

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

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ABSTRACT

Background. The SARS-CoV-2 (coronavirus disease 2019; COVID-19) pandemic and its concomitant movement control measures have had a profound impact on the world. In spite of its potential impact on sexual health, there is a lack of research on how the pandemic and its movement control measures have impacted sexual wellbeing among Singaporeans. **Methods.** This observational, cross-sectional study was conducted from August to September 2020. Participants were recruited through an online survey instrument promoted through social media. Respondents self-reported their sexual behaviours and levels of sexual satisfaction prior to and during the COVID-19 pandemic movement control measures. **Results.** We recruited a total of 562 participants, of whom 338 (60.1%) ever had a sexual experience. Singles ($n = 106$, 31.4%) and those not living with their partners ($n = 115$, 34.0%) reported a greater decrease in partnered sexual activities but a greater increase in individual sexual activities such as masturbation, sending and receiving nudes and watching pornography, relative to those who were living with their partners ($n = 117$, 34.6%). Multivariable analyses indicated that relative to singles, those who were not living with their partners were more likely to experience a decrease in sexual satisfaction (adjusted prevalence ratio [aPR] = 1.42, 95% CI [1.07, 1.90]), whereas those who were living with their partners were less likely to experience a decrease in sexual satisfaction (aPR = 0.45, 95% CI [0.25, 0.81]). **Conclusions.** Interventions may focus on enhancing sexual wellness by educating on and supporting individual or partnered sexual activities that may vary along the lines of partnership status and living arrangements during the implementation of movement control measures.

Keywords: Asia, behaviour, COVID-19, sexual behaviours, sexual health, sexual practices, Singapore, surveillance.

Introduction

The SARS-CoV-2 (coronavirus disease 2019; COVID-19) pandemic has had a profound impact on economic and social lives globally. Since COVID-19 was declared as a public health emergency of international concern on 30 January 2020 by the World Health Organization,¹ countries have enacted varying modes of movement control measures in an effort to curb its spread.^{2,3} COVID-19 and its concomitant movement control measures have also inadvertently impacted the sexual wellbeing of individuals around the world.⁴

The COVID-19 pandemic has directly impacted the delivery of and access to sexual and reproductive health services among the general population, as well as among vulnerable populations, such as refugees, across the world.^{5–8} Studies have found that sexual behaviours have been impacted in varying ways across different settings and population subgroups; specifically, the evidence has shown a general decrease in sexual behaviours, as reported by studies among the general population in China as well as among college

students in the United States,^{9–11} and an increase in others, as reported among women in Turkey and gay, bisexual and other men who have sex with men in the United States.^{12,13} The findings of some studies have also found that sexual behaviours associated with a heightened risk of acquiring HIV and other sexually transmitted infections, such as inconsistent condom use or the use of substances with sex, have either remained stable or been on the rise during this time in spite of movement control measures, which were reported in a study of heterosexual young adults in Australia and sexual minority men in the United States.^{14,15} Correspondingly, a study in Finland found that the pandemic and its lockdown measures had not reduced diagnoses of chlamydia or gonorrhoea, whereas a study in Italy found that diagnoses of syphilis had not dropped in spite of such measures.^{16,17}

There have also been attempts to investigate how the quality of one's sex life and sexual wellbeing has been impacted by the pandemic. Studies in the United States and China have found that although sexual behaviours in general have decreased, individuals are reporting an expanded sexual repertoire of new sexual activities such as an increasing use of pornography, virtual sex, sexting, and trying out new sexual positions.^{18,19} Another study investigating global internet traffic for Pornhub, one of the largest pornography sites, found increases in online traffic across the world.²⁰ Nevertheless, satisfaction with one's sex life and quality of sex life have been on a decline in the general population during this pandemic, which was reflected in online survey studies conducted in Taiwan and Italy,^{21,22} though evidence from another study in Italy on couples who were cohabiting during the lockdown period seemed to suggest that the lockdowns did not have a large impact on the sexual behaviour of cohabiting couples, though some participants did report a decrease in satisfaction.²³ Sexual wellbeing and satisfaction have been shown to be positively associated with individual mental wellbeing and relationship quality among couples, and are thus important areas of inquiry.^{24,25}

Singapore is a city-state comprising a population of ~5.7 million.²⁶ Singapore society holds largely conservative views around sexual behaviours, especially towards sexual relations before marriage, sexual relations between two adults of the same sex, and cohabitation before marriage.²⁷ Although scholars have largely attempted to characterise risk factors for HIV and other sexually transmitted infections among at-risk populations such as men who have sex with men, sex workers and their clients, as well as adolescents,^{28–35} there is a gap in published studies on the sexual behaviour of Singaporeans in general, notwithstanding a few studies on sexual health in the general population.^{36–38}

Singapore's version of its 'lockdown', or COVID-19 movement control measures, were also known as the 'circuit breaker' period. This was in effect from 7 April until 1 June 2020, and involved the closure of all non-essential workplaces and the implementation of strictly enforced

movement control measures such as mandatory mask-wearing and restrictions on leaving one's home unless for essential services. Individuals were also only allowed to physically interact with other people living in the same household during this time, and individuals who were partnered, but not cohabiting with their partners, were not allowed to visit their partners who were physically living in other households. The term 'circuit breaker' refers to this set of measures that would curb the continued spread of COVID-19 in the community, and in effect 'break the circuit' of transmission.³⁹ The circuit breaker measures were then gradually eased in phases from 2 June 2020.

Given the lack of research on sexual behaviours in Singapore in general, and a gap in our understanding of how the pandemic and its movement control measures have impacted sexual well-being among Singaporeans, the objectives of this study are two-fold. First, this study attempts to characterise levels of individual and interpersonal sexual behaviours among an online sample of Singapore residents and investigate how the circuit breaker had impacted such behaviours; and second, to determine how levels of sexual satisfaction have changed for individuals of varying partnership status and living arrangements.

Methods

Study design and participants

This observational, cross-sectional online survey was conducted in Singapore from August to September 2020. This study is part of a larger global consortium of online surveys on the impact of COVID-19 on sexual and reproductive health, called the International Sexual Health And REproductive (I-SHARE) health survey.⁴⁰ To be eligible for this study, participants had to report being at least 18 years of age, and a Singapore permanent resident or Singapore citizen residing in Singapore at the point of participation.

Data collection

Ethics approval was obtained from the institutional review board at the National University of Singapore (NUS-IRB Reference Code NUS-IRB-2020-58) prior to data collection. Participants were recruited through an advertisement to participate that was promoted through the sharing of the study through posts made by the study team members on social media, as well as through Facebook and Instagram advertisements. The advertisements were run in the English language and included the headline: 'Survey on sexual and reproductive health in times of COVID-19 – Get a \$10.00 GrabRide [transportation] Voucher for your participation' (see Supplementary Fig. S1). The advertisements were run from 20 August to 25 September 2020 and were targeted to all individuals aged ≥18 years who were residing in

Singapore at the point at which the advertisements were promoted. Based on a resident population of 5.69 million in Singapore, a sample size of 385 was calculated to provide us with a 5% margin of error at 95% confidence intervals (CIs). We opted to recruit beyond 385 participants and targeted a total of 600 participants based on the study's available budget.

Upon clicking on or visiting the enrolment link, participants were led to a page where the participant information sheet was embedded, which they could download and keep. Participants who agreed to participate in the survey provided informed consent by clicking on a button at the end of the page to acknowledge that they have read the participant information sheet and agreed to participate in the survey. Participants who completed the survey were asked to provide an email address, to which an SGD10.00 (approximately USD7.50) transport voucher was transmitted as reimbursement for their time. Each survey took an average of 15 min to complete.

Demographic variables

We measured age in years as a continuous variable, sex assigned at birth (male vs female), sexual orientation (heterosexual vs non-heterosexual), race (non-Chinese vs Chinese), religion (no religion vs with religion), housing type (public housing vs private housing; as of 2020, ~80% of the Singapore resident population were living in public housing),⁴¹ gross personal monthly income (below SGD3000 [~USD2250] vs SGD3000 [~USD2250] and above, given that SGD2925 [~USD2200] was the most recent figure published for median income in Singapore),⁴² and educational attainment (degree educational attainment vs below degree educational attainment). Relationship status was collected through the question: 'What is your marital status?', which allowed for the recoding of a categorical variable with options involving permutations of a participant's partnership status (e.g. single, legally married, in a relationship) and if they were living together (e.g. 'legally married and living together'). A copy of the survey questionnaire is available in the Supplementary Material.

Sexual behaviour variables

Participants were asked if they ever had a sexual experience, which was defined in the survey instrument as any kind of experience that participants felt was sexually arousing, including kissing, touching, intercourse, masturbation, watching sexually explicit images, or any other form of sex. Participants reported about their sexual behaviours in the 3 months prior to the circuit breaker through a series of questions on their self-reported frequencies of engaging in various sexual behaviours. Frequencies were solicited through two sets of potential options; the first being 'never', 'monthly or less', 'two to four times a month', 'two to three times a week', and 'four or more times a week'; the second being 'never',

'rarely', 'sometimes', 'most of the time', and 'always' for variables such as condom use where the proportion of such behaviours were of interest, rather than the frequency. The sexual behaviours included hugging, kissing or holding hands, sexual activities (including oral, vaginal, anal intercourse or touching), condom use for sex with a steady sexual partner, sexual activities and condom use for sex with a casual sexual partner ('someone who you are not in a long-term relationship with'), masturbation, sending and receiving of nude photos, having sex in exchange for money, goods, favours, drugs or shelter, watching of pornography, and engaging in webcam sex. Participants reported how such sexual behaviours had changed during the circuit breaker period in relation to 3 months prior, to which they could respond to the following set of options for all sexual behaviours listed above: 'decreased a lot', 'decreased a bit', 'stayed the same', 'increased a bit', and 'increased a lot'.

Sexual satisfaction was measured among all participants who reported ever having a sexual experience, and was determined through the question: 'How satisfied were you with your sex life *in the three months before* the circuit-breaker?', as well as 'How satisfied were you with your sex life *during* the circuit-breaker?', to which participants could respond with 'very', 'somewhat', 'not very' or 'not at all'. We recoded this into a binary variable to reflect increases or decreases in sexual satisfaction, comparing changes in such responses in the 3 months prior to COVID-19 and during COVID-19. Participants who indicated the same response for both time frames were coded as having 'stayed the same', while participants with missing data for this variable on either time frame were excluded for the newly-coded variables.

Statistical analysis

Statistical analysis was carried out using the statistical software, STATA ver. 15 (Stata Corp., College Station, TX, USA). As the outcomes of interest for this study included measures of sexual behaviours and sexual satisfaction, we limited our analyses to individuals who reported ever having a sexual experience. We employed descriptive statistics to describe broad patterns in the measures collected for our study. We used bivariable statistics to assess and compare trends in sociodemographic characteristics, sexual behaviours, and levels of sexual satisfaction by one's partnership status. Chi-squared tests were employed to determine if statistically significant differences existed across such comparisons. Multivariable Poisson regression models with robust sandwich variances were used to compute the adjusted prevalence ratio (aPR) for a reported decrease in one's sexual satisfaction. Poisson regression was chosen over logistic regression as the outcome was considered to be common and exceeded 10% of the study population.⁴³ We controlled for key sociodemographic variables such as age, sex assigned at birth, sexual orientation, race, religion, housing type, income level, and educational attainment. Selection of these variables were

Table 1. Sociodemographic attributes and description of individuals who ever had a sexual experience ($n = 338$).

Demographic variables	Single ($n = 106$)		Partnered: not cohabiting ($n = 115$)		Partnered: cohabiting ($n = 117$)		Total ($n = 338$)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Age ^A ($n = 338$)	24	24, 31	26	23, 31	34	30, 46	28	23, 36
Sex assigned at birth ($n = 338$)								
Male	55	51.9	67	58.3	68	58.1	190	56.2
Female	51	48.1	48	41.7	49	41.9	148	43.8
Sexual orientation ($n = 334$)								
Heterosexual	46	44.2	71	61.7	75	65.2	192	57.5
Asexual	12	11.5	16	13.9	14	12.2	42	12.6
Bisexual	17	16.4	10	8.7	9	7.8	36	10.8
Queer/Questioning	9	8.7	3	2.6	9	7.8	21	6.3
Gay/Lesbian	15	14.4	8	7.0	5	4.4	28	8.4
Pansexual	5	4.8	7	6.1	3	2.6	15	4.5
Race ($n = 330$)								
Chinese	83	79.8	96	86.5	96	83.5	275	83.3
Malay	8	7.7	7	6.3	11	9.6	26	7.9
Indian	8	7.7	3	2.7	6	5.2	17	5.2
Others ^B	5	4.8	5	4.5	2	1.7	12	3.6
Religion ($n = 332$)								
No religion	33	31.4	42	37.2	23	20.2	98	29.5
Buddhism	27	25.7	21	18.6	22	19.3	70	21.1
Christianity	17	16.2	24	21.2	33	29.0	74	22.3
Taoism	10	9.5	9	8.0	7	6.1	26	7.8
Islam	5	4.8	5	4.4	5	4.4	15	4.5
Atheism	5	4.8	5	4.4	10	8.8	20	6.0
Hinduism	2	1.9	3	2.7	3	2.6	8	2.4
Sikhism	4	3.8	2	1.8	4	3.5	10	3.0
Others (e.g. agnostic, Baha'i faith)	2	1.9	2	1.8	7	6.1	11	3.3
Housing type ($n = 335$)								
HDB housing three-room and below ^C	23	21.9	14	12.3	19	16.4	56	16.7
HDB housing four-room	36	34.3	34	29.8	38	32.8	108	32.2
HDB housing five-room and executive	30	28.6	42	36.8	23	19.8	95	28.4
Private housing	16	15.2	24	21.1	36	31.0	76	22.7
Gross monthly personal income (SGD; $n = 335$)								
No income	26	24.8	26	22.8	18	15.5	70	20.9
<1000	0	0.0	0	0.0	0	0.0	0	0.0
1000–1999	12	11.4	7	6.1	11	9.5	30	9.0
2000–2999	21	20.0	15	13.1	11	9.5	47	14.0
3000–3999	18	17.1	24	21.1	13	11.2	55	16.4
4000–4999	14	13.3	11	9.7	12	10.3	37	11.0
5000–5999	8	7.6	15	13.2	26	22.4	49	14.6
≥6000	6	5.7	16	14.0	25	21.6	47	14.0

(Continued on next page)

Table 1. (Continued).

Demographic variables	Single (<i>n</i> = 106)		Partnered: not cohabiting (<i>n</i> = 115)		Partnered: cohabiting (<i>n</i> = 117)		Total (<i>n</i> = 338)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Educational attainment (<i>n</i> = 336)								
Secondary school and below	17	16.2	19	16.7	21	18.0	57	17.0
Tertiary level	44	41.9	41	36.0	12	10.3	97	28.9
Degree and above	44	41.9	54	47.4	84	71.8	182	54.2

^AMedian with lower and upper quartiles.

^BSingapore identity cards reflect 'Others' for individuals whose race do not fall under 'Chinese', 'Malay', or 'Indian'.

^CHDB flats are Singapore government-owned, public housing flats.

informed by key population indicators used in Singapore, as well as measures of the social determinants of health.^{26,44} Missing data were <5% for variables used in regression analyses, and thus were not likely to have a consequential impact on analyses.⁴⁵ Statistical significance was set at $P < 0.05$.

Results

Sociodemographic characteristics of the sample

The survey advertising campaign reported a total number of 14 026 impressions and 427 clicks, indicating a click-through rate of 3.04%. As the survey only captured responses from eligible participants, we were unable to ascertain a disqualification or eligibility rate. Five-hundred and fifty-nine out of 562 participants who were eligible for the study fully completed the online questionnaire, thus providing a survey completion rate of 99.5%. Full completion of the survey was not a criterion for inclusion in the study. Table 1 summarises the sociodemographic characteristics of all individuals who ever had a sexual experience ($n = 338$). A total of 106, 115 and 117 reported being single (31.4%), not living with their partner (34.0%), and living with their partner (34.6%), respectively. The median age of participants was 28 years, and older respondents were more likely to be cohabiting with their partners. Participants were largely heterosexual ($n = 192$, 57.5%), of Chinese race ($n = 275$, 83.3%), had no religion ($n = 98$, 29.5%), staying in four-room Housing Development Board (HDB) flats ($n = 108$, 32.2%), earning an income ($n = 265$, 79.1%), and had educational attainment of a university degree and above ($n = 182$, 54.2%).

Sexual behaviours in the 3 months prior to and during the COVID-19 circuit breaker measures

A total of 338 ($n = 60.1\%$) respondents reporting ever having a sexual experience. Figs 1 and 2 summarise the reported sexual behaviours by partnership status in the 3 months before and during the COVID-19 circuit breaker measures, respectively. Supplementary Tables S1 and S2 provide detailed tables for

these figures. Of those who ever had a sexual experience, 106, 115 and 117 participants reported being single (31.4%), not living with their partners (34.0%), and living with their partners (34.6%), respectively. We assessed the relationship between partnership status and sexual behaviours for both time frames.

For sexual behaviours in the 3 months prior to COVID-19, participants who were single reported lower levels of activities with a steady sexual partner and higher level of activities with casual sexual partners. Bivariable analysis revealed that respondents who were single or not living with their partners engaged in higher levels of masturbation ($P < 0.001$), sending or receiving nudes ($P < 0.001$), sex in exchange for money, goods, favours, drugs or shelter ($P = 0.021$), watching pornography ($P < 0.001$), and engaging in sex on webcam ($P = 0.034$). For changes in sexual behaviours during COVID-19 circuit breaker measures, participants who were single or not living with their partners experienced a greater decrease in sexual activities with steady and casual partners, but a greater increase in masturbation ($P < 0.001$), receiving or sending of nudes ($P < 0.001$), and watching pornography ($P < 0.001$) in relation to those living with their partners. Supplementary Tables S1 and S2 provide further details of such trends.

Sexual satisfaction in the 3 months prior to and during the COVID-19 circuit breaker measures

Table 2 summarises levels of sexual satisfaction in the 3 months prior to and during the COVID-19 circuit breaker measures. In general, there were statistically significant relationships between partnership status with levels of sexual satisfaction across both time frames, as well as changes in sexual satisfaction. Those who were single reported lower levels of sexual satisfaction than those who were partnered in the 3 months before the COVID-19 circuit breaker measures ($P = 0.017$), whereas those who were living with their partners reported the highest levels of sexual satisfaction compared to those who were single or not staying with their partners ($P < 0.001$).

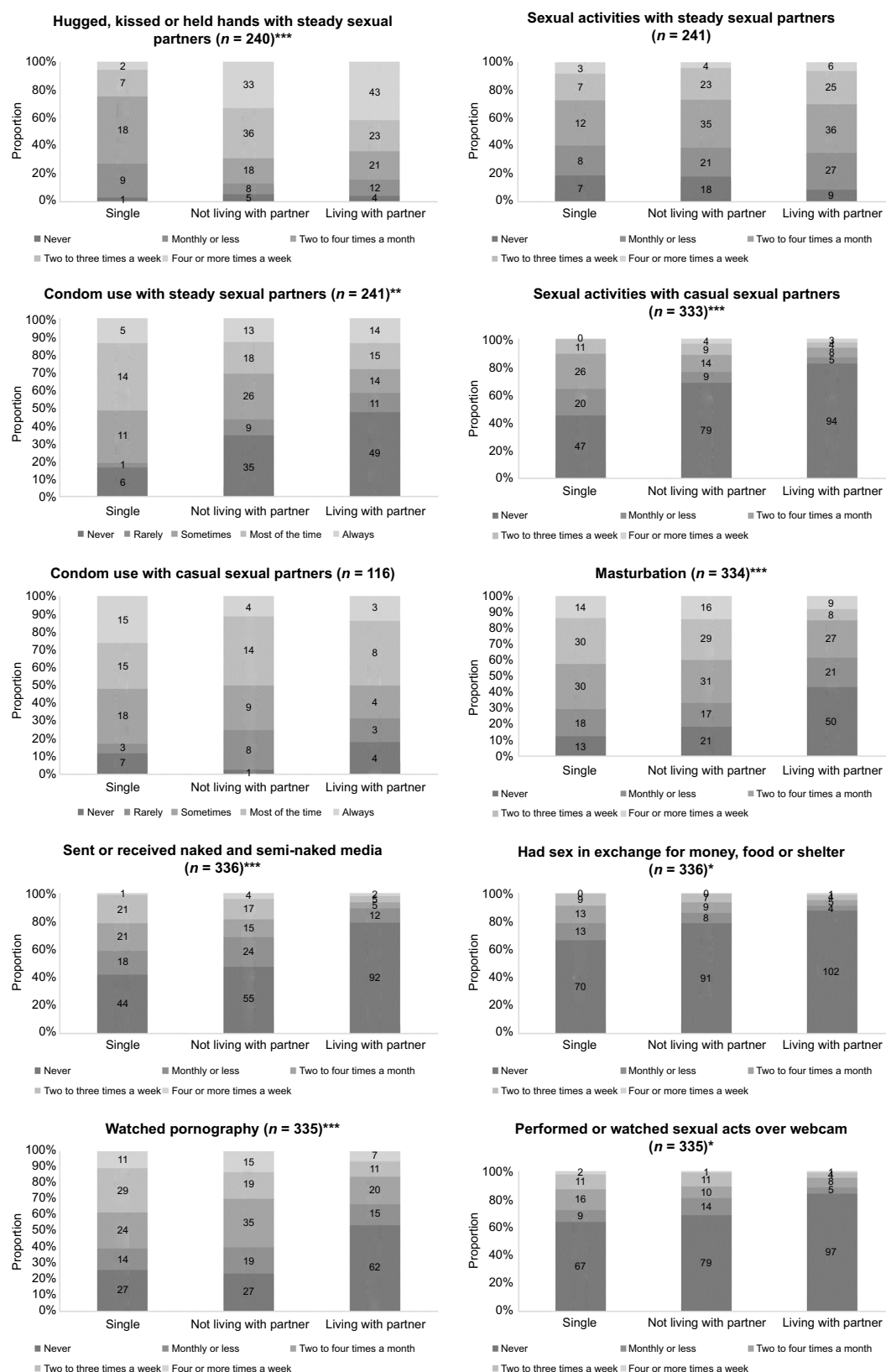


Fig. 1. Frequency of sexual behaviours in the 3 months prior to the COVID-19 circuit breaker measures. Notes: Chi-squared test: * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

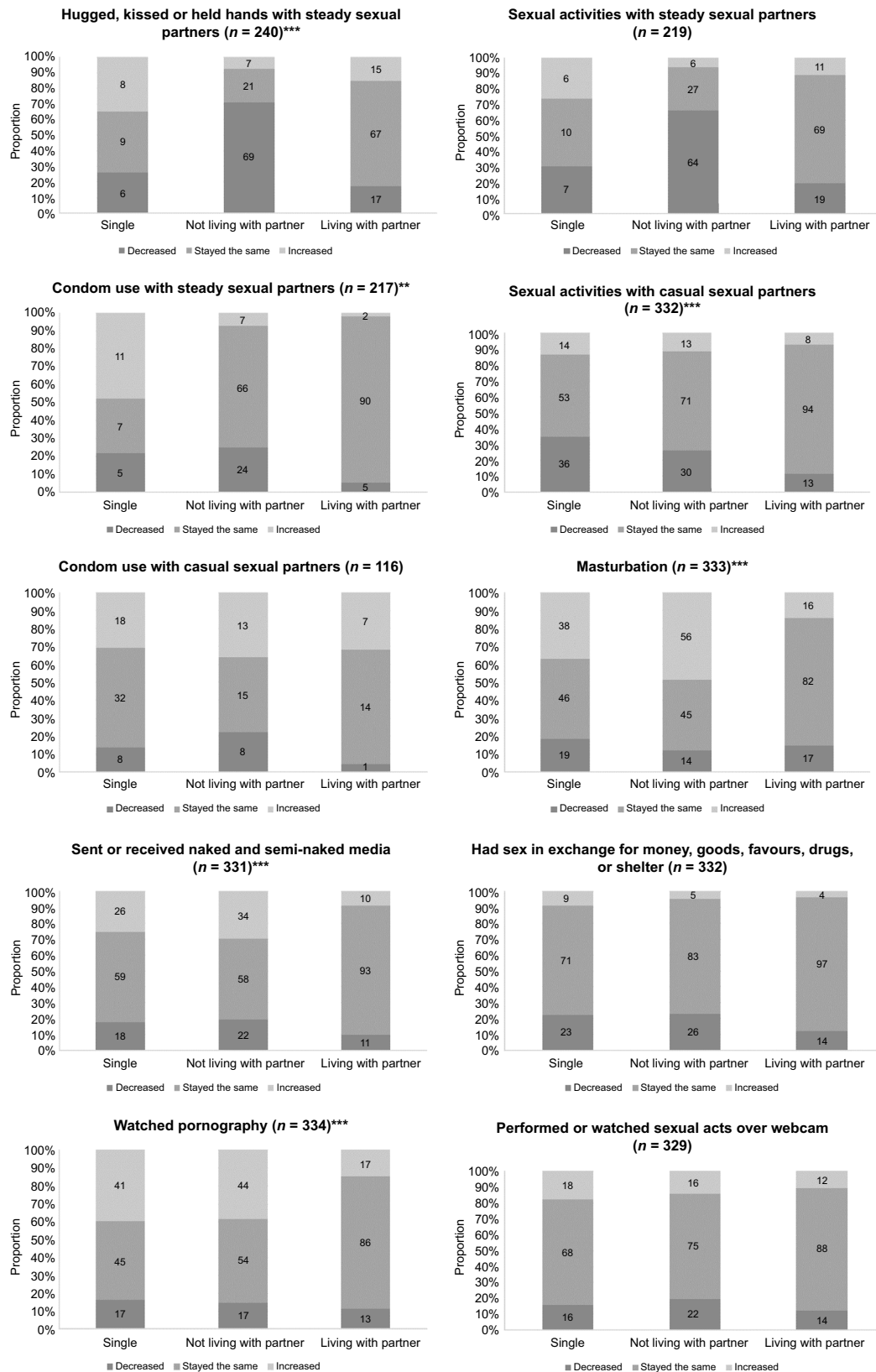


Fig. 2. Change in sexual behaviours during the COVID-19 circuit breaker measures. Notes: Chi-squared test: * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Table 2. Sexual satisfaction and problems before and during the COVID-19 circuit breaker measures, among individuals who ever had a sexual experience ($n = 338$).

Sexual satisfaction	Single (<i>n</i> = 106)		Not living with partner (<i>n</i> = 115)		Living with partner (<i>n</i> = 117)		Total (<i>n</i> = 338)		Chi-squared test
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Sexual satisfaction in the 3 months before circuit breaker measures (<i>n</i> = 332)									
Not at all satisfied	3	2.9	3	2.6	5	4.4	11	3.3	0.017
Not very satisfied	28	27.2	12	10.4	14	12.3	54	16.3	
Somewhat satisfied	50	48.5	60	52.2	59	51.8	169	50.9	
Very satisfied	22	21.4	40	34.8	36	31.6	98	29.5	
Sexual satisfaction: during circuit breaker measures (<i>n</i> = 330)									
Not at all satisfied	15	14.6	26	22.6	8	7.1	49	14.9	<0.001
Not very satisfied	43	41.8	41	35.7	19	17.0	103	31.2	
Somewhat satisfied	35	34.0	32	27.8	53	47.3	120	36.4	
Very satisfied	10	9.7	16	13.9	32	28.6	58	17.6	
Changes in sexual satisfaction (<i>n</i> = 330)									
Decreased satisfaction	42	40.8	64	55.7	16	14.3	122	37.0	<0.001
Stayed the same	56	54.4	44	38.3	92	82.1	192	58.2	
Increased satisfaction	5	4.9	7	6.1	4	3.6	16	4.9	

Table 3 summarises the multivariable Poisson regression models with aPRs (95% CI) for decrease in sexual satisfaction as a result of COVID-19 circuit breaker measures. Multivariable analyses revealed that those who were not living with their partners were more likely (aPR = 1.42, 95% CI [1.06, 1.90]), whereas those who were living with their partners were less likely (aPR = 0.44, 95% CI [0.25, 0.78]) to experience a decrease in sexual satisfaction, relative to those who were single. Results indicated that several demographic attributes were associated with decreased sexual satisfaction when stratified by partnership status. Among singles, those who were older in age (aPR = 0.96, 95% CI [0.93, 0.99]) and being of female sex (aPR = 0.52, 95% CI [0.32, 0.86]) were less likely to experience a decrease in sexual satisfaction; among those not living with their partners, those who were older in age (aPR = 1.02, 95% CI [1.01, 1.04]) were more likely to experience a decrease in sexual satisfaction; and among those living with their partners, those who were older in age (aPR = 0.95, 95% CI [0.93, 0.98]) were less likely to experience a decrease in sexual satisfaction.

Discussion

Findings of this study indicate that changes in sexual behaviour and satisfaction as a result of COVID-19 movement control measures may vary along the lines of an individual's partnership status and living arrangements. Among participants who ever had a sexual experience, those who were single or not living with their partners experienced a greater

decrease in sexual activities with steady and casual partners, but a greater increase in individual sexual behaviours such as masturbation, receiving or sending of nudes, and watching pornography. We found that those who were not living with their partners were more likely, whereas those who were living with their partners were less likely, to experience a decrease in sexual satisfaction, relative to those who were single.

We found that all subgroups reported a decrease in partnered sexual activities, though this was greater for those who were single or not living with their partners, compared to those living with their partners. This finding is unsurprising given that the circuit breaker measures meant that individuals could not visit their partners if they belonged to different households during that time. This finding is also consistent with research showing that those who were staying with their partners did not experience much change in their own sexual activities^{23,46} and, in fact, were given opportunities to try out novel forms of partnered sexual activities.¹⁹ In contrast, our finding that individuals who were single or not staying with their partners reported a decrease in such partnered activities comports with evidence elsewhere,^{10,47} though this finding is not consistent across settings,⁴⁸ and may be influenced by the extent of each nation's lockdown, as well as cultural or moral norms around social distancing.^{49,50}

Findings of the study illustrate that participants experienced changes in their levels of sexual satisfaction that varied along the lines of partnership status as well as living arrangements. Specifically, those who were living with their partners were

Table 3. Multivariable Poisson regression with aPRs (95% CI) for decrease in sexual satisfaction as a result of COVID-19 circuit breaker measures among individuals who ever had a sexual experience ($n = 338$).

Demographic variables	Overall ($n = 319$)			Single ($n = 101$)			Partnered: not cohabiting ($n = 110$)			Partnered: cohabiting ($n = 108$)		
	n/ Median	aPR	95% CI	n/ Median	aPR	95% CI	n/ Median	aPR	95% CI	n/ Median	aPR	95% CI
Age (years)	28	0.99	(0.97, 1.00)	24	0.97*	(0.94, 1.00)	26	1.02**	(1.01, 1.04)	34	0.95**	(0.93, 0.98)
Female sex (Ref = male sex assigned at birth)	246	0.83	(0.63, 1.10)	51	0.48**	(0.30, 0.78)	48	1.04	(0.74, 1.46)	49	0.91	(0.32, 2.55)
Non-heterosexual (Ref = heterosexual)	142	1.25	(0.94, 1.67)	58	1.44	(0.88, 2.36)	44	0.97	(0.68, 1.38)	40	2.34	(0.66, 8.27)
Non-Chinese (Ref = Chinese race)	55	1.12	(0.78, 1.60)	21	1.08	(0.64, 1.84)	15	1.18	(0.74, 1.86)	19	2.00	(0.51, 7.77)
No religion (Ref = having a religion)	98	0.94	(0.70, 1.28)	33	0.82	(0.49, 1.39)	42	0.94	(0.64, 1.38)	23	0.89	(0.28, 2.86)
Private housing (Ref = public housing)	76	1.22	(0.93, 1.61)	16	1.07	(0.68, 1.69)	24	1.13	(0.81, 1.57)	36	3.24*	(1.04, 10.06)
SGD3000 and above (Ref = below SGD3000)	188	0.97	(0.70, 1.35)	46	1.13	(0.73, 1.74)	66	0.58*	(0.36, 0.95)	76	1.10	(0.24, 5.00)
Degree educational attainment (Ref = below degree)	182	0.96	(0.69, 1.34)	44	0.92	(0.58, 1.47)	54	1.47	(0.99, 2.18)	84	0.41	(0.15, 1.15)
Relationship status (Ref = single)												
Partnered; not cohabiting	115	1.42*	(1.07, 1.90)									
Partnered; cohabiting	117	0.45**	(0.25, 0.81)									

Notes: The outcome variable on experiences of sexual satisfaction was only asked among individuals who ever had a sexual experience ($n = 338$); drops in sample size for models specified above are due to missing data for independent variables, as indicated in Table 1.

Statistically significant results are bolded; * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

least likely, whereas those who were not living with their partners were most likely, to experience a decrease in sexual satisfaction. This finding is consistent with some studies that show that levels of sexual satisfaction seem to be the least affected among those who were married or living with their partners during national lockdown or confinement periods.^{51,52} Nevertheless, several studies also report how increasing conflicts in romantic relationships as a result of the pandemic may also negatively impact the sexual lives of couples in some settings as well.^{53,54}

A key strength of this paper would be its contribution to the published literature on the sexual lives of individuals in Singapore and, more importantly, the impact of COVID-19 and the circuit breaker measures on sexual behaviours across different partnership status, as well as levels of sexual satisfaction. This study also contributes to a gap in sexual behaviour research among general populations in Asia due to conservative attitudes towards sex in the region.⁵⁵

We are also mindful of the study's limitations. First, the data in this study were not weighted, and the study is not a nationally representative study, we thus caution

generalising or extrapolating these findings to the general population of Singapore. Furthermore, the low median age of our sample may bias our findings towards younger groups in the Singapore context. Second, due to prevailing conservative attitudes towards sex and sexuality, social desirability bias may have led to the under-reporting of certain sexual behaviours that may be stigmatised, such as sex with casual partners or inconsistent condom use. Furthermore, participants who are more conservative might have also chosen not to participate in the survey, thus biasing our results towards participants with more sex-positive or liberal attitudes. Finally, we did not account for varying levels of sexual health and sexuality education or knowledge as a potential confounder, which may serve as a factor in the outcomes measured in this study. We also did not measure gender identity as a variable in this study, which may better reflect the role of gender rather than sex assigned at birth on sexual behaviour and outcomes.

We conclude with several recommendations for policymakers. First, given that partnered sexual activities were still taking place during the COVID-19 circuit breaker

measures, sexual and reproductive health services need to remain operational and accessible even as healthcare resources may be channelled towards emergency or primary care units during the pandemic. Second, a decrease in sexual satisfaction was experienced to varying extents across different partnership statuses and living arrangements; interventions that seek to promote sexual wellbeing should focus on those most affected by lockdown measures and promoting novel ways of promoting and reinventing intimacy with oneself or a partner in a different household.⁵⁶ Overall, those who were younger and not living with their partners were most likely to have experienced decreased sexual satisfaction as a result of the pandemic. Given that sexual satisfaction may impact mental wellbeing among young people,⁵⁷ interventions that seek to promote mental wellbeing should also consider how sexual wellbeing may have been a factor for poorer mental health outcomes in young people during the COVID-19 pandemic.

Finally, our findings indicate how COVID-19 and the circuit breaker measures have disrupted patterns of partnered and individual sexual behaviours across Singapore residents, and sexual and reproductive health services should anticipate a relative increase in partnered sexual activity to baseline levels as movement control measures are lifted.

Supplementary material

Supplementary material is available [online](#).

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Data availability. The data that support the findings of this study are available on request from the corresponding author, RKJT. The data are not publicly available due to information that could compromise the privacy of research participants.

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Author contributions. RKJT and CAO conceptualised the study; RKJT acquired the funding for the study; RKJT, CAO and NK conducted formal analyses; RKJT and CAO conducted the investigation; RKJT, CAO and NK curated the data associated with the study; RKJT wrote the original draft; CAO and NK reviewed and approved of the manuscript prior to submission.

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