender: Men Sexual orientation: MSM	In-house created questions	73% reported reduction in number of casual sex partners. No HIV cases were registered during study period.	Decline in casual sex partner activity and temporary decline in HIV/STI transmission.
Walsh and Stephenson (2021) USA ¹²³	To study impact of COVID-19 on relationship satisfaction of male same-sex couples.	Online survey, including open-ended questions	N = 209 Age: 36 (mean) Gender: Men Sexual orientation: MSM Relationship: Partnered	In-house created questions	55% reported no changes in relationship happiness. 30% reported an increase. 25% reported to be more invested in relationship, which was positively associated with increased sexual activity during COVID-19.	Relationship investment increased with increased sexual activity.

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Table 1. Continued

Authors (year) Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Walsh et al (2021) USA ¹²⁴	To study sexual agreement and behavior changes among partnered MSM during COVID-19.	Online survey	N = 215 Age: 35.9 (mean) Gender: Men Sexual orientation: MSM Relationship: Partnered	In-house created questions	15% changed intra-relational agreements on sexual behavior during COVID-19, and the pandemic factored into 85% of reported changes.	15% of partnered MSM shifted sexual agreements towards monogamy.
Wignall et al (2021) UK ²⁷	To examine self-reported changes in young adults' sexual desire and behaviors during the most significant social restrictions imposed to deal with COVID-19.	Cross-sectional online survey	N = 565 Age: 25.4 (mean); 18–32 Gender: Cisgender women, cisgender men, non-binary, unknown Sexual orientation: Heterosexual (78.94%), mostly heterosexual (7.26%), bisexual (8.85%), gay/lesbian (3.54%), mostly gay/lesbian (1.06%) Other characteristics: White (82.12%)	SDI-2 SOI-R In-house created questions on sexual behavior, health, and well-being	SDI = 54.5 (mean) during lockdown compared to 58.3; 17.4 (SD) before lockdown. SOI-R global = 32.9 (mean).	Overall decrease in sexual behaviors. Levels of sexual desire decreased in women compared to men. Individuals in steady relationships reported higher increase in sexual activity than individuals who were single or dating casually.
Yarger et al (2021) USA ¹²⁵	To compare adolescents and young adults' romantic relationships and sexual activity before and after social distancing policies were enacted.	Online survey, sub study	N = 128 (351) Age: 18–21 (13–17 excluded) Gender: Women (64.6%), men (34.7%), transgender (0.8%) Sexual orientation: Straight/heterosexual (84.8%), LGBQ (12.8%)	In-house created questions on romantic and sexual interactions	62.9% did not do sexting. 75.4% did not online date. 62.4% did not watch porn. 12.0% watched more porn, 14.5% watched about the same, and 11.1% less.	Overall, youth were not pursuing romantic or sexual relationships online during the pandemic, and the majority stated that they did not watch porn.
Yuksel and Ozgor (2020) Turkey ¹²⁶	To evaluate the effect of the COVID-19 pandemic on female sexual behavior.	Observational study	N = 58 Age 27.6 (mean) Gender: Women Other characteristics: Sexually active	FSFI Frequency of sex	Frequency of intercourse before pandemic 1.9/wk vs 2.4/wk during the pandemic. Total FSFI before pandemic 20.5 vs 17.6 during the pandemic. Sexual desire subdomain 3.9 during pandemic vs 3.42 before.	Increase in frequency of intercourse during pandemic compared to before, but a decrease in total sexual function scores. Desire domain increased during pandemic, while the other subdomains decreased.
Zamboni et al (2021) Italy ¹²⁷	To measure perceived loss of control regarding online gambling, online shopping, online pornographic content and web navigation.	Online survey	N = 1,196 Age: 43.3 (mean) Gender: Men (35.1%), women (64.6%), other (0.3%) Other characteristics: Healthcare workers (43.1%)	In-house created questions on emotional status, loss of control and online behaviors	21.6% reported use of online pornographic material during Lock down; 90.1% of them stated that the frequency of their fruition of it remained unchanged, 5.2% reported a decrease and 4.7% reported an increase.	No significant increase in use of online pornographic material.
Zhang et al (2021) China ¹²⁸	To determine the changes in health, relationships, and sexuality among the Chinese couples who lived together	Online survey	N = 1,139 Age: 33.6 (mean) Gender: Men (65%), women (35%)	IES In-house created questions on relationship and	69.7% reported no changes in the mean frequency of their sexual intercourse/wk. 78.8% reported no effect on	The majority reported no changes in frequency of sexual intercourse and quality of sex life. Frequency of sexual intercourse and quality of sex life in

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Table 1. Continued

Authors (year)	Country	Aims	Study design	Population	Measures	Outcomes	Key findings
Özülü et al (2021) Turkey ²⁹		amidst the early stages of COVID-19. To determine the effects of the COVID-19 pandemic on the quality of sexual life.	Online survey	N = 329 Age: 33.69 (mean) Gender: Men (26.4%), women (73.6%) Relationship: Married or living with sexual partner	sexuality SQOL-F or SQOL-M	quality of their usual sex lives. Being male was significantly associated with increased frequency of sexual intercourse amid pandemic. Being in a relationship <1 year were more likely to have increased frequency of sexual intercourse. Mean quality of sexual life 59.77 (women), 54.56 (men). 27.7% women and 34.5% men reported that COVID-19 affected their sexual life. 19% of women and 12.6% of men had stopped having sex during COVID-19.	participants who experiences high stressful impact were more likely to be affected by the COVID-19 pandemic.

Sexual Frequency and Practices. Most studies reported an overall decline in partnered sexual activity,^{30,31,41,55,61,69,83,90,105,118,120,130,131} defined as frequency or number of sexual intercourse^{40,44,49,54,63,66,77,79,80,84,102,112} and/or number of sexual contacts.^{61,55,130,43,67,103,106,122} For example, a multinational study comprising 2,512 participants (partnered and single cis-women and cismen of mixed, mainly heterosexual, orientation) showed that the frequency of most sexual activities had declined significantly since the beginning of the pandemic.⁶⁹

Only a few studies presented exact numerical data on the sexual frequency before and after the pandemic. However, a Turkish study including 1,356 participants found that the mean number of coital activities per week decreased from 1.86 before to 1.35 during COVID-19 lockdowns.⁷⁹ Likewise, a Belgian study with 694 participants showed that the proportion who were sexually engaged with casual partners dropped from 59.1% to 8.9% during the first weeks of lockdown among men who had sex with men (MSM).¹⁰³

Nonetheless, a small number of studies identified an increase in interpersonal sexual activity during COVID-19.^{120,38,39,59,89,94,116,126} Hence, a German study including 414 cismen of mixed, mainly heterosexual, orientation revealed an increase in coital frequency: the proportion of respondents having had sexual intercourse >3 times weekly increased from 7.8% before to 37.5% during confinement.⁹⁴ Finally, some investigators found no statistically significant changes in the frequency of partnered sexual activities before and during the pandemic.^{55,84,32,62,81,101,104,110,115,121,125,127,128}

Several studies found an association between sex frequency during COVID-19 and current relationship status. Thus, the large-scale British Natsal-COVID study, including 6,654 participants aged 18–59 years, found that partnered sex was less frequently reported with decreasing relationship formality: of those who were not in a steady relationship, one-quarter reported partnered sex since lockdown, while almost three-quarters of those in a steady, but non-cohabiting, relationship reported to have had sex. Among those in a steady, cohabiting relationship, 8-out-of-10 (81.0%) had engaged in partnered sex during the pandemic.²⁵ This trend resonates with other studies.^{30,61,90,130,40,41,131} For example, Gleason et al and Amerio et al showed that a decline of partnered sexual behavior was more extensive in non-cohabiting than cohabiting individuals,^{30,61} while Wignall et al found that people in serious relationships more frequently reported increases in partnered sexual activity during the lockdowns than people who were single or dating casually.¹³¹ Interestingly, however, Cito et al found an inverse correlation between the number of hours spent at home with a partner and the number of sexual intercourses during the quarantine period. The authors suggested poor privacy, relational tensions, and lack of external stimuli as possible explanations.⁴⁰

When looking at the frequency of sexual solo activities, an altogether different picture appears, as studies overall showed strong trends towards an increase of masturbatory behavior.^{26,61,90,120,77,79,94,32} For example, a Spanish study including 1,448 participants of men and women with mixed sexual orientations revealed that the most prevalent sexual activity during lockdown was masturbation without use of sex toys (reported by 61%). Moreover, the percentage of those who masturbated more than once a day rose from 12.5% before to 25.8% during confinement.³²

Some studies suggested an association of increased masturbatory activity with being single and/or male.^{26,61,94} Such links were found in an Australian study (with most participants aged 18–29), where one-quarter (26%) reported masturbating more than pre-COVID-19. Further, those who reported less or no partnered sex during lockdown were significantly more likely to report using sex toys alone compared with those reporting the same amount or more partnered sex during COVID-19 (35.6% vs 10.3%).⁴¹ Only few studies indicated no change with regard to masturbation.^{105,131,63,66}

In terms of other sexual activities, different trends were highlighted by studies from around the world. A study from the US including 1,559 participants of mixed sexual orientations, genders, and racial identities revealed that one-fifth (20.3%) reported expanding their sexual repertoire by incorporating new activities in relation to both solo-sex and partnered sex, for example, trying new coital positions, acting out sexual fantasies with a partner, or filming oneself while masturbating.⁸⁴ A similar trend appeared in a study by Hille et al, where 19.5% reported sexual experimentation during lockdown,⁶⁹ and in a study by Cascalheira et al, where 30.4% reported an increase in sexual fantasizing and solitary sexual behaviors.²⁷ Finally, a British study among MSM showed that three-quarters (76%) implemented one or more changes to their sexual behavior.⁷³

Overall, the studies showed a tendency towards a worldwide decline in partnered sexual activities, especially among those who were not in a relationship or cohabiting during the pandemic. At the same time, the studies nearly uniformly showed an increase in masturbatory activities especially among those who were not in a relationship. Finally, few studies showed a tendency towards exploring new sexual practices, predominantly among those with a steady partner.

Pornography Consumption and Virtual Sexual Practices. Not surprisingly, many studies showed that watching pornography was a common activity during the pandemic.^{25,27,61,43,59,89,113,68} Thus, a study from the UK including 565 young adults of mixed genders and sexual orientations found that 59.5% had watched pornography sometime during lockdown.²⁷ In Natsal-COVID, Mercer et al showed that a little more than half (52.6%) reported some form of virtual sexual activity with 43.2% specifically

reporting pornography use.²⁵ Correspondingly, a number of studies revealed an increase in the use of pornography during the lockdowns compared to the pre-pandemic era.^{26,61,43,59,68,109,113}

However, pornography consumption displayed characteristic differences in relation to gender and age, and the high/increasing usage seemed to apply especially to younger participants and/or males.^{25–27,61,109,85} Hence, according to Mercer et al, 61.5% men vs 21.1% women used pornography during lockdown,²⁵ while Gleason et al found that men, as opposed to women, reported a significant increase in pornography use during COVID-19, with young participants reporting the highest increase.⁶¹

Other research, however, showed consistent pornography usage or a downward trend during the pandemic.^{105,63,125,127,64} For example, a German study including 3,245 participants investigated changes in online media consumption during lockdown and found that 86.7% of respondents reported consistently low usage of online erotic applications before and during the lockdown.⁸⁵ A similar tendency was found among 2,518 American adults, where pornography consumption trended downward during COVID-19 for both women and men.⁶⁴

A few studies investigated virtual dating or virtual sexual activities, including digital sexual encounters, for example, cybersex and sexting, that is, sending, receiving, or forwarding sexually explicit messages, photographs, or videos. Generally, the studies found a tendency towards low occurrence or decreasing of such activities during the lockdowns,^{41,125,62,85,57,58} although notable differences occurred. Thus, Gabster et al found that among 960 participants of various genders and ethnicities in Panama, 86.7% reported a decrease of virtual sex activities during the pandemic,⁵⁷ while a Spanish study indicated that sexting practices decreased during lockdown despite increased online attendance.⁵⁸ Tan et al found a higher prevalence of receiving and sending nudes and watching pornography during the pandemic among Singaporean participants, who were single/non-cohabiting than among those cohabiting.²⁶

Further, Coombe et al showed an overall decline of dating app use during the pandemic compared to baseline data from 2019 (42.1% vs 27.3%), although chatting/texting and virtual dating increased among individuals who continued to use apps during COVID-19 waves.⁴¹ A similar trend was reported by Shilo et al among 2,562 Israeli MSM. Here, the participants predominantly met their sex partners through online dating applications, and sexual uses of phones and webcams had increased during the pandemic.¹¹³ Comparable conclusions were reached in a couple of other studies.^{90,43} Not surprisingly, Lehmler et al found higher rates of virtual and technology-based behaviors, such as sexting, among those living alone, compared to those living with a partner.⁸⁴

Overall, pornography consumption widely increased during the pandemic, especially among younger individuals and/or

men. Generally, most studies found a low occurrence of virtual sexual activities such as digital sexual encounters and sexting, though few studies pointed to an increase.

Sexual Risk Behaviors and Casual Sex Activities. Many studies have focused on sexual risk behaviors, particularly casual sex activities and/or unsafe sex practices, and chemsex, that is, using illicit drugs as part of sexual activities. The majority of such studies investigated MSM and, as a whole, they showed a reduction in risky sex behaviors.^{90,130,67,103,122,115,110,113,71,76} Consistently, a number of studies revealed a decline in casual partner activity during COVID-19.^{90,67,103,122,76,86} For example, Reyniers et al showed a significant decrease in casual partner sex among MSM from 59.1% to 8.9% during the first weeks of lockdown,¹⁰³ while van Bilsen et al found that nearly three-quarters (73%) of MSM reduced their casual sex contacts during COVID-19.¹²²

A pandemic-induced shift in condom use during sex was noted by some studies, especially among MSM. Howarth et al, including 2,018 MSM, showed that although 17% had engaged in unprotected anal sex during lockdown, a decrease in the prevalence of multiple episodes of unprotected intercourse were seen.⁷¹ Likewise, Starks et al revealed a significant decline in unprotected anal sex among a group of MSM from 71.6% pre-COVID-19 to 26.4% during COVID-19.¹¹⁵ Similar trends were registered by Rogers et al²⁵ and Jongen et al⁸⁹

As was the case for other dimensions of sexual activity during the pandemic, some studies did not register significant changes in casual sex activity.^{115,57} The aforementioned Israeli study among 2,562 MSM found that even though risky sex behavior generally lessened, 39.5% still had occasional casual sex partners.¹¹³ Other studies found *no* major changes in condom use during COVID-19.^{43,110,57}

Overall, only a small number of studies revealed high/increasing prevalence of sexual risk behaviors during the pandemic.^{39,46–48} For example, De Sousa et al, who investigated casual sex among MSM in Brazil and Portugal, found that half (53%) of the participants had had casual sex during lockdown,⁴⁷ while 38.9% had engaged in chemsex with casual partners.⁴⁶ Likewise, a study including 1,301 Portuguese MSM (based on the same data as⁴⁷) found that one-fifth (20.2%) had engaged in chemsex during lockdown.³⁹ Similarly, Stephenson et al found that increases in sexual behaviors during the pandemic among MSM were associated with increases in concomitant substance use.¹¹⁶ Finally, Meunier et al showed that sex venue attendance was generally high among sexual and gender minority individuals despite COVID-19.⁹¹

In conclusion, the studies generally pointed to a decrease in risk behaviors/casual sex activities, although fluctuations were seen. Risky sex was predominantly studied in segments of MSM populations, whereas safe sex adherence was scarcely explored

among heterosexuals or women who have sex with women (WSW).

Sexual Functioning

Many studies have looked at overall sexual function and dysfunction during COVID-19, and they have scrutinized the impact of lockdowns in different phases of the sexual response: sexual desire, arousal and erectile function, orgasm, and ejaculation.

Overall Sexual Function and Dysfunction. Several studies have investigated respondents' overall rating of their sexual life during lockdowns, and results pointed to both improvements, impairments, and status quo.^{101,42,114} In an Italian survey of 2,149 mainly heterosexual individuals in stable relationships, half (49%) reported that their sexual life had improved, whilst 29% (predominantly women) had experienced a deterioration of their sex life. Statistically, women reporting a decrease in sexual contentment did not experience more sexual dysfunction, while sexually discontent men experienced mild erectile dysfunction (ED) and orgasmic problems more often than sexually content men.⁴²

In a Greek study with 299 heterosexual participants, nearly half (46%) reported that the quarantine had improved their sexuality; and 42% felt that intercourse was more enjoyable than before the quarantine, while 29% stated that the quarantine had not benefitted their sexual activity. One-quarter reported no change. Investigating sexual function using the International Index of Erectile Function (IIEF) and the Female Sexual Function Index (FSFI) demonstrated no effect of the lockdowns on the total scores nor in any subdomains.¹¹⁴ Similarly, among 33 mainly heterosexual men and 91 mainly heterosexual women in Italy, Panzeri et al found that most participants reported no change in their overall sexual function compared to pre-COVID-19. Notably, more men than women reported no such difference.¹⁰¹

Only few large-scale studies investigated overall female sexual functioning during the pandemic, and most of them utilized the FSFI scale measurement.^{118,44,66,77,112,80,126,101,34,37,56,74,95,96,114} Several studies showed an impairment of overall sexual function in women, although few studies assessed the level of sexual distress which is crucial for the definitions of a sexual dysfunction. Thus, in a prospective Polish study on 746 women, Fuchs et al found that a mean total FSFI score of 30.1 before the pandemic dropped to 25.8 during the pandemic. Simultaneously, the proportion of women with a score indicative of a dysfunction raised from 15.3% to 34.3%. The reported reasons for impaired sexual function included isolation from partner, lack of desire due to stress, conflicts with partner, and fear of contracting the virus.⁵⁶ Another prospective study among Italian women found a change in the mean FSFI score from

29.2 before to 19.2 during the pandemic, in addition to an increase in sexually related distress from 9.3 to 20.1 on the Female Sexual Distress Scale (FSDS).¹¹²

In 2 other follow-up studies, significant decreases in the FSFI scores were also demonstrated. In the first study, a shift from one mean in the dysfunctional area (20.5) to another (17.6) was seen.¹²⁶ In the other study, a discrete shift from one mean in the functional area (28.82) to another (27.22) was seen.³⁴ In a study by Ilgen et al, no significant changes in the total FSFI score comparing pre-pandemic and pandemic levels were detected. Decrease in the sexual function score was associated with increased anxiety scores.⁷⁴ A clinical study from Pakistan included 300 women, who had been hospitalized with COVID-19, and measured their sexual function 60 days after discharge from the hospital comparing this with the pre-infection level. A significant drop in the total FSFI score from a mean of 28.2 to a mean of 24.4 was found.⁹⁵

Overall, many reports of an overall decline in sexual function during COVID-19 were located, and it seems that the pandemic has impacted the overall sexual function of women more negatively than that of men.

Sexual Desire. Studies from all over the world have investigated changes in sexual desire during COVID-19, mostly by means of asking participants to recall the level of desire before the outbreak of the pandemic.^{8,105,118,131,40,54,79,126,32,101,117} In a Spanish study including 1,448 men and women aged 18–60 years, around one-third (35%) reported reduced, one-third (36%) increased, and one-third (29%) unchanged sexual desire. A statistically significant difference between genders was found, as more women than men reported increased desire during the pandemic, while more men than women reported reduced desire. The study population had a relatively high representation of non-heterosexual participants (22%), and 44% had a steady partner.³²

In a Turkish study of 1,356 men and women, two-thirds of which were in a stable partnership, 42% reported no change, 32% a decrease, and 27% an increase in sexual desire. Female gender and high age were associated with decreased desire. Furthermore, the authors reported that people living in smaller cities (ie, less than 4 million inhabitants) had a more stable level of sexual desire than people living in big cities.⁷⁹ Feng et al confirmed that many respondents did not experience any change in sexual desire during COVID-19. Among 284 heterosexual participants, 56% reported no change, 19% an increase, and 25% a reduction of desire.⁵⁴

Many studies found pronounced differences in sexual desire between male and female respondents. For example, in a study among mainly partnered men and women with mixed sexual orientations, Cito et al found that 79% of men vs 30% of women reported a decrease in sexual desire, whereas 21% of men vs 67% of women reported an unchanged or augmented sexual desire.⁴⁰

In contrast, among 467 younger cisgender men and cisgender women of mixed sexual orientation, Wignall et al reported that men had higher levels of sexual desire than women both before and during lockdowns. Women reported significant decreased levels of sexual desire during lockdown compared to before, whereas a similar trend among men did not reach statistical significance.¹³¹ In a Polish study among 1,644 mainly partnered women, significantly more participants reported low libido during (24%) than before (13%) the pandemic, while about one-third reported no change.¹¹⁸

In one of the few longitudinal studies, Brotto et al investigated 1,019 mainly partnered men, women, and non-binary persons with mixed sexual orientation from Canada. In addition to investigating sexual desire at 4 different points in time (from the very restrictive period to more relaxed periods), the authors differentiated between solitary and dyadic sexual desire. They found that at baseline (the restrictive period), solitary and dyadic desire were in the moderate range of the scale, and that men scored higher than women on both desire domains, while non-heterosexual individuals scored higher on the solitary desire domain than heterosexual individuals. Interestingly, high COVID-19-related distress was associated with high dyadic desire at baseline, and having a live-in partner was associated with lower solitary and dyadic desire at baseline. Over time, no change in solitary desire and a decrease in dyadic desire were reported.⁸

In conclusion, the overall trend was that around one-third to half of the participants experienced no changes in sexual desire during lockdown, while the remaining participants reported either an increase or a reduction in sexual desire.

Erectile and Ejaculatory Function. A relatively small number of large-scale studies have evaluated erectile function in men, and even fewer studies have focused on ejaculatory functioning. Most studies used retrospectively reported function as a reference point, and they typically registered some, but not overwhelming, negative changes.^{105,94,101,37,50,53,72,97,111} The largest study identified was a Turkish investigation of medical charts from 3,231 men presenting themselves at a urological out-patient clinic pre-COVID-19 and during COVID-19. A significant increase in overall sexual health complaints was seen (8.6% vs 10.8%), including 6.6% vs 8.7% presenting symptoms of ED.⁵⁰

In a Chinese study among 612 men (53% unmarried), 84% and 83% reported no changes in erectile or ejaculatory function during lockdown, respectively. 8–9% of respondents reported improved erectile or ejaculatory function, while a similar fraction reported some degree of deterioration in erectile or ejaculatory function. A decrease in erectile or ejaculatory function was associated with increased levels of anxiety, depression, and/or decreased physical activity.⁵³ In a study among 245 heterosexual men, Carvalho et al established that psychological adjustment to the pandemic living conditions mitigated the relationship between lockdown measures and ED.³⁷ An opposite trend was

seen in a German study among 414 cismen of mixed, mainly heterosexual, sexual orientation. The authors found a significant increase in arousability during the quarantine period compared to before, with no differences observed between hetero-, bi-, or homosexual men.⁹⁴

Two smaller prospective studies investigated the effect of being diagnosed with COVID-19 on erectile function. Hu et al recruited 67 men, who had recently recovered from the infection, and they found that nearly half (45%) had ED. This proportion had dropped to 30% at follow-up 3 months later.⁷² Sansone et al compared 25 men, who had had COVID-19, with 75 men with no such medical history. They found an odds ratio (OR) of 5.7 (CI: 1.5–24.0) for having ED when having had COVID-19 and an OR of 5.3 (CI: 1.5–20.1) for having had COVID-19 when reporting ED. On this background, the authors suggested that inflammation processes may facilitate COVID-19-induced ED.¹¹¹

Overall, the ramifications of the lockdowns on men's erectile function seemed to be modest, while experiencing a corona virus infection might somehow contribute to triggering erectile problems.

Sexual Function Among Health-Care Providers. Several studies have implied that health-care providers may have been particularly affected on their sexual well-being during the COVID-19 lockdowns.^{44,66,127,96,82,45} Thus, the largest study from Neto et al evaluated the impact of the pandemic on sexual function in 1,314 health-care professionals (with mainly heterosexual orientation) at a COVID-19 reference center in Brazil. Overall, 37% of the respondents reported lower libido (42% of men vs 25% of women) during than before the pandemic, whereas 45% reported lower sexual satisfaction (42% of men vs 47% of women). Low libido was associated with lack of nightlife attendance, older age, isolation from partner, and living with a partner.⁹⁶

A study from Italy investigated 544 hospital workers and their acquaintances using an online survey. Eight out of 10 men (82%) and 4 out of 10 women (42%) reported low levels of sexual desire compared to the pre-pandemic era. 65% of health-care workers vs 57% of their relatives and friends reported low sexual desire.⁴⁵ Studies from several other countries supported these findings.^{44,66,82,35} Interestingly, Bulut et al showed that being a nurse or working in a COVID-19 diagnostic unit were risk factors for severe ED compared to working in a urological clinic or being a physician.³⁵

Overall, these findings suggest that health-care providers might have experienced relatively more sexual adversities than other groups during the lockdowns.

Sexual Satisfaction

The vast majority of identified studies dealt with various aspects of sexual behavior and functioning, whereas only few

investigators designated sexual satisfaction as a main outcome. Nonetheless, self-reported contentment with sex life before and during lockdown was touched upon by several studies and overall, the proportion of respondents being dissatisfied with their sex life seemed to raise somewhat during COVID-19.^{25,54,62,96,99,98}

For example, in a study among Kenyan male-female couples, a significant increase in sexual dissatisfaction from 26.6% before to 41.6% during lockdown occurred;⁹⁹ and a similar pattern was observed in Egypt, where sexual satisfaction was significantly higher before than during restrictions (males: 91.2% vs 70.5%; females: 73.5% vs 56.2%).⁹⁸ In a study among 1,079 French-speaking men and women, more than half (56.4%) did not experience any change in sexual contentment, whereas one-third (33.5%) reported a decrease. The authors noted a statistically significant association between negative sexual cognitions/emotions and sexual dissatisfaction, and suggested that the impact of restrictive measures on sexual cognitions/emotions was greater than the impact on actual sexual behaviors.⁶²

As previously mentioned, the Natsal-COVID study revealed a marked shift in sexual repertoires, frequency, and satisfaction following COVID-19 restrictions. Especially young and non-cohabiting respondents were likely to report adverse sexual health outcomes, including low sexual satisfaction. Thus, 36.9% of individuals who had had partnered sex since the introduction of lockdown had experienced changes in sexual satisfaction, and 23.3% reported mostly negative changes. This proportion increased with relationship informality from 16.5% of those cohabiting to 31.0% of those with no steady partner. Among individuals reporting no partnered sex during lockdown, one-third (32.7%) reported mostly negative changes in sexual satisfaction, whereas 2.5% reported mostly positive changes. Overall, sexual changes were reported significantly more often by younger than older respondents. Thus, nearly one-third (31.5%) of 18–24-year-olds reported mostly negative changes in sexual satisfaction during COVID-19 compared to nearly one-fifth (18.8%) of 45–59-year-olds.²⁵ A smaller study from Singapore found that participants not living with their partner were more likely than singles to experience a decrease in sexual satisfaction; while those living with their partner were less likely to experience sexual dissatisfaction than singles.²⁶

In addition to young age, negative sexual cognitions/emotions and not being in a steady relationship, observed risk factors of lowered sexual satisfaction during lockdowns included strict adherence to physical distancing rules,⁷⁰ pandemic-related stress,⁸ general anxiety,⁸¹ depressive symptoms,⁶² loneliness,⁷⁰ poor relational intimacy and satisfaction,⁵⁴ short duration of relationship,⁹⁹ and current isolation from partner.⁹⁶

Finally, few studies investigated the vulnerability to post-lockdown sexual discontentment among sexual minority individuals.^{81,70} Among 10,089 American GBMSM (gay, bisexual, and other men having sex with men), those who adhered to

physical distancing were more likely to report that their sexuality had been negatively impacted and less likely to be satisfied with their current sex life.⁷⁰ In a German study with 523 participants of various sexual orientations, a significant increase in general satisfaction with sexual life was detected among bisexual compared to hetero- and homosexual individuals.⁹⁴

Other investigators also found traces of overall improvements in sexual lives during COVID-19. Thus, in an Italian survey of 2,149 mainly heterosexual men and women in stable relationships, half (49%) reported that their sexual life had improved, while slightly less than one-third (29%) had experienced a deterioration. Sexual improvements were primarily reported by men.⁴² Similar results were found in a Greek study mentioned previously among 299 heterosexual men and women. Thus, nearly half (46%) reported that the quarantine had benefited their sexual activity; and 42% stated that intercourse had become more enjoyable compared to the pre-quarantine era.¹¹⁴

In conclusion, the majority of respondents did not seem to experience any deterioration of their sexual contentment during the lockdown. However, a significant minority reported a decrease of sexual satisfaction in relation to the demand for physical distancing. Young age, mental distress, single or non-cohabitating status, short relationship duration, and poor relationship contentment were among the most frequently reported determinants of lowered sexual satisfaction during COVID-19 restrictions. Few studies suggested that the overall sexual contentment had improved for some, especially male, respondents.

The Interplay Between Mental Health and Sexual Well-Being

Several studies have investigated correlations between mental well-being and sexual health in the shadow of COVID-19 lockdowns. While some authors measured mental health and sexual well-being independently,^{83,77} others aimed to establish possible links between the two. Most such studies indicated that an increase in COVID-19-induced adverse reactions such as stress, anxiety, and depression impacted negatively on both sexual activity, functioning, and satisfaction.^{7,8,118,49,63,66,38,62,81,74,53,29,36,65,88} For example, a prospectively designed Chinese study including 2,998 undergraduate students showed that COVID-19-related stress, depression, and anxiety were linked to sexual compulsivity, both at baseline and after 4 months.⁷ The same tendency was reported by Albertella et al, where COVID-19-related psychological distress was associated with increased compulsive behavior including problematic pornography use.²⁹

Further, a Polish study, including 1,644 women, showed an inverse correlation between sexual functioning (measured by the FSFI scale) and both depressive symptoms and fear of contracting corona virus.¹¹⁸ A number of studies indicated a similar connection between low psychosocial well-being and poor sexual function within a pandemic context.^{49,63,66,38,74,53,65,88} In Chinese

men, Fang et al found an association between deteriorating erectile function and the presence of anxiety and/or depression,⁵³ while Luetke et al found that marital conflicts due to COVID-19 lockdown tended to decrease the ability to reach an orgasm as well as feelings of being emotionally close to one's partner.⁸⁸

Although vastly cross-sectional by design, some studies focused on the potential of sexual activity and well-functioning to sustain or induce mental well-being during lockdowns.^{31,40,93,107} For example, in an Italian study among 6,821 participants, Mollaioli et al showed that validated anxiety and depression scores were significantly lower in subjects, who were sexually active during lockdown.⁹³ Another Italian study with 1,576 participants also found a positive correlation between well-being scores and participants' number of sexual intercourses.⁴⁰ Also, an American study with 1,010 participants of mixed race/ethnicity found that the group with "very frequent" in-person sexual connections trended towards lower prevalence of depression and loneliness compared to those having "remote" sexual connections.¹⁰⁷

Although causal mechanisms cannot be established using cross-sectional designs, studies suggested that sexual activity, and the underlying dyadic relationship, may have had protective or at least mitigating effects on mental health during the pandemic. Regardless of potential pathways between sexual contentment and mental thriving, however, it seems evident that COVID-19-related mental distress have impacted negatively on sexual activity, functioning, and satisfaction in the studied populations.

DISCUSSION

We identified 107 studies that exhibited some overall patterns, but also revealed complex and multifaceted tendencies. Roughly speaking, the scoping review indicated that COVID-19 restrictions have impacted *all* dimensions of sexual health, although their effects were not necessarily substantial, predictable, or evenly distributed across all segments of the population.

Regarding sexual behavior, the studies clearly showed a tendency towards a decline in partnered sexual activities, especially for those not cohabiting or being in a steady relationship. Conversely, data showed an increase in solo sexual activities such as masturbation and pornography use; and some studies even suggested a tendency to engage in new sexual practices.

Pornography use was a globally widespread sexual activity during the pandemic, and some studies showed a significant increase in porn usage, especially among younger individuals and/or men. These results are consistent with other research indicating a lockdown-generated peak in pornography interest.¹³² This trend may have been triggered by the fact that leading pornography providers such as Pornhub.com expanded the access to their online content in the early phases of the pandemic.¹³³ Thus, Zattoni et al found a significant upsurge in the consumption of pornography, including COVID-19-themed porn, in nations with harsh stay-home restrictions, that is, China, Italy,

Spain and France.¹³⁴ The steep gender differences in pornography consumption during COVID-19 are consistent with pre-pandemic patterns.¹³⁵

Despite fluctuating findings regarding digital sex practices such as sexting and virtual dating, the overall trend reflected a relatively low or even decreasing engagement in such activities. Moreover, studies consistently showed a general reduction of sexual risk behaviors and casual sex activities, although few studies found a high or even increasing prevalence of risky sex, predominantly among MSM, who was a well-known risk group regarding HIV/STI transmission before the outbreak of the pandemic.¹³⁶

Overall, studies demonstrated that up to half of the participants did not experience any changes in their sexual functioning, while some reported a decline or an improvement. We already know that sexual function is influenced by a broad range of bio-psycho-social factors¹³⁷; and since most of the studies were carried out on relatively young and healthy individuals, it must be assumed that mainly psycho-social factors were operational in the reviewed studies. It is thus well established that sexual desire can be negatively impacted by psycho-social factors^{138,139} such as stress,^{140,141} anxiety and depression,^{142,143} relationship conflicts,¹⁴⁴ and lack of intimacy.¹⁴⁵

The most pronounced effect of the pandemic was seen on sexual desire in women. Studies reporting a negative effect on female sexual desire are in line with a general understanding of how psycho-social risk factors might impair sexual desire in women. On the other hand, few studies showed an increase in sexual desire in women during the pandemic. This may reflect that lockdowns led to more time together with the partner, thereby enhancing the intimacy of the couple. In men, the effect on desire was not equally clear; but in cases where desire was decreased, associations with especially anxiety and depression were seen.

Also, the effect of lockdowns on erectile function was primarily associated with anxiety and depression, both well-known risk factors of ED. With regard to strictly biological risk factors, we know that endothelial dysfunction, as well as pulmonary and cardiovascular disease, constitute major determinants for ED.¹⁴⁶ These are all factors that may occur during a COVID-19 disease trajectory.¹⁴⁷ Hence, future studies need to focus on corona virus infection as a possibly long-term risk factor for ED. Furthermore, the potential adverse effects on sexual functioning produced by the sedentary lifestyle during the pandemic¹⁴⁸ also need further scrutiny, as both physical inactivity and subsequent overweight are risk factors for impaired sexual function.^{146,149–151}

As for sexual satisfaction during the COVID-19 pandemic, most participants reported an unchanged level of sexual contentment, although a substantial minority experienced growing sexual dissatisfaction following physical distancing requirements and lockdown of nightlife venues and sex scenes. Several studies noted a particular susceptibility for sexual discontentment among younger respondents and people with pandemic-related mental distress such as loneliness, anxiety, and depression. Also, single/non-cohabitation status and short duration of relationship

seemed to increase the risk of sexual dissatisfaction, implying that a couple relationship may serve as a protecting factor against external stressors of sexual health.¹⁵² Some studies suggested improvements of overall sexual contentment during the restrictions.

Not unexpectedly, numerous studies showed a pronounced interplay between mental health and sexual well-being. Most studies thus indicated that COVID-19-related boosts in stress, loneliness, anxiety, and depression served as independent risk factors of sexual inactivity, dysfunction, and dissatisfaction. In a non-included mixed-method study with 3,545 respondents, increases in levels of psychosocial distress, anxiety, depressive symptoms, and irritability were closely linked with a decrease in overall well-being and sexual contentment.¹⁵³ Likewise, a recently published narrative review by Eleuteri et al found that worsening of sex life during lockdown was, among other factors, associated with negative emotions and psychological difficulties.¹⁰

In general, it seems that COVID-19 lockdowns have had a wide-ranging and potentially long-lasting impact on mental health.^{2,153} As mental ill-health is a well-established risk factor of sexual ill-health,¹⁵⁴ we anticipate that some of the reported changes in sexual behavior, functioning, and satisfaction may persist well into the post-pandemic era. On the other hand, it is well-known from clinical practice, and to a lesser degree from research, that a rewarding intimate and sexual life may be a health-promoting factor that provides psychosocial resources and enhances individual coping skills in times of crises and adversity.¹⁵⁵ Such an interplay was reflected by a small number of studies reporting that the continuance of sexual activity was closely associated with increased mental well-being. Studies have revealed that psychological resilience during the COVID-19 lockdowns was related to modifiable factors such as support from significant others.¹⁵⁶ However, the potentially protecting qualities of intimacy and sexuality during health crises are research themes that deserve further attention.

In sum, the rich and diverse results of this scoping review illustrate that the impact of the pandemic on sexual health has largely been negative, yet also unpredictable and complex with numerous examples of no or even positive sexual ramifications. In other words, the systemic and contextual qualities of sexual health have become overly apparent facing a worldwide health crisis like COVID-19. This underscores the indisputable need for researchers and clinicians to observe sexuality in a dynamic bio-psycho-social framework; and it underpins the significance of psychological, social, familial, cultural, and even spiritual factors when coping with external stressors and threats to relationships and sex lives. This is in full concordance with the World Health Organization's holistic understanding of sexuality as an ever-changing phenomenon influenced by a multitude of personal, inter-personal, and extra-personal factors.¹⁵⁷

Research included in this review suggested a variety of factors mitigating, that is, alleviating or aggravating, the impact of lockdowns on the respondents' sexual life. Especially, determinants related to relationship status, quality and duration, age, gender, and mental well-being appeared to be of importance. For example, being single or non-cohabitating had a particularly negative effect on partnered sexual activities, whereas it tended to facilitate solo-sex activities or even expand people's sexual repertoires. Further, young age, mental distress, single or non-cohabitating status, and poor relational satisfaction were among the most frequently reported determinants of lowered sexual satisfaction. Similar correlations were recently found by Eleuteri et al.¹⁰

A newly published, and therefore not included, mix-method study based on the I-SHARE (International Sexual Health And REproductive health) survey fully confirms our findings: Among 611 German adults, a significant decline in sexual satisfaction and a significant rise in sexual problems and partnership conflicts were reported, as well as increases in pornography consumption and masturbation. Using supplementary qualitative methodology, the researchers investigated the underlying causes of these adverse effects; and COVID-19-related psychological stress seemed to be the main operative factor.¹⁵⁸

Future Research Perspectives

Although including over 100 original research studies, some topics have not received sufficient attention and should be further scientifically pursued in the future. For example, a major theme throughout the literature was the incidence of domestic violence in relation to the pandemic, and some researchers reported increases in partner-related violence and sexual abuse during lockdowns.^{153,159,160} Indeed, this is a theme that deserves further investigation.

In addition, our initial search revealed an emerging number of papers on the impact of the COVID-19 crisis among individuals with HIV and frequent users of *Pre-Exposure Prophylaxis* (PrEP) treatment.^{103,106,76} Several studies thus showed a diminished access to sexual health clinical resources, including treatment, as a result of physical restrictions and re-prioritizations within national health-care settings.^{57,100} This was also the case for health-care services regarding other sexually transmittable infections, as restricted access to testing, treatment, and safe sex counselling was observed.^{57,71,100} For example, Howarth et al found that one-fourth (25.3%) of 2,018 participants (including cis- and transgender men, transgender women, and gender-diverse individuals) had experienced an unmet need for STI testing since the beginning of the lockdown.⁷¹ These findings are consistent with results from Gabster et al, who found that among 960 Panamanians (including mixed genders and ethnicities), 58.0% of those in need could not gain access to HIV/STI testing.⁵⁷

Furthermore, the fear of contracting COVID-19 during sex has not been thoroughly addressed. Interestingly, in the study among 2,562 Israeli MSM, 3.2% reported that they would willingly have sex with a person with COVID-19, whereas 10 times as many

(30.1%) would have sex with a person with HIV.¹¹³ This trend resonates with an Australian study, where 93.4% of the respondents stated that engaging in casual sex during the pandemic was "too risky" because of the threat of COVID-19.⁶⁷ However, risk perceptions have presumably changed since the early stages of the pandemic, and newer research may reach different conclusions.

Our review also pointed to other groups and themes that were generally understudied in the context of sexual health during COVID-19. Such groups include physically or mentally disabled or institutionalized individuals, older people, chronically ill people, women of color, migrants, sex workers, and LGBTQ+ individuals, including transgender people, non-binary people, bisexual people, and WSW. An increasing number of studies have revealed that LGBTQ+ persons, as a group, are prone to a marked excess of mental ill-health compared to heterosexual/cisgendered people,¹⁶¹ so predictably mental consequences of COVID-19 lockdowns are more likely to occur in the LGBTQ+ community than in other segments of society. Special attention should be drawn to transgender and gender-diverse health, which may be adversely affected by reduced access to expert clinical care and/or subsequent delays in gender-affirming health services.^{162,163} The present research mainly consists of heterosexual cisgender men and women supplemented by a fair share of studies focusing narrowly on risky behaviors among MSM. Possibly, this can be explained by prevailing transnational norms in relation to gender and sexuality and a subsequent "blindness" to non-heterosexual and non-cisgender expressions of gender and sexuality.

Another group that deserves further attention is adolescents and young adults, who have been shown to be particularly exposed to social and mental distress during lockdowns.^{1,164,165} Research is needed to cover both short- and long-term consequences for adolescents and young adults' sexual health and well-being in the wake of COVID-19.

Finally, relevant research on COVID-19 "long haulers" has recently emerged^{147,166} and this will undoubtedly dominate future research in the field. In a review on longtime COVID-19 effects and their relevance for erectile dysfunction, Sansone et al found that several complications could adversely affect the erectile function of "long haulers".¹⁴⁷ A similar trend was described by Hsieh et al, who presented compelling evidence that sequelae of COVID-19 can cause or aggravate ED.¹⁶⁶ More research on the topic of long COVID-19 disease and its effect on sexual health is most certainly called for.

Strengths and Limitations

A particular strength of this study is its systematic literature search combined with a thorough screening process and data extraction. Also, the scoping process has implied consistent transparency throughout all research phases, as described in the Materials and Methods section. Further, to our knowledge, no other literature review concerning sexuality and COVID-19 has yet included the same extensive number of studies.

For scoping review reasons, narrow inclusion and exclusion criteria have omitted otherwise relevant research themes and angles, for example, papers based on qualitative or mixed-method approaches, studies based on young populations under the age of 18 years, and studies focusing purely or primarily on relational well-being. Furthermore, our systematic search was conducted over a short period of time, and even though the pandemic seemed to recede in early 2022, recently published high-quality studies may have been missed. Thus, ongoing data collection and studies yet to be published, including the British Natsal-COVID Study¹⁶⁷ and the international I-SHARE Survey,¹⁶⁸ should draw researchers' and clinicians' attention in the near future.

Despite these limitations, the scoping review has proven appropriate to assess the extent of the knowledge in the emerging field of COVID-19 research and to identify various dimensions of sexuality under the repeated COVID-19 lockdowns of 2020 and 2021.

Methodological Considerations

Any scoping review is inherently limited by the weaknesses embedded in the individual studies included. As indicated, the validity of the reviewed studies is generally fair, but due to the pace, extensiveness, and urgency of the COVID-19 pandemic, methodological shortcomings are inevitable.

From a methodological point of view, there are several limitations to interpreting the current literature. For example, it should be remembered that inter-study comparisons are challenged by non-negligible cultural, societal, political, and structural differences. Moreover, studies measuring sexual function rarely assessed whether reported sexual problems were associated with discomfort or distress. Further, nearly all included studies employed an observational, cross-sectional questionnaire study design, based predominantly on small, non-representative populations, sampled by convenience. Also, most data were conducted online based on self-reported information concerning a relatively short time span, typically 2–4 months. In most studies, the risk of selection and/or information bias was therefore high.

Finally, most of the included research was conducted during the early stages of the pandemic, and one must assume that the picture has already changed in the evolving reality of COVID-19. Certainly, it would be interesting to investigate the long-term consequences of COVID-19 on sexuality and partnership quality, requiring large and well-designed longitudinal studies. Also, supplementary qualitative or mixed-method studies will, no doubt, be of use in future, as we try to understand what really happened to our sexual health during 2 intense years of social disruption triggered by novel coronavirus.

CONCLUSIONS

This scoping review clearly illustrated that the COVID-19 pandemic has had a broad impact on all dimensions of sexual

health. Implications have been mainly negative ones, although the frequency of sexual solo activities such as masturbation and pornography viewing seemed to increase during the lockdowns. Further, findings from the 107 transnational studies were characterized by a certain degree of complexity and unpredictability; and in addition to the overall patterns, it became apparent that sexual health during COVID-19 was widely modified by, for example, gender, age, sexual orientation, and contextual factors such as duration and quality of partnership, sociodemographic characteristics, mental vulnerability, and individual coping skills.

Ramifications of COVID-19 could be traced in all of the 4 domains explored, and the vast majority of literature indicated that harsh and long-lasting preventive measures prompted a need for personal re-orientation and social re-negotiations in the realms of sexual behavior, functioning, and satisfaction. It also became evident that COVID 19-related mental health was closely entwined with overall sexual well-being.

The literature drew attention to several groups at particular risk of sexual adversities during societal lockdowns. Moreover, it appeared that COVID-19 restrictions had impacted more negatively on women's than men's overall sexual function. On the other hand, some studies pointed to apparent protecting potentials of steady partnerships, intimacy, and sexual activity during an extensive health crisis such as this.

In particular, the review emphasized a need for future research employing prospective and/or methodically complex approaches on diverse and large samples to shed light on possible long-term consequences of the COVID-19 pandemic on sexual health and well-being. Repetitive reviews on the emerging literature in this field are also highly encouraged.

Corresponding Author: Annamaria Giraldi, MD, PhD, FECSM, IF, Sexological Clinic, Mental Health Center, Copenhagen, Copenhagen University Hospital – Mental Health Services CPH, Ole Maaloesvej 14, 2200 Copenhagen, Denmark. Tel: + 45 38 64 71 69; E-mail: annamaria.giraldi@regionh.dk

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STATEMENT OF AUTHORSHIP

Category 1:

a. Conception and design

Nana Toldam, Christian Graugaard, Annamaria Giraldi, Emmanuele Jannini

b. Acquisition of data

Nana Toldam, Christian Graugaard, Annamaria Giraldi, Rikke Meyer, Louise Thomsen, Sabine Dreier

c. Analysis an interpretation of data

Nana Toldam, Christian Graugaard, Annamaria Giraldi, Rikke Meyer, Emmanuele Jannini

Category 2:

a. Drafting the manuscript Nana Toldam, Christian Graugaard, Annamaria Giralddi, Emmanuele Jannini, Sabine Dreyer, Louise Thomsen

b. Revising it for intellectual content

Nana Toldam, Christian Graugaard, Annamaria Giralddi, Emmanuele Jannini, Rikke Meyer, Louise Thomsen, Sabine Dreier

c. Final approval of the completed manuscript

Nana Toldam, Christian Graugaard, Annamaria Giralddi, Emmanuele Jannini, Rikke Meyer, Louise Thomsen, Sabine Dreier

This form must be completed by one author who will act as guarantor for co-authors in declaring responsibility and maintaining transparency for the manuscript. A third party submitting this manuscript on behalf of the authors cannot be considered as the responsible author. Each author must have participated in each of the categories below (1, 2 and 3) to be listed as an author. All others should be listed in the Acknowledgment.

REFERENCES

- Varga TV, Bu F, Dissing AS, et al. Loneliness, worries, anxiety, and precautionary behaviours in response to the COVID-19 pandemic: A longitudinal analysis of 200,000 Western and Northern Europeans. *Lancet Reg Heal - Eur* 2021;2:100020.
- Brooks SK, Webster RK, Smith LE, et al. The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *Lancet* 2020;395:912–920. doi: 10.1016/S0140-6736(20)30460-8.
- Pfefferbaum B, North C. Mental health and the COVID-19 pandemic. *N Engl J Med* 2020;383:510–512.
- New York City Health Department. Sex and coronavirus disease 2019 (COVID-19): Safer sex and COVID-19 [Internet]. Available at: <https://www1.nyc.gov/assets/doh/downloads/pdf/imm/covid-sex-guidance.pdf>. Accessed 22 March, 2022.
- UK Legislation. The health protection (coronavirus, restrictions) (England) regulations 2020. 2020. Available at: <https://www.legislation.gov.uk/ukxi/2020/350/regulation/7/made>. Accessed 22 March, 2022.
- Li G, Tang D, Song B, et al. Impact of the COVID-19 pandemic on partner relationships and sexual and reproductive health: Cross-sectional, online survey study. *J Med Internet Res* 2020;22:e20961.
- Deng J, Li T, Wang J, et al. Longitudinal influence of COVID-19-related stress on sexual compulsivity symptoms in Chinese undergraduates. *BMC Psychiatry* 2021;21:376. doi: 10.1186/s12888-021-03369-x.
- Brotto LA, Jabs F, Brown N, et al. Impact of COVID-19 related stress on sexual desire and behavior in a Canadian sample. *Int J Sex Health* 2021. doi: 10.1080/19317611.2021.1947932.
- Eleuteri S, Terzitta G. Sexuality during the COVID-19 pandemic: The importance of internet. *Sexologies* 2021;30:e55–e60. doi: 10.1016/j.sexol.2020.12.008.
- Eleuteri S, Alessi F, Petruccelli F, et al. The global impact of the COVID-19 pandemic on individuals' and couples' sexuality. *Front Psychol* 2022;12:1–13.
- Kumar N, Janmohamed K, Nyhan K, et al. Sexual health (excluding reproductive health, intimate partner violence and gender-based violence) and COVID-19: A scoping review. *Sex Transm Infect* 2021;97:402–410.
- Bolarinwa OA, Ahinkorah BO, Seidu AA, et al. Mapping evidence of impacts of covid-19 outbreak on sexual and reproductive health: A scoping review. *Healthc* 2021;9:436. doi: 10.3390/healthcare9040436.
- Malik J, Younus F, Iftikhar I, et al. Love in the time of COVID-19: a scoping review on male sexual health. *J Comm Hosp Intern Med Perspect* 2021;11:496–500. doi: 10.1080/20009666.2021.1922133.
- de Oliveira L, Carvalho J. Women's sexual health during the pandemic of COVID-19: Declines in sexual function and sexual pleasure. *Curr Sex Heal Rep* 2021;13:76–88.
- Bazyar J, Chehreh R, Sadeghifar J, et al. Effects of the COVID-19 pandemic on the intimate partner violence and sexual function: A systematic review. *Prehosp Disaster Med* 2021;36:593–598.
- Masoudi M, Maasoumi R, Bragazzi NL. Effects of the COVID-19 pandemic on sexual functioning and activity: A systematic review and meta-analysis. *BMC Public Health* 2022;22:1–18. doi: 10.1186/s12889-021-12390-4.
- Collado ZC, Dueñas ZD, Orozco NMIG, et al. Touch me please —when this enhanced community quarantine is over: Sexual intimacies among pre-marital partners during pandemic-induced lockdown. *Sex Relatsh Ther* 2021. doi: 10.1080/14681994.2021.1881055.
- Fournier AB, Fulcher K, Shumka L, et al. Group sex in the time of COVID: Intimacy, learning, and community-building in sexual communities during a pandemic. *Can J Hum Sex* 2021;30:278–285.
- Harkness A, Weinstein ER, Atuluru P, et al. "Let's hook up when the pandemic is over:" Latinx sexual minority men's sexual behavior during COVID-19. *J Sex Res* 2021;58:951–957. doi: 10.1080/00224499.2021.1888064.
- Nelson KM, Gordon AR, John SA, et al. Physical sex is over for now: Impact of COVID-19 on the well-being and sexual health of adolescent sexual minority males in the U.S. *J Adolesc Heal* 2020;57:756–762.
- Rothmüller B. The grip of pandemic mononormativity in Austria and Germany. *Cult Heal Sex* 2021;23:1573–1590.
- Peters MDJ, Marnie C, Tricco AC, et al. Updated methodological guidance for the conduct of scoping reviews. *JBI Evid Synth* 2020;18:2119–2126.
- Tricco A, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA ScR): Checklist and explanation. *Ann Intern Med* 2018;169:467–473.
- Aromataris E, Munn Z. JBI manual for evidence synthesis. JBI; 2020.
- Mercer CH, Clifton S, Riddell J, et al. Initial Impacts of COVID-19 on sexual behaviour in Britain: Findings

- from a large, quasi-representative survey (Natsal-COVID). *Sex Transm Infect* 2021. doi: [10.2139/ssrn.3862706](https://doi.org/10.2139/ssrn.3862706).
26. Tan RKJ, O'Hara CA, Kumar N. Partnership status, living arrangements, and changes in sexual behaviour and satisfaction during the COVID-19 lockdown: Insights from an observational, cross-sectional online survey in Singapore. *Sex Health* 2021;18:366–377.
 27. Cascalheira CJ, McCormack M, Portch E, et al. Changes in sexual fantasy and solitary sexual practice during social lockdown among young adults in the UK. *Sex Med* 2021;9:100342. doi: [10.1016/j.esxm.2021.100342](https://doi.org/10.1016/j.esxm.2021.100342).
 28. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: [10.1136/bmj.n71](https://doi.org/10.1136/bmj.n71).
 29. Albertella L, Rotaru K, Christensen E, et al. The influence of trait compulsivity and impulsivity on addictive and compulsive behaviors during COVID-19. *Front Psychiatry* 2021;12:634583. doi: [10.3389/fpsy.2021.634583](https://doi.org/10.3389/fpsy.2021.634583).
 30. Amerio A, Lugo A, Bosetti C, et al. Italians do it ... less. Covid-19 lockdown impact on sexual activity: Evidence from a large representative sample of Italian adults. *J Epidemiol* 2021;31:648–652.
 31. Asiamah N, Opuni FF, Mends-Brew E, et al. Short-term changes in behaviors resulting from COVID-19-related social isolation and their influences on mental health in Ghana. *Comm Ment Health J* 2021;57:79–92.
 32. Ballester-Arnal R, Nebot-Garcia JE, Ruiz-Palomino E, et al. "INSIDE" project on sexual health in Spain: Sexual life during the lockdown caused by COVID-19. *Sex Res Soc Policy* 2021;18:1023–1041.
 33. Baran O, Aykac A. The effect of fear of covid-19 transmission on male sexual behaviour: A cross-sectional survey study. *Int J Clin Pract* 2020;00:1–7.
 34. Bhambhani HP, Chen T, Kasman AM, et al. Female sexual function during the COVID-19 pandemic in the United States. *Sex Med* 2021;9:100355. doi: [10.1016/j.esxm.2021.100355](https://doi.org/10.1016/j.esxm.2021.100355).
 35. Bulut EC, Ertas K, Bulut D, et al. The effect of COVID-19 epidemic on the sexual function of healthcare professionals. *Andrologia* 2021;53:e13971. doi: [10.1111/and.13971](https://doi.org/10.1111/and.13971).
 36. Camargo ELS, de Oliveira BIA, Siffoni IF, et al. Low psychological well-being in men who have sex with men (MSM) during the shelter-in-place orders to prevent the COVID-19 spread: Results from a nationwide study. *Sex Res Soc Policy* 2022;19:391–400.
 37. Carvalho J, Campos P, Carrito M, et al. The relationship between COVID-19 confinement, psychological adjustment, and sexual functioning, in a sample of Portuguese men and women. *J Sex Med* 2021;18:1191–1197.
 38. Chen T, Bhambhani HP, Kasman AM, et al. The association of the COVID-19 pandemic on male sexual function in the United States: A survey study of male cannabis users. *Sex Med* 2021;9:100340. doi: [10.1016/j.esxm.2021.100340](https://doi.org/10.1016/j.esxm.2021.100340).
 39. Chone JS, Almeida Lima SVM, Fronteira I, et al. Factors associated with chemsex in Portugal during the COVID-19 pandemic. *Rev Lat Am Enfermagem* 2021;29:e3474.
 40. Cito G, Micelli E, Cocci A, et al. The impact of the COVID-19 quarantine on sexual life in Italy. *Urology* 2021;147:37–42.
 41. Coombe J, Kong FYS, Bittleston H, et al. Love during lockdown: Findings from an online survey examining the impact of COVID-19 on the sexual health of people living in Australia. *Sex Transm Infect* 2021;97:357–362.
 42. Costantini E, Trama F, Villari D, et al. The impact of lockdown on couples' sex lives. *J Clin Med* 2021;10:1414. doi: [10.3390/jcm10071414](https://doi.org/10.3390/jcm10071414).
 43. Craig-Kuhn MC, Schmidt N, Scott G, et al. Changes in sexual behavior related to the COVID-19 stay-at-home orders among young black men who have sex with women in New Orleans, LA. *Sex Transm Dis* 2021;48:589–594.
 44. Culha MG, Demir O, Sahin O, et al. Sexual attitudes of healthcare professionals during the COVID-19 outbreak. *Int J Impot Res* 2021;33:102–109. doi: [10.1038/s41443-020-00381-9](https://doi.org/10.1038/s41443-020-00381-9).
 45. De Rose AF, Chierigo F, et al. Sexuality during COVID lockdown: A cross-sectional Italian study among hospital workers and their relatives. *Int J Impot Res* 2021;33:131–136. doi: [10.1038/s41443-020-00393-5](https://doi.org/10.1038/s41443-020-00393-5).
 46. De Sousa ÁFL, Queiroz AAFLN, Lima SVMA, et al. Chemsex practice among men who have sex with men (MSM) during social isolation from COVID-19: Multicentric online survey. *Cad Saude Publica* 2020;36:e00202420.
 47. de Sousa AFL, de Oliveira LB, Queiroz AAFLN, et al. Casual sex among men who have sex with men (MSM) during the period of sheltering in place to prevent the spread of covid-19. *Int J Environ Res Public Health* 2021;18:1–13.
 48. de Sousa AFL, Lima SVMA, Rocha JV, et al. Sexual exposure to HIV infection during the covid-19 pandemic in men who have sex with men (MSM): A multicentric study. *Int J Environ Res Public Health* 2021;18:9584. doi: [10.3390/ijerph18189584](https://doi.org/10.3390/ijerph18189584).
 49. Dincer B, Yıldırım Ayaz E, Oğuz A. Changes in sexual functions and alexithymia levels of patients with type 2 diabetes during the COVID-19 pandemic. *Sex Disabil* 2021;39:461–478.
 50. Duran MB, Yildirim O, Kizilkan Y, et al. Variations in the number of patients presenting with andrological problems during the coronavirus disease 2019 pandemic and the possible reasons for these variations: A multicenter study. *Sex Med* 2021;9:100292. doi: [10.1016/j.esxm.2020.100292](https://doi.org/10.1016/j.esxm.2020.100292).
 51. Effati-Daryani F, Jahanfar S, Mohammadi A, et al. The relationship between sexual function and mental health in Iranian pregnant women during the COVID-19 pandemic. *BMC Pregn Childbirth* 2021;21:327. doi: [10.1186/s12884-021-03812-7](https://doi.org/10.1186/s12884-021-03812-7).
 52. ESERDAĞ S, YÜCEDAĞ M, ANĞIN AD, et al. Sexual life changes in pregnant women during COVID-19 outbreak. *J Surg Med* 2021;5:597–601.
 53. Fang D, Peng J, Liao S, et al. An online questionnaire survey on the sexual life and sexual function of Chinese adult men during the coronavirus disease 2019 Epidemic. *Sex Med* 2021;9:100293. doi: [10.1016/j.esxm.2020.100293](https://doi.org/10.1016/j.esxm.2020.100293).

54. Feng YJ, Fan YJ, Su ZZ, et al. Correlation of sexual behavior change, family function, and male-female intimacy among adults aged 18-44 years during COVID-19 epidemic. *Sex Med* 2021;9:100301. doi: [10.1016/j.esxm.2020.100301](https://doi.org/10.1016/j.esxm.2020.100301).
55. Firkey MK, Sheinfil AZ, Woolf-King SE. Substance use, sexual behavior, and general well-being of U.S. college students during the COVID-19 pandemic: A brief report. *J Am Coll Health* 2020;1-7. doi: [10.1080/07448481.2020.1869750](https://doi.org/10.1080/07448481.2020.1869750).
56. Fuchs A, Matonóg A, Pilarska J, et al. The impact of COVID-19 on female sexual health. *Int J Environ Res Public Health* 2020;17:7152. doi: [10.3390/ijerph17197152](https://doi.org/10.3390/ijerph17197152).
57. Gabster A, Erausquin JT, Michielsen K, et al. How did COVID-19 measures impact sexual behaviour and access to HIV/STI services in Panama? Results from a national cross-sectional online survey. *Sex Transm Infect* 2021;0:1-9. doi: [10.1136/sextrans-2021-054985](https://doi.org/10.1136/sextrans-2021-054985).
58. Gassó AM, Mueller-Johnson K, et al. Exploring sexting and online sexual victimization during the COVID-19 pandemic lockdown. *Int J Environ Res Public Health* 2021;18:6662. doi: [10.3390/ijerph18126662](https://doi.org/10.3390/ijerph18126662).
59. Gil-Llario MD, Díaz-Rodríguez I, Morell-Mengual V, et al. Sexual health in Spanish people with intellectual disability: The impact of the lockdown due to COVID-19. *Sex Res Soc Policy* 2021;1-11. doi: [10.1007/s13178-021-00621-7](https://doi.org/10.1007/s13178-021-00621-7).
60. Gillespie SM, Jones A, Uzieblo K, et al. Coping using sex during the coronavirus disease 2019 (COVID-19) outbreak in the United Kingdom. *J Sex Med* 2021;18:50-62.
61. 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.
62. Gouvernet B, Bonierbale M. COVID-19 lockdown impact on cognitions and emotions experienced during sexual intercourse. *Sexologies* 2020;30:e9-21.
63. Grover S, Vaishnav M, Tripathi A, et al. Sexual functioning during the lockdown period in India: An online survey. *Indian J Psychiatry* 2021;63:134-141.
64. Grubbs JB, Perry SL, Grant Weinandy JT, et al. Porn-demic? A longitudinal study of pornography use before and during the COVID-19 pandemic in a nationally representative sample of Americans. *Arch Sex Behav* 2022;51:123-137.
65. Gul ZB. Depression and sexual functions in epilepsy patients: Comparison before and during the COVID-19 pandemic. *Ann Med Psychol (Paris)* 2022;180:127-132.
66. Güzel A, Döndü A. Changes in sexual functions and habits of healthcare workers during the ongoing COVID-19 outbreak: A cross-sectional survey study. *Irish J Med Sci* 2021;191:1013-1021.
67. Hammoud MA, Maher L, Holt M, et al. Physical distancing due to COVID-19 disrupts sexual behaviors among gay and bisexual men in Australia: Implications for trends in HIV and other sexually transmissible infections. *J Acquir Immune Defic Syndr* 2020;85:309-315.
68. Hernández-Torres JL, Rodríguez-Vázquez N, Martínez-Cervantes R, et al. Impact of the use of sexual material and online sexual activity during preventive social isolation due to COVID-19. *Salud Ment* 2021;44:185-192.
69. Hille Z, Oezdemir UC, Beier KM, et al. The disruptive impact of the COVID-19 pandemic on sexual behavior of a German-speaking population. *Sexologies* 2021;30:22-33.
70. Holloway IW, Garner A, Tan D, et al. Associations between physical distancing and mental health, sexual health and technology use among gay, bisexual and other men who have sex with men during the COVID-19 pandemic. *J Homosex* 2021;68:692-708.
71. Howarth AR, Saunders J, Reid D, et al. 'Stay at home . . .': exploring the impact of the COVID-19 public health response on sexual behaviour and health service use among men who have sex with men: Findings from a large online survey in the UK. *Sex Transm Infect* 2021;0:1-7. doi: [10.1136/sextrans-2021-055039](https://doi.org/10.1136/sextrans-2021-055039).
72. Hu B, Ruan Y, Liu K, et al. A mid-to-long term comprehensive evaluation of psychological distress and erectile function in COVID-19 recovered patients. *J Sex Med* 2021;18:1863-1871.
73. Hyndman I, Nugent D, Whitlock GG, et al. COVID-19 restrictions and changing sexual behaviours in HIV-negative MSM at high risk of HIV infection in London, UK. *Sex Transm Infect* 2021;97:521-524.
74. Ilgen O, Kurt S, Aydin C, et al. COVID-19 pandemic effect on female sexual function. *Ginekol Pol* 2021;92:856-859. doi: [10.5603/GP.a2021.0084](https://doi.org/10.5603/GP.a2021.0084).
75. Jacob L, Smith L, Butler L, et al. Challenges in the practice of sexual medicine in the time of COVID-19 in the United Kingdom. *J Sex Med* 2020;17:1229-1236.
76. Jongen VW, L Zimmermann HM, Boyd A, et al. Transient changes in preexposure prophylaxis use and daily sexual behavior after the implementation of COVID-19 restrictions among men who have sex with men. *Acquir Immune Defic Syndr*. 2021;87:1111-1118.
77. Karagöz MA, Gül A, Borg C, et al. Influence of COVID-19 pandemic on sexuality: A cross-sectional study among couples in Turkey. *Int J Impot Res* 2020;33:815-823.
78. Karakas LA, Azemi A, Simsek SY, et al. Risk factors for sexual dysfunction in pregnant women during the COVID-19 pandemic. *Int J Gynecol Obstet* 2021;152:226-230. doi: [10.1002/ijgo.13462](https://doi.org/10.1002/ijgo.13462).
79. Karsiyakali N, Sahin Y, Ates HA, et al. Evaluation of the sexual functioning of individuals living in turkey during the COVID-19 pandemic: An internet-based nationwide survey study. *Sex Med* 2021;9:100279. doi: [10.1016/j.esxm.2020.10.007](https://doi.org/10.1016/j.esxm.2020.10.007).
80. Kaya Y, Kaya C, Tahta T, et al. Examination of the effect of COVID-19 on sexual dysfunction in women. *Int J Clin Pract* 2021;75:e13923. doi: [10.1111/ijcp.13923](https://doi.org/10.1111/ijcp.13923).
81. Ko NY, Lu WH, Chen YL, et al. Changes in sex life among people in Taiwan during the covid-19 pandemic: The roles of risk perception, general anxiety, and demographic characteristics. *Int J Environ Res Public Health* 2020;17:1-15. doi: [10.3390/ijerph17165822](https://doi.org/10.3390/ijerph17165822).

82. Kumar M, Mohindra R, Sharma K, et al. The impact of working in a COVID hospital on sexual functioning in male nurses: A study from North India. *Ind Psychiatry J* 2021;30:187.
83. Kusuma AHW, Brodjonegoro SR, Soerohardjo I, et al. Sexual activities during the COVID-19 pandemic in Indonesia. *African J Urol* 2021;27:116. doi: [10.1186/s12301-021-00227-w](https://doi.org/10.1186/s12301-021-00227-w).
84. Lehmler JJ, Garcia JR, Gesselman AN, et al. Less sex, but more sexual diversity: Changes in sexual behavior during the COVID-19 coronavirus pandemic. *Leis Sci* 2021;43:295–304. doi: [10.1080/01490400.2020.1774016](https://doi.org/10.1080/01490400.2020.1774016).
85. Lemenager T, Neissner M, Koopmann A, et al. Covid-19 lockdown restrictions and online media consumption in Germany. *Int J Environ Res Public Health* 2021;18:1–13.
86. López-Bueno R, López-Sánchez GF, Gil-Salmerón A, et al. COVID-19 confinement and sexual activity in Spain: A cross-sectional study. *Int J Environ Res Public Health* 2021;18:2559. doi: [10.3390/ijerph18052559](https://doi.org/10.3390/ijerph18052559).
87. Lorentz MS, Chagas LB, Perez AV, et al. Correlation between depressive symptoms and sexual dysfunction in postpartum women during the COVID-19 pandemic. *Eur J Obstet Gynecol Reprod Biol* 2021;258:162–167.
88. Luetke M, Hensel D, Herbenick D, et al. Romantic relationship conflict due to the COVID-19 pandemic and changes in intimate and sexual behaviors in a nationally representative sample of American adults. *J Sex Marital Ther* 2020;46:747–762.
89. Mahanty C, Kumar R, Mishra BK. Analyses the effects of COVID-19 outbreak on human sexual behaviour using ordinary least-squares based multivariate logistic regression. *Qual Quant* 2021;55:1239–1259. doi: [10.1007/s11135-020-01057-8](https://doi.org/10.1007/s11135-020-01057-8).
90. McKay T, Henne J, Gonzales G, et al. Sexual behavior change among gay and bisexual men during the first COVID-19 pandemic wave in the United States. *Sex Res Soc Policy* 2021;1–15. doi: [10.1007/s13178-021-00625-3](https://doi.org/10.1007/s13178-021-00625-3).
91. Meunier É, Sundelson AE, Tellone S, et al. Willingness to attend sex venues in the context of the COVID-19 pandemic in New York City: Results from an online survey with sexual and gender minority individuals. *J Urban Heal* 2021;98:469–480.
92. Mirzaei N, Jahanian Sadatmahalleh S, Bahri Khomami M, et al. Sexual function, mental health, and quality of life under strain of COVID-19 pandemic in Iranian pregnant and lactating women: A comparative cross-sectional study. *Health Qual Life Outcomes* 2021;19:1–8.
93. Mollaioli D, Sansone A, Ciocca G, et al. Benefits of sexual activity on psychological, relational, and sexual health during the COVID-19 breakout. *J Sex Med* 2021;18:35–49.
94. Mumm J-N, Vilsmaier T, Schuetz JM, et al. How the COVID-19 pandemic affects sexual behavior of hetero-, homo-, and bisexual males in Germany. *Sex Med* 2021;9:100380. doi: [10.1016/j.esxm.2021.100380](https://doi.org/10.1016/j.esxm.2021.100380).
95. Nawaz MU, Rivera E, Vinayak S, et al. Comparison of sexual function before and after COVID-19 infection in female patients. *Cureus* 2021;13:e18156.
96. Neto RP, Nascimento BCG, Carvalho dos Anjos Silva G, et al. Impact of COVID-19 pandemic on the sexual function of health professionals from an epicenter in Brazil. *Sex Med* 2021;9:100408. doi: [10.1016/j.esxm.2021.100408](https://doi.org/10.1016/j.esxm.2021.100408).
97. Oğraş MS, Yildirim K. The relationship of psychogenic erectile dysfunction with coronavirus anxiety in the COVID-19 pandemic period. *Acta Medica Mediterr* 2021;37:2377.
98. Omar SS, Dawood W, Eid N, et al. Psychological and sexual health during the COVID-19 pandemic in Egypt: Are women suffering more? *Sex Med* 2021;9:100295. doi: [10.1016/j.esxm.2020.100295](https://doi.org/10.1016/j.esxm.2020.100295).
99. Osur J, Ileri EM, Esho T. The effect of COVID-19 and its control measures on sexual satisfaction among married couples in Kenya. *Sex Med* 2021;9:100354. doi: [10.1016/j.esxm.2021.100354](https://doi.org/10.1016/j.esxm.2021.100354).
100. Pampati S, Emrick K, Siegler AJ, et al. Changes in sexual behavior, PrEP adherence, and access to sexual health services due to the COVID-19 pandemic among a cohort of PrEP-using MSM in the South. *medRxiv Prepr Serv Heal Sci* 2021;87:639–643.
101. Panzeri M, Ferrucci R, Cozza A, et al. Changes in sexuality and quality of couple relationship during the COVID-19 lockdown. *Front Psychol* 2020;11:565823. doi: [10.3389/fpsyg.2020.565823](https://doi.org/10.3389/fpsyg.2020.565823).
102. Prabowo KA, Ellenzy G, Wijaya MC, et al. Impact of work from home policy during the COVID-19 pandemic on mental health and reproductive health of women in Indonesia. *Int J Sex Heal* 2021. doi: [10.1080/19317611.2021.1928808](https://doi.org/10.1080/19317611.2021.1928808).
103. Reyniers T, Rotsaert A, Thunissen E, et al. Reduced sexual contacts with non-steady partners and less PrEP use among MSM in Belgium during the first weeks of the COVID-19 lockdown: Results of an online survey. *Sex Transm Infect* 2021;97:414–419.
104. Rodrigues DL, Lehmler JJ. COVID-19 and sexual desire: Perceived fear is associated with enhanced relationship functioning. *J Sex Res* 2021;1–10. doi: [10.1080/00224499.2021.1966359](https://doi.org/10.1080/00224499.2021.1966359).
105. Rodríguez-Domínguez C, Lafuente-Bacedoni C, Durán M. Effect of the lockdown due to COVID-19 on sexuality: The mediating role of sexual practices and arousal in the relationship between gender and sexual self-esteem. *Psychol Rep* 2021;332941211028999. doi: [10.1177/00332941211028999](https://doi.org/10.1177/00332941211028999).
106. Rogers BG, Tao J, Darveau SC, et al. The impact of COVID-19 on sexual behavior and psychosocial functioning in a clinical sample of men who have sex with men using HIV pre-exposure prophylaxis. *AIDS Behav* 2022;26:69–75.
107. Rosenberg M, Luetke M, Hensel D, et al. Depression and loneliness during April 2020 COVID-19 restrictions in the United States, and their associations with frequency of social and sexual connections. *Soc Psychiatry Psychiatr Epidemiol* 2021;56:1221–1232. doi: [10.1007/s00127-020-02002-8](https://doi.org/10.1007/s00127-020-02002-8).
108. Roy D, Kar SK, Arafat SMY, et al. Emotional bonding and sexual activity during COVID-19 lockdown: A cross-national pilot study. *J Psychosexual Heal* 2021;3:236–241.
109. Sallie SN, Ritou VJE, Bowden-Jones H, et al. Assessing online gaming and pornography consumption patterns during COVID-19 isolation using an online survey: Highlighting distinct avenues of problematic internet behavior. *Addict Behav* 2021;123:107044. doi: [10.1016/j.addbeh.2021.107044](https://doi.org/10.1016/j.addbeh.2021.107044).

110. Sanchez TH, Zlotorzynska M, Rai M, et al. Characterizing the impact of COVID-19 on men who have sex with men across the United States in April, 2020. *AIDS Behav* 2020;24:2024–2032. doi: [10.1007/s10461-020-02894-2](https://doi.org/10.1007/s10461-020-02894-2).
111. Sansone A, Mollaioli D, Ciocca G, et al. “Mask up to keep it up”: Preliminary evidence of the association between erectile dysfunction and COVID-19. *Andrology* 2021;9:1053–1059.
112. Schiavi MC, Spina V, Zullo MA, et al. Love in the time of COVID-19: Sexual function and quality of life analysis during the social distancing measures in a group of Italian reproductive-age women. *J Sex Med* 2020;17:1407–1413.
113. Shilo G, Mor Z. COVID-19 and the changes in the sexual behavior of men who have sex with men: Results of an online survey. *J Sex Med* 2020;17:1827–1834.
114. Sotiropoulou P, Ferenidou F, Owens D, et al. The impact of social distancing measures due to COVID-19 pandemic on sexual function and relationship quality of couples in Greece. *Sex Med* 2021;9:100364. doi: [10.1016/j.esxm.2021.100364](https://doi.org/10.1016/j.esxm.2021.100364).
115. Starks TJ, Jones SS, Sauermilch D, et al. Evaluating the impact of COVID-19: A cohort comparison study of drug use and risky sexual behavior among sexual minority men in the U.S.A. *Drug Alcohol Depend* 2020;216:108260. doi: [10.1016/j.drugalcdep.2020.108260](https://doi.org/10.1016/j.drugalcdep.2020.108260).
116. Stephenson R, Chavanduka TMD, Rosso MT, et al. Sex in the time of COVID-19: results of an online survey of gay, bisexual and other men who have sex with men’s experience of sex and HIV prevention during the US COVID-19 epidemic. *AIDS Behav* 2021;25:40–48.
117. Suen YT, Chan RCH, Wong EMY. To have or not to have sex? COVID-19 and sexual activity among Chinese-speaking gay and bisexual men in Hong Kong. *J Sex Med* 2021;18:29–34.
118. Szuster E, Kostrzewska P, Pawlikowska A, et al. Mental and sexual health of polish women of reproductive age during the COVID-19 pandemic – An online survey. *Sex Med* 2021;9:100367. doi: [10.1016/j.esxm.2021.100367](https://doi.org/10.1016/j.esxm.2021.100367).
119. Mitchell KR, Shimonovich M, Bosó Pérez R, et al. Initial impacts of COVID-19 on sex life and relationship quality in steady relationships in Britain: Findings from a large, quasi-representative survey (Natsal-COVID). *SSRN Electron J* 2021:1–12. doi: [10.1080/00224499.2022.2035663](https://doi.org/10.1080/00224499.2022.2035663). E-pub ahead of print.
120. Tribowo JA, Tanojo TD, Supardi S, et al. The impact of the coronavirus disease-19 pandemic on sexual behavior of marriage people in Indonesia. *Open Access Maced J Med Sci* 2021;9:440–445.
121. Gungor Ugurlucan F, Yasa C, Ates Tikiz M, et al. Effect of the COVID-19 pandemic and social distancing measures on the sexual functions of women treated for vaginismus (genitopelvic pain/penetration disorder). *Int Urogynecol J* 2021;32:1265–1271. doi: [10.1007/s00192-020-04667-w](https://doi.org/10.1007/s00192-020-04667-w).
122. Van Bilsen WPH, Zimmermann HML, et al. Sexual behavior and its determinants during covid-19 restrictions among men who have sex with men in Amsterdam. *J Acquir Immune Defic Syndr* 2021;86:288–296.
123. Walsh AR, Stephenson R. Positive and negative impacts of the COVID-19 pandemic on relationship satisfaction in male couples. *Am J Mens Health* 2021;15:1–14.
124. Walsh AR, Sullivan S, Stephenson R. Are male couples changing their sexual agreements and behaviors during the COVID-19 pandemic? *AIDS Behav* 2021;25:3798–3803.
125. Yarger J, Gutmann-Gonzalez A, Han S, et al. Young people’s romantic relationships and sexual activity before and during the COVID-19 pandemic. *BMC Public Health* 2021;21:1780. doi: [10.1186/s12889-021-11818-1](https://doi.org/10.1186/s12889-021-11818-1).
126. Yuksel B, Ozgor F. Effect of the COVID-19 pandemic on female sexual behavior. *Int J Gynecol Obstet* 2020;150:98–102. doi: [10.1002/ijgo.13193](https://doi.org/10.1002/ijgo.13193).
127. Zamboni L, Carli S, Marika B, et al. COVID-19 lockdown: Impact on online gambling, online shopping, web navigation and online pornography. *J Public Health Res* 2021;10:1759. doi: [10.4081/jphr.2021.1759](https://doi.org/10.4081/jphr.2021.1759).
128. Zhang Y, Wen C, Zhang Y, et al. The impact of mental health and stress concerns on relationship and sexuality amidst the COVID-19 Lockdown. *J Sex Med* 2021;18:1843–1850.
129. Özlü İ, Özlü ZK, Kiliç T, et al. Was the quality of sexual life affected during the COVID-19 pandemic? *Am J Fam Ther* 2021. doi: [10.1080/01926187.2021.1941418](https://doi.org/10.1080/01926187.2021.1941418). E-pub ahead of print.
130. Li W, Li G, Xin C, et al. Challenges in the practice of sexual medicine in the time of COVID-19 in China. *J Sex Med* 2020;17:1225–1228.
131. Wignall L, Portch E, McCormack M, et al. Changes in sexual desire and behaviors among UK young adults during social lockdown Due to COVID-19. *J Sex Res* 2021;58:976–985.
132. Sansone A, Mollaioli D, Cignarelli A, et al. Male sexual health and sexual behaviors during the first national COVID-19 lockdown in a Western Country: A real-life, web-based study. *Sexes* 2021;2:293–304.
133. Pornhub. Coronavirus update [Internet]. 2020. Available at: <https://www.pornhub.com/insights/coronavirus-update-april-14>. Accessed 20 March, 2022.
134. Zattoni F, Gül M, Soligo M, et al. The impact of COVID-19 pandemic on pornography habits: A global analysis of google trends. *Int J Impot Res* 2020;33:824–831.
135. Hald GM. Gender differences in pornography consumption among young heterosexual Danish adults. *Arch Sex Behav* 2006;35:577–585.
136. Traeger MW, Schroeder SE, Wright EJ, et al. Effects of pre-exposure prophylaxis for the prevention of human immunodeficiency virus infection on sexual risk behavior in men who have sex with men: A systematic review and meta-analysis. *Clin Infect Dis* 2018;67:676–686.
137. McCabe MP, Sharlip ID, Lewis R, et al. Risk factors for sexual dysfunction among women and men: A consensus statement from the fourth international consultation on sexual medicine 2015. *J Sex Med* 2016;13:153–167.
138. Eplöv L, Girdali A, Davidsen M, et al. Sexual desire in a nationally representative Danish population. *J Sex Med* 2007;4:47–56.

139. Brotto L, Atallah S, Johnson-Agbakwu C, et al. Psychological and interpersonal dimensions of sexual function and dysfunction. *J Sex Med* 2016;13:538–571. doi: 10.1016/j.jsxm.2016.01.019.
140. Bodenmann G, Ledermann T, Blattner D, et al. Associations among everyday stress, critical life events, and sexual problems. *J Nerv Ment Dis* 2006;194:494–501.
141. McCabe MP, Connaughton C. Sexual dysfunction and relationship stress: How does this association vary for men and women? *Curr Opin Psychol* 2017;13:81–84.
142. Johannes CB, Clayton AH, Odom DM, et al. Distressing sexual problems in United States women revisited: Prevalence after accounting for depression. *J Clin Psychiatry* 2009;70:1698–1706.
143. Laurent SM, Simons AD. Sexual dysfunction in depression and anxiety: Conceptualizing sexual dysfunction as part of an internalizing dimension. *Clin Psychol Rev* 2009;29:573–585.
144. Osborn M, Hawton K, Gath D. Sexual dysfunction among middle aged women in the community. *Br Med J (Clin Res Ed)* 1988;296:959–962.
145. McCabe MP. Intimacy and quality of life among sexually dysfunctional men and women. *J Sex Marital Ther* 1997;23:276–290.
146. Mollaioli D, Ciocca G, Limoncin E, et al. Lifestyles and sexuality in men and women: The gender perspective in sexual medicine. *Reprod Biol Endocrinol* 2020;18:10. doi: 10.1186/s12958-019-0557-9.
147. Sansone A, Mollaioli D, Limoncin E, et al. The sexual long COVID (SLC): Erectile dysfunction as a biomarker of systemic complications for COVID-19 long haulers. *Sex Med Rev* 2022;10:271–285.
148. Elvén M, Kerstis B, Stier J, et al. Changes in physical activity and sedentary behavior before and during the COVID-19 pandemic: A Swedish population study. *Int J Environ Res Public Health* 2022;19:2558. doi: 10.3390/ijerph19052558.
149. Gerbild H, Larsen CM, Graugaard C, et al. Physical activity to improve erectile function: A systematic review of intervention Studies *Sex Med* 2018;6:75–89.
150. Fergus KB, Gaither TW, Baradaran N, et al. Exercise improves self-reported sexual function among physically active adults *J Sex Med* 2019;16:1236–1245.
151. Maseroli E, Rastrelli G, Di Stasi V, et al. Physical Activity and female sexual dysfunction: A lot helps, but not too much. *J Sex Med* 2021;18:1217–1229.
152. Dosch A, Rochat L, Ghisletta P, et al. Psychological factors involved in sexual desire, sexual activity, and sexual satisfaction: A multi-factorial perspective. *Arch Sex Behav* 2016;45:2029–2045. doi: 10.1007/s10508-014-0467-z.
153. Jung S, Kneer J, Krüger THC. Mental health, sense of coherence, and interpersonal violence during the covid-19 pandemic lockdown in Germany. *J Clin Med* 2020;9:1–12.
154. Basson R, Rees P, Wang R, et al. Sexual function in chronic illness. *J Sex Med* 2010;7:374–388. doi: 10.1111/j.1743-6109.2009.01621.x.
155. Graugaard C. Sexuality as a health-promoting factor-theoretical and clinical considerations. *Nat Rev Urol* 2017;14:577–578.
156. Killgore WDS. Psychological resilience during the COVID-19 lockdown. *Psychiatry Res* 2020;291:1–2.
157. World Health Organization. Defining sexual health Sexual health document series. Geneva: WHO Publ; 2006. p. 1–35.
158. Räuchle J, Briken P, Schröder J, et al. Sexual and reproductive health during the COVID-19 pandemic: Results from a cross-sectional online survey in Germany. *Int J Environ Res Public Health* 2022;19:1428. doi: 10.3390/ijerph19031428.
159. Kaukinen C. When stay-at-home orders leave victims unsafe at home: Exploring the risk and consequences of intimate partner violence during the COVID-19 pandemic. *Am J Crim Justice* 2020;45:668–679.
160. Ditekemena JD, Luhata C, Mavoko HM, et al. Intimate partners violence against women during a covid-19 lockdown period: Results of an online survey in 7 provinces of the Democratic Republic of Congo. *Int J Environ Res Public Health* 2021;18:5108.
161. Wittgens C, Fischer MM, Buspavanich P, et al. Mental health in people with minority sexual orientations: A meta-analysis of population-based studies. *Acta Psychiatr Scand* 2022;145:357–372.
162. Jarrett BA, Peitzmeier SM, Restar A, et al. Gender-affirming care, mental health, and economic stability in the time of COVID-19: A multi-national, cross-sectional study of transgender and nonbinary people. *PLoS One* 2021;16:1–17. doi: 10.1371/journal.pone.0254215.
163. Hawke LD, Hayes E, Darnay K, et al. Mental health among transgender and gender diverse youth: An exploration of effects during the COVID-19 pandemic. *Psychol Sex Orientat Gen Divers* 2021;8:180–187.
164. Parola A, Rossi A, Tessitore F, et al. Mental health through the COVID-19 Quarantine: A growth curve analysis on Italian young adults. *Front Psychol* 2020;11:567484. doi: 10.3389/fpsyg.2020.567484.
165. Hall SS, Zygmunt E. “I hate it here”: Mental health changes of college students living with parents during the COVID-19 quarantine. *Emerg Adulthood* 2021;9:449–461.
166. Hsieh TC, Edwards NC, Bhattacharyya SK, et al. The epidemic of COVID-19-related erectile dysfunction: A scoping review and health care perspective. *Sex Med Rev* 2022;10:286–310.
167. Natsal-COVID. Natsal-COVID study [Internet]. 2021. Available at: <https://www.natsal.ac.uk/natsal-covid-study>. Accessed 21 March, 2022.
168. I-SHARE (International Sexual Health And REproductive Health) survey [Internet]. Available at: <https://ishare.web.unc.edu/>. Accessed 21 March, 2022.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jsxm.2022.06.005.