Original Research Article

University Students' Condom Use During the COVID-19 Pandemic: Cross-Cultural Differences and What Predict Them

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Abstract

Humans instinctively adopt methods to reduce their risk of encountering harmful pathogens, yet their adherence to preventive health practices can often be erratic. Condoms exemplify one vital preventive tool against sexually transmitted infections (STIs) that, despite their effectiveness, are not consistently utilized. This pattern of behavior appears to persist even during periods of widespread disease transmission, with varied data from the COVID-19 pandemic indicating that condom usage remained inconsistent. The present study aimed to clarify these inconsistencies by examining changes in condom use cross-culturally. Heterosexual participants who were sexually active (N = 3,972 [1,327 men, 2,645 women], M_{age} = 22.82) across 18 countries were asked about their condom use prior to the pandemic, then about their current use. Results revealed a significant decline in Australia, Canada, Portugal, Vietnam, Uganda, and Taiwan. Vaccination percentage and lockdown stringency were associated with this decline cross-culturally. These findings continue to add concerns about the spread of STIs among young people during the pandemic.

Keywords

condoms, COVID-19, sexually transmitted infections, sexual health

The continued proliferation of sexually transmitted infections (STIs) remains a global concern. The World Health Organization (WHO, 2022) estimates that one million STIs are newly acquired each day. A significant amount of new cases are attributed to asymptomatic spread (Mayaud & Mabey, 2004). Consistent condom use is subsequently highly recommended by the WHO (2022), as condoms are the most effective tool for preventing STIs when used correctly (Holmes et al., 2004). Despite decades of messaging about the benefits of condom use (Frew et al., 2013), STI infection rates have increased over the past decade, suggesting condoms are not used adequately or frequently enough.

Young people—those in late adolescence to early twenties—are of a primary concern, as the rise in STIs is most pronounced in this age group (Shannon & Klausner, 2018). Condom use is highly inconsistent among young people (WHO, 2022), leading to this age group accounting for half of total STIs annually (Wolfers et al., 2011). Condoms have the benefit of warding against both STIs and unwanted pregnancies; however, young people are more concerned about pregnancy than STIs (Milhausen et al., 2013), and they have a strong preference for hormonal contraception, rather than barrier methods of contraception (e.g., condoms: O'Sullivan et al., 2010). Young people's poor knowledge of STIs (Carrotte et al., 2016; Milhausen et al., 2013) and sense of invulnerability to STIs (Pollack et al., 2013; Wolfers et al., 2011) allow them to underestimate

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the harmful impact of STIs, promoting condomless sex. Indeed, young people are so unconcerned with STIs that they often delay seeking treatment even when aware of possible exposure (Malek et al., 2013). With these factors in mind, it is unsurprising that, in practice, only 41.5% of young women and 26.7% of young men report always using a condom during casual sex (Copen, 2017). Such a pattern is concerning when young people tend to have more sexual partners during this period of their life (Westerman et al., 2021). Low condom use and more sexual partners then allows STIs to disproportionately spread among this age group.

The advent of the COVID-19 pandemic, and its related lockdowns particularly, has further complicated STI spread among young people. After the introduction of lockdown conditions, STI clinics observed a significant drop in daily patients (Ogunbodede et al., 2021; Tao et al., 2021). However, even months after lockdown conditions ended, global STI testing rates have not returned to pre-pandemic levels (Chow et al., 2021; Sentís et al., 2021). Despite these low STI rates, young people still engaged in penetrative sex with non-cohabiting partners, even when social distancing measures were in place (Ballester-Arnal et al., 2021; Gillespie et al., 2021; Herbenick et al., 2022). Given young people's already inconsistent condom use and the increased difficulty of access to condoms during lockdowns (Herbenick et al., 2022; Lewis et al., 2021), the pandemic likely disrupted condom use further, propagating STI spread. Therefore, the current incidence of STIs is likely severely underreported.

Inconsistent condom use has been primarily attributed to young people disregarding the threat of STIs (Wolfers et al., 2011). However, the COVID-19 pandemic might have made pathogens more salient to young people, which may alter their perception of STIs and their condom use in unexpected directions. The Behavioral Immune System (BIS) theory posits that humans have evolutionarily acquired behavioral defenses to novel diseases, which are activated when the presence of illness is especially salient (Schaller et al., 2015). Experimental evidence has demonstrated that people think and act differently when the threat of a novel infection is psychologically induced (e.g., by displaying disease-related behaviors, such as sneezing: Schaller, 2011; Schaller et al., 2015). Pathogen threat has generally been mitigated by the advancement of antibiotics and other easily accessible medical treatments (Schaller et al., 2022); young people's blasé approach to condom use and appropriate STI treatment (Nguyen et al., 2019) reflects their perception that the threat from STIs is minimal and/or manageable. Prior to the development of a vaccine, COVID-19 posed a threat without treatment or prevention, dramatically increasing the salience of pathogen threat, exacerbated by the high degree of media attention COVID-19 received (Bridgman et al., 2021). In turn, this higher pathogen threat may impact a range of disease-preventive measures, including condom use. Indeed, one study has found people increase their intention to use condoms after being experimentally exposed to a pathogen prime (Tybur et al., 2011). If COVID-19 has had the expected impact on awareness of disease threat, it could have influenced attitudes toward condom use, potentially encouraging more precautionary sexual behaviors.

In line with this reasoning, an infodemiological study found the expected pattern across 102 countries—when there was a higher level of COVID-19 related concerns online (e.g., on social media) in a given week, condom-related Google searches significantly increased in comparison to the previous week (Ma & Ye, 2021). Research into actual sexual behaviors among men who have sex with men (MSM) also provided some support for the BIS. In Israel, MSM were more likely to use condoms after the spread of COVID-19 (Shilo & Mor, 2020). MSM in America also reported a decline in condomless anal sex during the pandemic (Starks et al., 2020). As such, there is some evidence of the expected increase in condom use following pathogenic threat from COVID-19, as posited by the BIS theory.

However, studies among heterosexual people specifically are not in line with MSM-related research, suggesting that heterosexual condom use has declined during the pandemic. A quantitative Australian study found a decline in condom use among young people in lockdown, and this

decline was more marked among single people than coupled (Dacosta et al., 2021). A qualitative Australian study further supported this, wherein participants reported being more concerned about possible COVID-19 exposure than STI spread, resulting in irregular condom use (Okeke, 2022). Unpartnered college students in an American study also reported a significant decline in condom use, although this was collated across sexual orientation groups, the sample was predominately heterosexual (Herbenick et al., 2022). A similar trend was observed in the United Kingdom, where a quarter of young people surveyed reported a significant decline in access and use of condoms during lockdown (Lewis et al., 2021). However, increases of condom use among MSM, and decreases among heterosexual people, are not consistent across all research—stable condom use has been found among American MSM (Sanchez et al., 2020) and young heterosexuals (Firkey et al., 2022). As it stands, there is not a clear pattern of condom use during the COVID-19 pandemic, even when limiting to a sole sexual orientation group. As such, the current studies seek to explore changes in condom use across time and countries among heterosexual populations to disentangle this conflicting research.

Factors Associated With Changes in Condom Use

By conducting research on condom use across countries, the present study also aims to explore potential cross-cultural factors that may contribute to changes in condom use. Historical prevalence of disease is an index of pathogen pervasiveness over the past eighty years (Murray & Schaller, 2010), which can be used to uncover how disease prevalence impacts different cultures. This index has been utilized to explain cross-cultural reactions to COVID-19 during the pandemic. One study found that this index can partly account for how different regions reacted to COVID-19—regions with higher historical prevalence of disease predicted faster and tighter COVID-19 restrictions by governments, and predicted population adherence to these restrictions (Lu et al., 2021). Historical prevalence of disease has also been linked to sexual behaviors across regions—people in areas with a higher prevalence of disease have a higher preference for physically attractive partners (Gangestad & Buss, 1993), as people cognitively infer positive health outcomes from physical attractiveness (Gangestad et al., 2006). Given that this index has been linked to both the COVID-19 pandemic and sexual behaviors, it is possible that higher prevalence of disease be associated with an increase in condom use. Specifically, people in regions with a higher prevalence of disease may be more sensitive to activation of pathogen concerns (e.g., in the form of COVID-19 typical news cycles) which translate to other domains of health-protective behavior (e.g., condom use).

Second, the effect of stringent and prolonged lockdowns on sexual behaviors cannot be ignored. Early evidence indicates that lockdowns inadvertently promote a range of unhealthy behaviors. When faced with stricter lockdowns, young people report an increase in alcohol intake (among both casual and binge drinkers; Niedzwiedz et al., 2021), increased tobacco and e-cigarette smoking, and poorer dietary choices (Naughton et al., 2021), significantly less time spent exercising, and poorer sleep quality (Czenczek-Lewandowska et al., 2021). In line with such a reduction in non-COVID-19-related health behavior, it is possible that lockdowns may also inadvertently promote unhealthy sexual behaviors, including condomless sex. Some research also indicates that young people in stricter lockdowns were seeking casual sex among their existing social groups (e.g., friends, acquaintances, previous sexual partners), rather than strangers (Herbenick et al., 2022). Casual sex with known partners, compared to strangers, was a predictor of lower condom use prior to the pandemic (Choi et al., 2016; Cooper & Orcutt, 2000; Macaluso et al., 2000; Parks et al., 2011). More severe lockdowns may then promote the unhealthy behavior of condomless sex, further exacerbated by young people having sex with known partners than strangers in lockdowns.

Finally, pre-occupation with the threat of COVID-19 may result in a lack of attenuation toward the threat of STIs. A core component of the Behavioral Immune System is detection of immediate pathogen threat (Rachman, 2016; Schaller & Park, 2011). The proliferation of COVID-19 globally, being in COVID-19-related lockdown, and the associated media coverage likely activated behavioral responses to pathogens, increasing avoidance of potential sources of COVID-19. However, this may not necessarily translate to increased behavioral responses in other domains. Condom use is a known behavioral response to STIs (Ma & Ye, 2021; Tybur et al., 2011) but likely does not overlap with the behaviors promoted by threat of COVID-19 (e.g., mask wearing, hand washing). As such, a strong focus with COVID-19 may diminish the perceived threat of other pathogens, including STIs. This theme was noted among Australian participants who reported being less concerned with STIs than COVID-19, resulting in less motivation to use condoms (Okeke, 2022). Vaccination rate across different regions may partially indicate how threatening COVID-19 is perceived to be in a given region, as receiving vaccination is the dominant protection against new pathogens in modern society (Schaller et al., 2022). As such, increased uptake of vaccinations may be negatively associated with condom use by indicating cognitively preoccupation with COVID-19 at the cost of attention to the threat of other pathogens, or a sense of security following vaccination, which may reduce overall health-related vigilance.

Overall, the present study sought to explore changes in heterosexual condom use cross-temporally and cross-culturally during the COVID-19 pandemic. Previous research on this topic has yielded inconsistent findings, with some studies suggesting increased condom use due to heightened awareness of disease transmission (e.g., Shilo & Mor, 2020; Starks et al., 2020), while others report a decline, particularly among heterosexual individuals (e.g., Dacosta et al., 2021; Herbenick et al., 2022). However, these studies often focus on single-country samples and fail to account for notable contextual factors such as lockdown stringency and vaccination rates. Given these gaps, the present study sought to examine whether condom use changed among heterosexual participants during the pandemic, and whether certain cross-cultural factors (i.e., historical prevalence of disease, lockdown stringency, and vaccination rates) are associated with these potential changes. Despite disagreement over the direction of change internationally, we expect condom use to decline on average, given previous findings among other heterosexual samples (Hypothesis 1) (Dacosta et al., 2021; Herbenick et al., 2022; Lewis et al., 2022; Okeke, 2022). It was also expected that an overall decline will be predicted by historical prevalence of disease, stringency of lockdown conditions, and total vaccination percentages—specifically, it was expected that each of these would correlate with declines in condom use (Hypothesis 2).

Method

Participants

Participants were recruited from universities across 18 different countries. An initial sample of 12,131 participants took part in the survey, of which 11,041 were complete and valid. Non-heterosexual participants ($n = 1{,}777$; 16.21%) were removed for two reasons. First, reasons to, or even the need for, condom usage varies substantially across sexual orientation groups (Sarkar, 2008). Second, homosexual men's condom use would be of noteworthy investigation, as discussed above, but there was only an average of 13 homosexual men per country. Non-sexually active participants were also removed, leaving a final sample of 3972 ($M_{age} = 21.80$; $SD = 6.47$). At the time of survey completion, most participants reported being single (55.5%) – 37.7% were in a relationship, 6.8% were married or in a de facto relationship, 0.6% were separated or divorced, and 0.1% were widowed. The demographic breakdown for each country is reported in

Table 1. Among those in a relationship, 29.59% had been together for less than one year, 30.96% for one to two years, and 39.29% for three years or more.

Materials

Items were translated from English in countries where any language other than English was the primary language used for instruction in local universities using the back translation method (i.e., items were translated by a native speaker to the relevant regional language, then back to English, to ensure validity). These native speakers were academics who were involved with the current research. Items were translated to Portuguese, Spanish (European and Latin American dialects), Slovak, Serbian, Chinese, Thai, Vietnamese, Hungarian, and Lithuanian, for their respective countries. The items were not piloted before use in the current study.

Demographics. Participants reported their age, gender, sexual orientation identity, and relationship status.

Condom Use. A single item capturing the use of condoms "before COVID-19" and "after COVID-19" was included. Both items read "How frequently do you engage in the following behaviors: Using a condom during penetrative sex," rated on a 7-point scale from 1 (*Never*) to 7 (*Very frequently/Almost always*).

Sexual Frequency. Two items assessing frequency of penetrative intercourse "before COVID-19" and "during COVID-19" were included. The items read "How often did you and your partner engage in the following behaviours: Sexual intercourse with vaginal penetration" and "Sexual intercourse with anal penetration." Both items were rated on a 7-point scale that read 1 (*Not at all*), 2 (*Once or twice*), 3 (*Once a week*), 4 (*2–3 times a week*), 5 (*4–5 times a week*), 6 (*Once a day*), 7 (*More than once a day*).

Historical Prevalence of Disease Index. A measure of historical prevalence of disease was obtained from Murray and Schaller (2010), who assessed the prevalence of nine disease-causing pathogens (leishmania, schistosoma, trypanosoma, leprosy, malaria, typhus, filaria, dengue, and tuberculosis) across 230 regions worldwide. A score of zero on this index is representative of the mean. Positive scores indicate disease prevalence that is higher than average, and negative scores indicate disease prevalence below the mean.

COVID-19 Stay-at-Home Restrictions Index. A measure of government policy on stay-at-home orders and household lockdowns was obtained from Our World in Data (https://ourworldindata.org/covid-stay-home-restrictions) at the corresponding dates of data collection per country. Each country's lockdown severity was sorted into one of four categories: no measures in place, recommended to not leave the house, required to not leave the house with exceptions (e.g., for exercise or grocery shopping), and required to not leave the house with minimal exceptions (e.g., only allowed to leave once every few days). Full details on how these categories were calculated can be accessed at https://ourworldindata.org/covid-stay-home-restrictions.

COVID-19 Vaccination. A percentage of COVID-19-vaccinated people for each country was obtained from Our World in Data (https://ourworldindata.org/covid-vaccinations). The percentage used in this study was calibrated to mid-2021, when data collection across all countries was finished.

Table 1. Sample Demographics and Data Collection Information.

				Exclusion characteristics		Final sample characteristics			
Country	*N*	Collection start	Collection end	Sexually inactive	Non-heterosexual	*n (included)*	Mean age (*SD*)	Single / coupled	Male / female/ other
Netherlands	285	7 November 2020	22nd December 2020	46	46	190	27.46 (10.91)	62/128	60/130/0
Hong Kong	274	7th September 2020	19th November 2020	192	51	63	19.98 (0.91)	20/43	12/51/0
Thailand	953	9th February 2021	12th March 2021	803	167	106	20.75 (1.42)	69/37	42/56/8
Canada	1083	23rd September 2020	15th March 2021	376	199	484	22.16 (4.90)	149/335	98/386/0
Portugal	464	30th October 2020	31st December 2020	143	62	259	26.43 (10.27)	87/172	92/166/0
Hungary	194	12th November 2020	27th November 2020	38	49	119	39.65 (10.69)	25/94	47/70/2
United Kingdom	300	15th October 2020	27th November 2020	105	61	154	20.92 (4.38)	71/83	29/125/0
Lithuania	187	8th October 2020	21st April 2021	64	35	111	24.09 (6.25)	11/90	13/88/0
Philippines	211	1st August 2020	17th April 2021	169	39	30	26.30 (8.45)	10/20	11/19/0
Serbia	646	17th February 2021	30th April 2021	192	60	389	25.00 (7.86)	134/255	176/212/1
Vietnam	3,361	1st April 2021	17th April 2021	2,659	460	547	19.93 (1.80)	177/370	153/386/7
Uganda	403	January 2021[a]	March 2021[a]	93	98	233	n/a[b]	54/179	164/68/1
Croatia	190	12th May 2021	31st May 2021	66	29	102	27.63 (10.22)	8/94	36/66/0
United States[c]	1,348	12th September 2020	6th May 2021	519	146	712	19.46 (3.18)	348/364	231/480/1
Spain	433	28th April 2021	19th May 2021	136	171	171	23.24 (5.77)	55/116	44/126/1
Colombia	232	12th May 2021	30th May 2021	96	34	110	23.77 (5.99)	37/73	38/72/0
Taiwan	186	16th April 2021	18th June 2021	112	32	63	31.22 (9.30)	10/53	15/48/0
Australia	291	23rd October 2020	3rd December 2020	129	32	129	20.62 (3.26)	59/70	57/72/0

[a]Dates are not available as surveys were distributed via paper format. [b] Age was collected in groups—specifically, there were 64 participants aged 18–22, 152 aged 23–27, 70 aged 28–32, 44 aged 33–37, 29 aged 38–42, and 44 over the age of 44. [c] Samples were collected across 4 states: Iowa ($n = 223$), Texas, ($n = 276$), Louisiana ($n = 326$), and Tennessee ($n = 523$)

Procedure

The Australian authors invited international colleagues from tertiary institutes to participate in a cross-cultural study about the impacts of the COVID-19 pandemic on dating, sexual, and relationship-related behaviors. A core questionnaire was approved by the ethics committee at The University of Sydney (approval number: 2020/312), and online survey links were distributed to students in each country. The survey was translated to respective languages when the language of instruction at each given institution was not English—specifically, in Portugal, Spain, Colombia, Slovakia, Serbia, Taiwan, Thailand, Vietnam, Hungary, and Lithuania.

Participants were informed of the goal of the study and provided with the contact details for the academics responsible for data collection in their corresponding country, before providing their consent. As part of this larger study, participants were asked to rate their condom use "before COVID-19," and then "during COVID-19," on the same page. They were instructed to answer identically if they did not believe the behavior had changed. The survey took approximately 30 minutes to complete.

It is important to note that data collection occurred at different times across countries, which could have influenced responses based on evolving perceptions of COVID-19 risk. To account for this, lockdown stringency was included as a predictor, given that it reflects the stage of the pandemic in each country at the time of data collection.

Analyses

A series of mixed method 2 (Relationship status—between participants: Single vs. Coupled) x 2 (Time of condom use—within participants: Before COVID-19 vs. During COVID-19) ANCOVAs were used to examine changes in condom use. Vaginal and anal intercourse items were totalled to create a composite variable to account for frequency of penetrative intercourse, both "before COVID-19" and "during COVID-19." A difference score was then created to account for changes in sexual frequency, such that negative scores indicated an increase while positive scores indicated a decrease. Change in sexual frequency was also included as a covariate. Responses from Ugandan participants were also excluded from the correlational analyses due to difficulties accessing vaccination in Uganda (Echoru et al., 2021) which undermines the interpretation of the variable as an indication of heightened concern with COVID-19.

A key assumption of ANCOVA is the homogeneity of regression slopes, where the relationship between the covariate and the dependent variable is consistent across groups. To test this, we examined whether the correlation between change in sexual frequency (covariate) and change in condom use (dependent variable) differed significantly across groups (relationship status, and before vs. during COVID-19) within each country. Significant differences indicate a violation of this assumption.

Results

In most countries, the correlation between sexual frequency change and condom use change did not differ significantly across groups. The two exceptions were Hong Kong and Hungary, where significant group differences were observed. As ANCOVA is not validly interpreted under such conditions, these two countries were excluded from the primary analyses.

Overall, participants reported modest condom use before the onset of the pandemic. Partially supporting Hypothesis 1, participants in Australia, Canada, Portugal, Vietnam, Uganda, and Taiwan reported a significant decline during the COVID-19 outbreak. Results from these analyses are displayed in Table 2. The effects in these countries were not moderated by single versus coupled people. Notably, results from the Australian data partially replicated a decline in condom use from a previous Australian study (Dacosta et al., 2021). Participants in all other countries did not report a significant change to their condom use (see Table 3). Further, participants in all

Table 2. Analysis of Covariance (ANCOVAs) for Changes in Condom Use Per Country.

	Single		Coupled								
Country	*M* "before COVID" (*SD*)	*M* "during COVID" (*SD*)	*M* "before COVID" (*SD*)	*M* "during COVID" (*SD*)	*F (single + coupled)*	*df*	*p*	Cohen's *d*	HPDI[a]	Lockdown severity[b]	Vaccination %
Netherlands	4.34 (2.47)	4.43 (2.44)	2.20 (2.09)	1.87 (1.76)	1.367	1, 187	.244	.064	−0.87	1	70.7
Hong Kong	4.80 (2.22)	4.10 (2.49)	5.14 (2.53)	5.25 (2.49)	6.348	1, 60	.423	.071	0.27	1	64.8
Thailand	4.92 (2.12)	4.77 (2.26)	4.61 (2.32)	4.63 (2.35)	0.014	1, 103	.905	.076	0.64	1	69.4
Canada	4.01 (2.44)	3.61 (2.53)	3.75 (2.60)	3.26 (2.61)	19.537	1, 481	<.001	.116	−1.31	2	79.8
Portugal	4.28 (2.49)	4.18 (2.47)	3.22 (4.44)	2.87 (2.35)	4.257	1, 256	.040	.117	0.47	2	89.4
Hungary	4.56 (2.00)	4.42 (2.66)	3.36 (2.60)	3.08 (2.65)	1.729	1, 116	.191	.115	−1.00	2	62.7
United Kingdom	4.45 (2.44)	4.08 (2.67)	3.27 (2.55)	3.11 (2.54)	3.405	1, 151	.067	.073	−1.01	1	72.3
Lithuania	5.27 (2.45)	4.64 (2.91)	4.22 (2.69)	4.01 (2.77)	1.190	1, 98	.278	.106	−0.75	2	66.7
The Philippines	2.60 (2.01)	1.80 (1.88)	2.50 (2.42)	2.40 (2.26)	0.142	1, 27	.709	.158	0.50	2	54.6
Serbia	4.49 (2.25)	4.32 (2.38)	3.44 (2.42)	3.37 (2.45)	2.253	1, 386	.134	.058	−0.23	1	47.0
Vietnam	4.30 (2.54)	3.83 (2.59)	4.37 (2.51)	3.93 (2.66)	16.306	1, 544	<.001	.146	0.61	1	73.9
Uganda	4.74 (1.49)	4.04 (1.69)	4.06 (2.23)	3.63 (2.14)	14.610	1, 230	<.001	.221	1.05	2	4.40
Croatia	5.63 (2.00)	5.63 (2.07)	4.60 (2.50)	4.41 (2.61)	0.326	1, 99	.596	.076	−0.44	0	54.7
United States	4.57 (2.42)	4.55 (2.38)	3.70 (2.50)	3.66 (2.55)	0.273	1, 709	.602	.042	−0.89	1	64.3
Spain	5.25 (2.33)	5.72 (1.98)	4.52 (2.62)	4.46 (2.66)	2.432	1, 168	.121	.083	−0.05	2	80.9
Colombia	4.69 (2.33)	4.62 (2.68)	3.62 (2.45)	2.96 (2.50)	3.602	1, 107	.060	.171	0.27	2	63.0
Taiwan	5.80 (1.99)	4.90 (2.77)	4.15 (2.68)	3.94 (2.74)	4.703	1, 60	.034	.154	0.30	3	74.0
Australia	4.91 (2.17)	4.64 (2.52)	4.66 (2.37)	4.07 (2.44)	7.697	1, 125	.006	.136	−0.25	1	94.1
Total	4.54 (2.36)	4.28 (2.48)	3.83 (2.55)	3.54 (2.58)							

[a]Historical prevalence of disease index. [b] 0 = no measures in place, 1 = recommended to not leave the house, 2 = required to not leave the house with exceptions (e.g., for exercise or grocery shopping), 3 = required to not leave the house with minimal exceptions (e.g., only allowed to leave once every few days).

Table 3. Analysis of Covariance (ANCOVAs) for Changes in Condom Use, by Gender, Per Country.

	Men		Women				
Country	*M* "before COVID" (*SD*)	*M* "during COVID" (*SD*)	*M* "before COVID" (*SD*)	*M* "during COVID" (*SD*)	*F (men + women)*	*df*	*p*
Netherlands	3.09 (2.31)	2.97 (2.25)	2.87 (2.51)	2.57 (2.36)	0.017	1, 187	.897
Hong Kong	5.53 (2.15)	4.82 (2.56)	4.60 (2.57)	4.64 (2.62)	1.671	1, 60	.201
Thailand	4.45 (2.15)	4.50 (2.26)	4.94 (2.35)	4.74 (2.42)	0.959	1, 103	.330
Canada	4.34 (2.48)	3.73 (2.57)	3.70 (2.58)	3.19 (2.58)	1.276	1, 481	.259
Portugal	3.68 (2.34)	3.45 (2.40)	3.57 (2.58)	3.28 (2.55)	0.053	1, 256	.819
Hungary	3.83 (2.60)	3.52 (2.68)	3.82 (2.61)	3.26 (2.73)	0.056	1, 116	.813
United Kingdom	4.73 (2.45)	4.11 (2.64)	3.50 (2.52)	3.37 (2.61)	1.023	1, 151	.314
Lithuania	4.50 (2.83)	4.00 (2.81)	4.34 (2.64)	4.00 (2.76)	0.474	1, 98	.493
The Philippines	3.93 (2.71)	2.67 (2.38)	2.18 (2.17)	1.77 (1.90)	0.019	1, 27	.891
Serbia	4.10 (2.47)	3.94 (2.53)	3.68 (2.40)	3.60 (2.44)	0.178	1, 386	.674
Vietnam	4.45 (2.37)	4.29 (2.51)	4.19 (2.62)	3.65 (2.68)	1.372	1, 544	.242
Uganda	4.46 (2.13)	3.83 (2.12)	3.77 (2.24)	3.66 (2.31)	1.641	1, 230	.201
Croatia	4.85 (2.34)	4.72 (2.45)	4.65 (2.55)	4.46 (2.68)	0.016	1, 99	.900
United States	4.39 (2.44)	4.38 (2.44)	4.04 (2.53)	4.04 (2.56)	0.238	1, 709	.626
Spain	4.71 (2.66)	4.45 (2.68)	4.78 (2.52)	4.81 (2.56)	1.023	1, 168	.313
Colombia	4.66 (2.41)	4.32 (2.72)	3.72 (2.47)	3.26 (2.58)	0.331	1, 107	.567
Taiwan	4.22 (2.60)	4.06 (2.78)	4.25 (2.72)	3.85 (2.76)	0.003	1, 60	.958
Australia	4.65 (2.42)	3.99 (2.65)	4.37 (2.46)	3.73 (2.60)	3.502	1, 125	.968
Total	4.29 (2.41)	4.03 (2.48)	3.96 (2.55)	3.69 (2.61)			

Table 4. Analysis of Variance (ANOVA) for Changes in Sexual Frequency Per Country.

Country	*M* "before COVID" (*SD*)	*M* "during COVID" (*SD*)	*Cohen's d*
Australia			
Netherlands	4.69 (1.63)	4.70 (1.77)	−.001
Hong Kong	4.09 (1.86)	3.88 (2.19)	.103
Thailand	5.44 (2.46)	5.22 (2.51)	.089
Canada	4.66 (1.92)	4.26 (1.94)	.207
Portugal	4.67 (1.93)	4.39 (1.97)	.144
Hungary	4.81 (1.73)	4.40 (1.76)	.229
United Kingdom	4.61 (1.56)	4.19 (2.11)	.226
Lithuania	3.69 (1.14)	3.68 (1.15)	−.009
The Philippines	3.65 (1.60)	3.26 (1.75)	.223
Serbia	4.91 (2.53)	5.11 (2.76)	−.075
Vietnam	4.45 (2.58)	4.16 (2.79)	.108
Uganda	5.00 (2.25)	4.60 (2.21)	.179
Croatia	4.93 (1.61)	5.03 (1.71)	−.060
United States	4.80 (2.05)	4.46 (2.08)	.019
Spain	4.75 (1.65)	4.28 (1.70)	.281
Colombia	5.32 (1.99)	4.64 (2.18)	.326
Taiwan	4.03 (1.65)	3.65 (1.22)	.299

countries reported a decline in penetrative sex (ps $< .05$), except in the Netherlands ($p = .454$), Serbia ($p = .299$), Croatia ($p = .959$), and the US ($p = .499$) (see Table 4). A cumulative global analysis also revealed an overall decline in condom use, $F(1, 3415) = 38.971$, $p < .001$.

Spearman correlations were utilized to explore potential factors contributing to this decline in condom use (Hypothesis 2). These correlational analyses explored relationships between the effect size (i.e., Cohen's d) of changes in condom use across countries, and a number of indices—namely, historical prevalence of disease, stringency of lockdowns, and vaccination percentage. Data from Hong Kong and Hungary were excluded due to violating the assumption of the homogeneity of variances—all other countries did not violate this assumption. As expected, significant relationships between changes in condom use were observed with lockdown stringency ($r_s = .643$, $p < .001$) and vaccination percentage ($r_s = .492$, $p = .038$). The higher lockdown stringency and higher vaccination percentage, the greater the decline in condom use (i.e., with the difference score calculated such that positive values indicate decreases in condom usage). However, there was no significant association between changes in condom use and historical prevalence of disease ($r_s = -.066$, $p = .794$). Post hoc analyses revealed a significant negative correlation between the proportion of non-sexually active participants and historical disease prevalence (rs = -.363, $p < .001$), suggesting that countries with higher historical disease prevalence had a greater proportion of sexually active participants (See Figures 1-3).

Exploratory analyses were undertaken to examine social, health, and economic indicators were gathered to investigate whether they were more relevant predictors of changes in condom use. Accordingly, we gathered Gross Domestic Product (GDP) per capita as an economic indicator, Gini coefficients as an inequality indicator, the Human Development Index (HDI) as a health indicator, and the Global Gender Gap Index (GGGI) as a measure of gender disparity. GDP and Gini values were collected from the World Bank, and HDI from the United Nations (see Table 5). Taiwan was the only country without data for all indices. Hong Kong also did not have a value for GGGI.

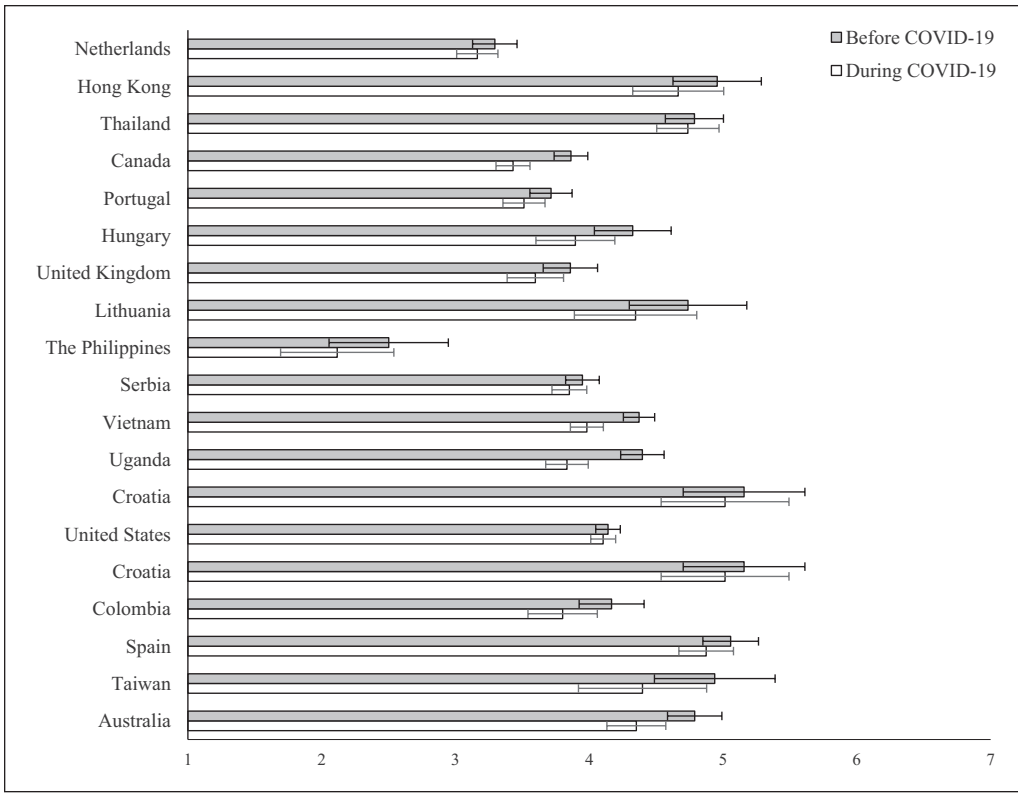

Figure 1. Differences in "Before COVID-19" and "During COVID-19" Scores Across Countries.

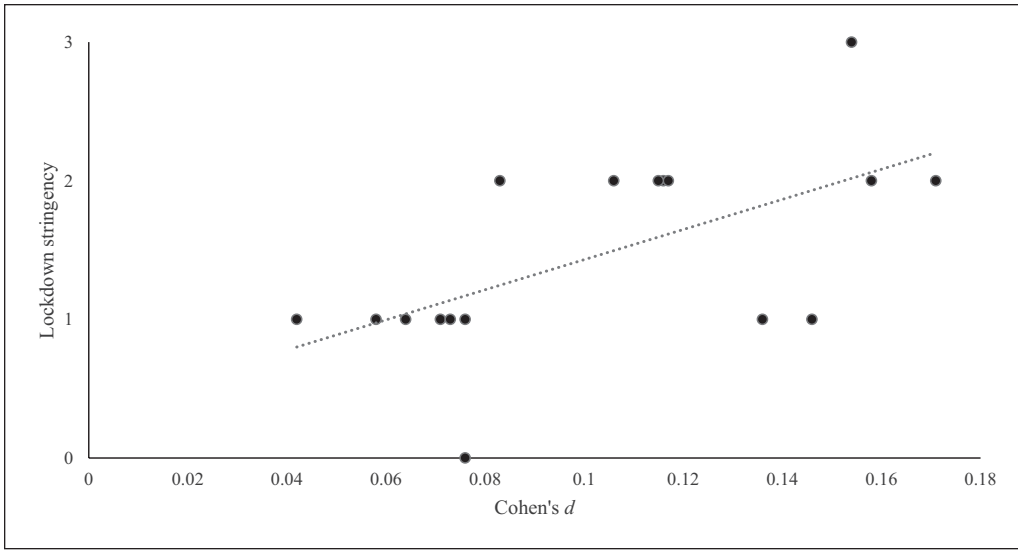

Figure 2. Association of Changes in Condom Use With Lockdown Severity, Across 18 Countries.
[a]Lockdown severity was sorted in 4 groups: 0 = no measures in place, 1 = recommended to not leave the house, 2 = required to not leave the house with exceptions (e.g., for exercise or grocery shopping), 3 = required to not leave the house with minimal exceptions (e.g., only allowed to leave once every few days).

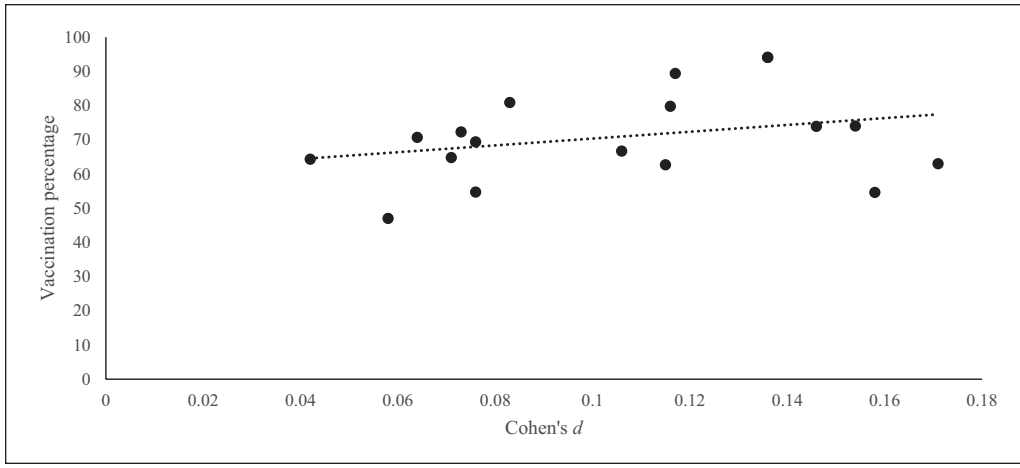

Figure 3. Association of Changes in Condom Use With Vaccination Uptake, Across 18 Countries.

Table 5. Social, Economic, and Health Indicators Per Country.

Country	GDP per capita ($)	GINI	HDI	GGGI
Australia	62,619	0.326	0.951	0.731
Netherlands	58,061	0.279	0.944	0.756
Hong Kong	49,700	0.539	0.952	n/a
Thailand	6,362	0.366	0.800	0.708
Canada	52,051	0.281	0.936	0.772
Portugal	24,262	0.331	0.866	0.758
Hungary	18,728	0.292	0.846	0.683
United Kingdom	47,334	0.351	0.929	0.779
Lithuania	23,492	0.354	0.875	0.776
Philippines	3,549	0.426	0.699	0.784
Serbia	8,593	0.336	0.802	0.747
Vietnam	3,756	0.373	0.703	0.705
Uganda	964	0.428	0.525	0.717
Croatia	17,398	0.292	0.858	0.744
US	70,248	0.414	0.921	0.763
Spain	30,103	0.344	0.905	0.795
Colombia	6,131	0.517	0.752	0.75
Taiwan	N/A	N/A	N/A	N/A

Note. GDP = gross domestic product; HDI = human development index; GGGI = Global Gender Gap Index.

Using a linear regression model, we examined whether these indicators predicted changes in condom use. The results indicated that GDP ($p = .299$), HDI ($p = .059$), and GGGI ($p = .539$) were not significant predictors. However, the GINI significantly predicted changes in condom use ($p < .001$).

Discussion

The present study aimed to examine changes in heterosexual condom use during the COVID-19 pandemic across 18 countries and to investigate whether cross-cultural factors, such as historical

disease prevalence, lockdown stringency, and vaccination rates, were associated with these changes. Consistent with our first hypothesis (H1), results revealed a nominal decline in condom use across all surveyed countries, with six of the 18 countries showing a statistically significant decline. Notably, no country exhibited even a nominal increase in condom use during the pandemic. Partially in line with our predictions (H2), lockdown stringency and vaccination rates were significantly associated with the extent of condom use decline. However, contrary to our second hypothesis (H2), historical disease prevalence was not significantly associated. In addition, these findings do not support the BIS-derived prediction that increased cognitive activation of pathogens due to COVID-19 would enhance health-protective behaviors in the sexual domain. Instead, the results suggest that the pandemic may have diverted attention away from STI prevention, underscoring the need for renewed public health efforts in this area.

The current study found evidence of a decline in condom use globally—namely, in Australia, Canada, Portugal, Vietnam, Uganda, and Taiwan. Further, despite non-significant observations in all other regions, there was no evidence of an increase in condom use after the onset of the pandemic. That is, despite evidence that pathogen threat generally (Tybur et al., 2011), and COVID-19 specifically (Ma & Ye, 2021), increases intention to use condoms, this seemingly does not translate to actual behavioral adoption of condom use during a pandemic. Previous research has indicated that disgust—the emotion most closely related to pathogen threats, as it triggers avoidance of potential infection (Aunger & Curtis, 2013; Lieberman & Patrick, 2014)—can be attenuated by sexual arousal (de Jong et al., 2013). For instance, young men and women find disgust-inducing stimuli to be significantly less disgusting when they are sexually aroused (Borg & de Jong, 2012; Stevenson et al., 2011). This aligns with the BIS framework, which suggests that while sex can be a disgust-inducing stimuli due to its potential for pathogen transmission, sexual arousal can override disgust mechanisms to facilitate sexual activity. People may report intentions to use condoms following pathogen threats, but being in a sexually arousing situation may interfere with translating this intention to behavior, contributing to the decline in condom use cross-culturally.

Limited research during lockdowns already indicated that people increased a range of unhealthy behaviors (Czenczek-Lewandowska et al., 2021; Naughton et al., 2021; Niedzwiedz et al., 2021), and the present study extends this research to decreased condom use. Indeed, the increase in drug and alcohol use during lockdowns may play a notable role in the use of condoms, as drug and alcohol use was a strong predictor of sexual risk taking, including condomless sex, prior to the pandemic (Berry & Johnson, 2018; Rehm et al., 2012; Scott-Sheldon et al., 2016). Relatedly, more severe lockdowns greatly reduced mobility and limited opportunities for casual sex (Coombe et al., 2021), leading to younger people seeking out sexual partners within their social circles (Okeke, 2022), another known predictor of reduced condom use (Choi et al., 2016; Cooper & Orcutt, 2000; Macaluso et al., 2000; Parks et al., 2011). Notably, of the countries where a significant decrease in condom was observed, Taiwan had implemented the highest level of lockdown restrictions, while Canada and Portugal were each one level below this maximum. Lockdowns may have inadvertently created conditions that allowed condomless sex to increase as indicated by the present results. Future research is needed to further distill the pathways that connect lockdown guidelines to condom use.

Vaccination uptake was a strong predictor of COVID-19-related reduced condom use across countries. The BIS postulates that people are particularly attuned to immediate pathogen threat rather than a distal one (Rachman, 2016; Schaller & Park, 2011). In the context of the pandemic, and the extensive media coverage, COVID-19 was obviously more salient than potential threats from STIs. Consequently, people may have been prioritizing COVID-19 protection strategies (e.g., vaccines) over other infections, like STIs (e.g., condoms). Low STI clinic attendance during lockdowns (Ogunbodede et al., 2021; Tao et al., 2021), and this continued lower attendance

after lockdowns (Chow et al., 2021; Sentís et al., 2021), further provide evidence of STIs being less salient during this time. Indeed, vaccination uptake was among the highest in countries that reported a significant decline in condom use, with Australia, Canada, and Portugal each being over eighty percent vaccinated, reinforcing the preoccupation of COVID-19 over other infectious diseases during this time. Even in countries in the current study that did not report a significant change, participants still reported middling condom use. This is concerning as these rates among young people pre-pandemic were not high enough to stem the spread of STIs (Shannon & Klausner, 2018). In sum, these findings indicate that the STI endemic may have worsened since the onset of COVID-19. Epidemiological data collected as STI clinics return to motivating STI testing will further illuminate these results.

The specific circumstances of the six countries that demonstrated significant declines in condom use further illustrate the complex interplay of cross-cultural factors that impacted condom use. In Taiwan and Vietnam, stringent early lockdowns and collectivist orientations likely fostered strong adherence to COVID-19 prevention while diverting attention from STI concerns. Uganda, in contrast, faced limited vaccine access but more restrictive lockdowns, perhaps limiting overall access to condoms. Meanwhile, Australia, Canada, and Portugal shared high vaccination uptake and relatively strict lockdowns, reflecting strong public trust in health messaging but also a prioritization of COVID-19 protection over sexual health. These patterns underscore how the intersection of governmental responses, cultural orientations, and structural conditions shaped cross-cultural differences in condom use during the pandemic.

Contrary to expectations, there was no association between the change in condom use and historical prevalence of disease. It was expected that experiences with previous infections would lead to greater increase in current behavioral responses (i.e., condom use), but this was not supported. This null finding may indicate that the chronic activation of disease risk that COVID-19 brought about did not interact with historical sensitivity to pathogens to a meaningful degree. Alternatively, the subset of sexually active individuals from the countries that have greater historical pathogen prevalence, which was smaller than the sexually active subsamples in the countries that have lower prevalence, may be less sensitive to the BIS activation cues in their environment.

In sum, the findings of the present study are consistent with previous research indicating a decline in heterosexual condom use during the COVID-19 pandemic. Notably, these results demonstrate that reductions in condom use are linked to vaccination uptake and lockdown stringency—both of which were heavily promoted through public health campaigns and guidelines. This suggests that the emphasis on these campaigns may have drawn attention toward pandemic-related health concerns at the expense of sexual health. Importantly, the six countries where significant declines were observed were also among those with relatively high vaccination uptake, stringent lockdown measures, or both, further reinforcing these specific cross-cultural factors as notable influences on decreases in condom use. Further, the countries in the current study were deliberately selected to capture a vast geographical footprint to introduce substantial heterogeneity in cultural and economic aspects. That heterogeneity is reflected in variations in the study's key variable of interest. Factors such as vaccination uptake and lockdown stringency varied significantly across countries, but so too did condom use and frequency of sexual intercourse, likely informed by variations in other external factors like sexual permissiveness. Indeed, other cross-cultural indicators examined did not appear to relate meaningfully to pandemic-related changes in condom use. Although the Gini coefficient emerged as a significant predictor, most recent data available for this measure are from 2019—prior to the pandemic—suggesting that its predictive value is likely unrelated to COVID-19-specific effects. Ultimately, our study highlights that these emergent COVID-19-specific factors may play a more significant role than those traditionally identified by the BIS.

Limitations

The primary limitation of this study lies in its dependency on participants' recall of condom use, which may lead to inaccuracies due to over- or underestimation. This reliance on retrospective data was necessitated by the onset of COVID-19 prior to the study's inception, precluding the collection of pre-pandemic data. Despite this, existing research has demonstrated that individuals can recall their condom use with considerable accuracy. One study compared participants' weekly reports of condom use with their retrospective annual recall and found a high correlation between the two (Jaccard et al., 2002). Moreover, our research demonstrates a uniform decrease in condom use during the first year of the pandemic across all surveyed countries, without any deviations, lending credence to the reliability of our data. This uniformity, reinforced with previous research, suggests that recall methods can still yield consistently valid insights into condom use, despite their limitations. Future studies might enhance accuracy by asking participants to recall their condom use within a specific timeframe, a method that has shown promise in improving recall fidelity (Crosby & Bounse, 2012). Another notable limitation of the current research is the lack of LGBTQI+ participants—especially, MSM. We speculated above that a preoccupation with COVID-19 may distract from the threat posed by STIs, but this may not extend to other sexual orientation groups. Limited findings among MSM suggest a trend of increased condom use during the pandemic (Shilo & Mor, 2020; Starks et al., 2020), implying that the activation of protective sexual behavior (e.g., condom use) among MSM during COVID-19 may have been in line with BIS predictions. One potential explanation may be MSM's more pronounced historical experience with HIV, where condom use is an appropriate counter to this serious virus. As such, MSM's behavioral defenses may be more readily available, and more generalisable, compared to their heterosexual peers, who have not experienced a pathogen threat as severe as HIV in recent history. Future research should investigate cross-cultural changes in condom use among MSM to explore this potential explanation.

Similarly, the role of HIV in shaping condom use must be acknowledged. While most countries included in this study had very low HIV prevalence ($< 0.1\%$ to ~0.4%), Thailand (~1.0%) and Uganda (~5.4%) were notable exceptions (CIA World Factbook, 2021). In these settings, the persistent threat of HIV transmission likely amplified the public health significance of condom use, particularly in Uganda. Despite this, the current study observed declines in condom use in Uganda. Such a finding harmonizes with the wider findings of the present study, wherein the threat of COVID-19, along with associated containment measures like lockdown, may have overshadowed other health risks, including HIV. Given these findings, further research is critical examine how the COVID-19 pandemic may have undermined HIV testing and prevention efforts in countries with higher HIV prevalence.

The present study also did not assess changes in the number or types of sexual partners during the pandemic. It is plausible that social distancing measures and lockdowns reduced opportunities for new sexual encounters, encouraging individuals to engage more frequently with familiar or existing partners—a trend observed in previous research (Okeke, 2022). Prior studies have shown that condom use tends to be lower with known partners compared to new or casual encounters (Choi et al., 2016), which may have contributed to the decline in condom use observed in the current study. Such relational dynamics were not directly measured in the current study, and represent an important avenue for future research.

Finally, the limitations of the BIS theory must be acknowledged. Ackerman et al. (2021) emphasize that modern pandemics, including COVID-19, differ from historical pathogen threats due to evolutionary mismatch. While the BIS evolved to detect visible infection cues, it has not necessarily adapted to factors like asymptomatic spread. As such, the BIS may not be able to fully explain pandemic-related behavioral shifts—indeed, findings from this study affirm that the introduction of lockdown had a larger impact on condom use than historical prevalence of disease. Future research should consider adapted BIS models, or alternative frameworks altogether, to better capture pandemic-related behavioral changes.

Implications

The WHO has declared the end of the COVID-19 global health emergency. Despite this, epidemiologists have noted that future outbreaks of new diseases are inevitable, given the rising incidence of zoonotic diseases (Jones et al., 2008; Pike et al., 2014; Rupasinghe et al., 2022). A key lesson from the COVID-19 pandemic has been the effectiveness of rapid lockdown measures in curbing disease transmission (Loewenthal et al., 2020)—as such, it is likely these measures will be utilized in the event of future outbreaks. However, such restrictions can also disrupt access to essential health services, including sexual health resources. This study highlights the importance of ensuring continued access to these services during health crises, reinforcing the need for targeted condom promotion strategies to mitigate potential increases in unprotected sex and sexually transmitted infections during future outbreaks.

Conclusion

The results of the present study continue to present a worrying trend among young heterosexual people, wherein condom use either remained poor or diminished even further during the pandemic. Indeed, the present research adds to the growing phenomenon of lockdowns having a significant negative impact on young people's health, even beyond the lockdowns themselves. Considerable efforts had been placed into promoting lockdowns and other behaviors safeguarding against COVID-19 (e.g., hand washing, mask wearing), in turn neglecting messaging about STI prevention, testing, and treatment. This is concerning when cases of STIs are often asymptomatic (Farley et al., 2003), and can have significant health implications if left untreated (Tsevat et al., 2017). As more regions return to "normal" with the introduction of COVID-19 vaccines, governments and health organizations need to explore effective messaging about STIs in a post-restriction world that may be exhausted of health messaging.

Data Availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to ethical restrictions.

Declaration of Conflicting Interests

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