

Transient Changes in Preexposure Prophylaxis Use and Daily Sexual Behavior After the Implementation of COVID-19 Restrictions Among Men Who Have Sex With Men

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Background: We assessed how the Dutch restrictions imposed on March 15, 2020, affected sexual behavior, preexposure prophylaxis (PrEP), and condom use among PrEP users in Amsterdam.

Methods: We used data on (1) PrEP use, (2) anal sex acts, and (3) condom use, per partner type [steady partners (SPs), known casual partners (KCPs), and unknown casual partners (UCPs)], collected daily through a mobile application used between December 1, 2019, and June 30, 2020. We compared the period before versus after March 15, 2020, regarding average proportion of days per week at which each end point was reported and average proportion of anal sex acts covered by PrEP and/or condoms.

Results: We included data from 136 men who have sex with men. After March 15, 2020, the proportion of days with anal sex increased with SPs [odds ratio (OR) = 1.26; 95% confidence interval (CI) = 1.10 to 1.44] and decreased with KCPs (OR = 0.73; 95% CI = 0.64 to 0.82) and UCPs (OR = 0.54; 95% CI = 0.48 to 0.61). Shifts in partner types were most profound immediately after March

15, 2020, whereas returning to prerestriction levels mid-May 2020. The proportion of days with PrEP use decreased from 74% before to 58% after March 15, 2020 ($P < 0.001$). After March 15, 2020, PrEP use during sex decreased with UCPs ($\beta = -0.36$; 95% CI = -0.72 to 0.00) but not with SPs and KCPs. Condom use during sex decreased with KCPs ($\beta = -0.36$; 95% CI = -0.67 to 0.04) and UCPs ($\beta = -0.24$; 95% CI = -0.46 to 0.03) but not with SPs.

Conclusions: MSM decreased sex with casual partners and increased sex with SP, but changes were transient. Decreases in sex acts with casual partners paralleled decreases in PrEP use. However, condom use during sex with casual partners decreased, indicating the importance of continued sexual health services, including sexually transmitted infections screening and PrEP care, during COVID-19 restrictions.

Key Words: COVID-19, preexposure prophylaxis, HIV, prevention and control, sexual behavior, men who have sex with men

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INTRODUCTION

In the Netherlands, the first case of coronavirus disease 2019 (COVID-19), caused by the SARS-CoV-2 virus, was diagnosed on February 27, 2020. By the end of October 2020, more than 350,000 confirmed SARS-CoV-2 infections had been reported.¹ To prevent the spread of SARS-CoV-2 virus, the Dutch government introduced a series of restrictions starting between March 12 and 15, 2020, such as cancelling large events, closing public facilities, restricting international travel, urging everyone to work from home, and minimizing physical contact (defined as less than 1.5-m distance) with nonhousehold members.^{2,3}

These restrictions also included closure of meeting venues alongside the specific recommendation of not to have sex with partners outside the household.⁴ This could have hypothetically led to decreases in sexual activity with casual partners and increases in sexual activity with steady partners. Consequently, the need for condoms and preexposure prophylaxis (PrEP) to prevent HIV and transmission of sexually transmitted infections (STI) including HIV could have decreased in parallel. By contrast, decreasing HIV/STI testing and less PrEP use could have also led to increased HIV/STI transmission. From May 11, 2020, onward, the Dutch government started to lift restrictions, albeit the recommendation of physical distancing was not lifted.⁵

In the Netherlands, PrEP is indicated for men who have sex with men (MSM) and transgender people (TGP) who, in the previous 6 months, had condomless anal sex (CAS) with a male partner with unknown HIV status or detectable HIV viral load, were diagnosed with an anal STI or syphilis, and/or used postexposure prophylaxis.⁶ PrEP is predominantly provided through STI clinics as part of a national program that started in August 2019, offering PrEP at a reduced price; it can also be obtained at a higher price through general practitioners. When COVID-19 restrictions were first put in place, the outpatient STI clinic in Amsterdam scaled down PrEP care and suspended routine HIV/STI testing from March 23. PrEP was provided only to those already using PrEP and who had a continued need for it. HIV/STI care was restricted to only those with STI-related symptoms, who were warned by a partner, or victims of a sex offence, and sexual health counseling during these consultations was minimized. From the beginning of May 2020, restrictions were gradually eased, and PrEP users in the National PrEP program were contacted again for follow-up appointments.

Given the scale down of routine PrEP care, it is uncertain whether all individuals received timely PrEP refills and adequate PrEP care during the period of heavy restrictions. Monitoring sexual behavior and HIV/STI prevention choices in the months before and after restrictions among PrEP users could inform future policy by providing a deeper understanding of sexual behavior and PrEP needs and help to prioritize related services during future periods of social restrictions.

Current evaluations of the effect of COVID-19 restrictions on PrEP use and sexual behavior have mainly relied on cross-sectional questionnaires in which individuals were asked to recall whether their sexual activity had changed

during restrictions.^{7–11} These studies are subject to recall bias. In the Amsterdam PrEP demonstration project, participating MSM were asked to complete a diary-based mobile application daily, which contained questions on sexual behavior and condom and PrEP use. We used these prospectively collected data to assess how sexual behavior and use of condoms and PrEP were affected by the Dutch COVID-19 restrictions imposed in March 2020.

METHODS

Study Design and Participants

Amsterdam PrEP (AMPrEP) was a prospective, open-label demonstration study conducted at the STI clinic of the Public Health Service of Amsterdam, the Netherlands. Its primary aim was to assess the uptake and feasibility of daily and event-driven PrEP use among MSM and TGP. Detailed study procedures have been previously published.¹² In brief, HIV-negative MSM and TGP aged 18 years or older were eligible for inclusion if they were indicated for PrEP. Enrollment took place between August 3, 2015, and May 31, 2016, and follow-up ended on December 1, 2020. All participants provided written informed consent.

The study was approved by the ethics board of the Amsterdam University Medical Centre, location Academic Medical Center (Amsterdam, the Netherlands; NL49504.018.14), and is registered with the Netherlands Trial Registry (number NL5302). The study protocol is available online (<https://www.ggd.amsterdam.nl/infectieziekten/soa-hiv-sense/prep/amprep/>). AMPrEP was part of the HIV Transmission Elimination Amsterdam (H-TEAM) Initiative, a multidisciplinary and integrative approach to stop the urban HIV epidemic.

Procedures

Participants self-selected either daily or event-driven PrEP use, both free of charge, at inclusion. Daily PrEP consisted of a single tablet containing 245 mg of tenofovir disoproxil fumarate combined with 200 mg of emtricitabine, taken once per day. Event-driven PrEP consisted of 2 tablets taken between 24 and 2 hours before sexual intercourse, followed by one tablet every 24 hours after the double dose, up to 48 hours after the last sexual intercourse.¹³ Participants were provided with free-of-charge PrEP, monitored, tested for HIV and STIs every 3 months, and allowed to switch PrEP regimens at every study visit.

A mobile application (app) was developed for Android and iOS in which participants could report their sexual behavior and PrEP use. Information on the design and use of the app has been previously published.¹⁴ In brief, participants could indicate every day whether they (1) took a PrEP pill and (2) had anal sex. If they indicated anal sex, follow-up questions were prompted about the type of sexual partners and whether a condom was used during sex on that day. We differentiated the partners as steady partners (SPs), known casual partners (KCPs), and unknown casual partners (UCPs). A SP was a sex partner with whom the participant was partnered in a steady relationship (independent of length of time). A KCP was a sex partner who was known to the

participant but not a steady partner. A UCP was a sex partner who was unknown to the participant. Participants could indicate multiple sex acts and multiple partner types per day. An update of the app was released in November 2019. Since then, participants could also indicate the number of different sex partners per partner type on a given day and whether they had used a condom during each individual sex act.

Outcomes

We assessed the proportion of days per week on which each of the following end points was reported of the total number of days on which data were reported in the app: (1) PrEP use (2) anal sex act, and (3) condom use, both overall and according to partner type. In addition, we evaluated the average proportion of anal sex acts during which PrEP and/or condoms were used. Similar to a previous analysis,¹⁵ we distinguished 4 possible prevention strategies per anal sex act: (1) PrEP and condom, (2) PrEP only, (3) condom only, and (4) no PrEP and no condom.

Statistical Analysis

For this analysis, we included data from all participants who were still actively followed up by December 1, 2019 (ie, at least one study visit in the 9 months before December 1, 2019) and who filled in information in the app at least once between December 1, 2019, and June 30, 2020. To assess possible differences in actively followed participants who were included and excluded from analysis, we compared characteristics and sexual behavior at PrEP initiation between those with and those without app data from December 1, 2019, to June 30, 2020. In addition, we assessed and compared characteristics and sexual behavior in included participants who recorded app data both before and after March 15, 2020, versus those who reported data only before or only after March 15, 2020. We obtained *P* values for comparisons using the Pearson χ^2 , Fisher exact, or rank sum tests, as appropriate. We plotted use of the app and PrEP pill intake over time.

We used app data from 2 periods. First, we used data from December 1, 2019, until June 30, 2020 (ie, 15 weeks before and 15 weeks after the restrictions imposed on March 15, 2020) to compare behavior in the periods directly before and after the implementation of COVID-19 restrictions. Second, we used data from December 1, 2018 until June 30, 2019 to define a control period based on the previous year (ie, 15 weeks before and 15 weeks after March 15, 2019).

We compared the mean proportion of days per week on which PrEP use, anal sex, and condom use was reported before and after March 15, 2020. We modeled each outcome using multilevel logistic regression while adding a random intercept to account for baseline variation between participants. In addition, we calculated variance assuming independently and identically distributed error across individuals. We included a dichotomous before/after restrictions covariate to calculate the odds ratio (OR) and 95% confidence interval (CI) comparing the odds of having an end point before versus after restrictions. To evaluate whether changes could also be observed the previous year, we evaluated changes in anal sex acts before and after March 15, 2019. We

accomplished this by running the same model with additional data from this control period. To evaluate whether the difference in anal sex acts before and after March 15 was different between periods, we tested a 2-way interaction term between period and before/after restrictions. We obtained *P* values for each comparison using the Wald χ^2 test.

We then compared the average proportion of sex acts during which PrEP and/or condom were used in the period before versus after March 15, 2020. We simultaneously modeled PrEP use (yes/no) and condom use (yes/no) using bivariate probit regression, while calculating the variance assuming independently and identically distributed error across clusters of individuals. Again, we included a dichotomous before/after restrictions covariate to estimate the fold effect on the predicted outcome probability (β) and its 95% CIs before and after restrictions. We obtained *P* values for these comparisons using the Wald χ^2 test.

Each of the above-described model was run separately for each partner type. In sensitivity analyses, we restricted analyses to participants who filled in the app $\geq 90\%$ of days during each month between December 1, 2019, and June 30, 2020. All analyses were performed using Stata (version 15.1, StataCorp, College Station, TX). Heatmaps showing patterns of PrEP use for each participant over time during the first period were generated using the ggplot2 package in R (version 3.6.3, Vienna, Austria).¹⁶

Role of the Funding Source

The study funders had no role in study design, data collection, data analysis, data interpretation, or writing of the report. All authors had full access to all data in the study. LC had final responsibility for the decision to submit for publication.

RESULTS

Of the 376 enrolled AMPPrEP participants, 302 (80.3%) were in active follow-up by December 1, 2019. Of these, 136 (45%) reported data in the app at least once between December 1, 2019, and June 30, 2020, and were included in this analysis. All included participants were MSM, 125 (92%) self-identified as White and 82 (60%) lived in Amsterdam at PrEP initiation (see Table 1, Supplemental Digital Content, <http://links.lww.com/QAI/B658>). By December 1, 2019, median age was 47.5 years [interquartile range 40–56], median follow-up time was 3.9 years (interquartile range 3.7–4.1), and 91 (67%) used PrEP daily and 45 (33%) used event-driven PrEP. Of all AMPPrEP participants who were in active follow-up by December 1, 2019, those included in this analysis were older, more often self-identified as White, and more often lived with a partner compared with those excluded (see Table 1, Supplemental Digital Content, <http://links.lww.com/QAI/B658>).

App Use

Between December 1, 2019, and June 30, 2020, the app was filled in for a total of 10,751 days in the 15 weeks before and 8851 days in the 15 weeks after March 15, 2020 (Table 1), and use of the app decreased per month (see Figure 1, Supplemental

Digital Content, <http://links.lww.com/QAI/B658>). Participants who recorded app data before and after March 15, 2020 (n = 103) were more likely to be employed compared with participants who reported data before or after 15 March 2020 (n = 33) but did not have significantly different sexual behavior (see Table 2, Supplemental Digital Content, <http://links.lww.com/QAI/B658>).

Sexual Behavior

The number of anal sex acts with SPs increased among 29 (28.2%) participants; 56 (54.4%) reported fewer sex acts

TABLE 1. PrEP Use and Sexual Behavior per Partner Type in the 15 Weeks Before and the 15 Weeks After the Implementation of COVID-19 Restrictions, as Reported in the App by 136 AMPrEP Participants From December 1, 2019, to June 30, 2020, Amsterdam, the Netherlands*

	On Days Before March 15		On Days From March 15		P‡
	n†	%†	n†	%†	
PrEP used					<0.001
No	2792	26	3712	42	
Yes	7959	74	5139	58	
Sex acts with an SP					0.088
No	10,233	95	8362	94	
Yes	518	5	489	6	
Condoms used during sex acts with SPs					
Never	500	97	472	97	
Sometimes	3	1	1	0	0.573
Always	15	3	16	3	0.517
Sex acts with a KCP					0.006
No	9984	93	8382	95	
Yes	767	7	469	5	
Condoms used during sex acts with KCPs					
Never	699	91	448	96	
Sometimes	14	2	3	1	0.253
Always	54	7	18	4	0.854
Sex acts with a UCP					<0.001
No	9766	91	8357	94	
Yes	985	9	494	6	
Condoms used during sex acts with UCPs					
Never	869	88	456	92	
Sometimes	43	4	10	2	0.079
Always	73	7	28	6	0.850

*On 9366 days between December 2019 and June 2020, no response was recorded in the app: on 3529 days (38%) before March 15, 2020 and on 5837 days (62%) from March 15.

†Unless stated otherwise.

‡P value was estimated using a multilevel logistic regression while adding a random intercept to account for baseline variation between participants. We calculated the variance assuming independently and identically distributed error across clusters of individuals.

IQR, interquartile range.

with KCPs and 68 (66.0%) with UCPs. Figure 1 shows the average proportion of days per week on which anal sex was reported over time, according to partner type and period. Compared with data before March 15, 2020, the proportion of days with anal sex was higher with SPs (OR 1.26, 95% CI 1.10 to 1.44) and lower with KCPs (OR 0.73, 95% CI 0.64 to 0.82) after this date (Table 2). In the previous year, there was no evidence for changes after March 15, 2019 in either partner type (OR 1.07, 95% CI 0.96 to 1.19 and OR 0.98, 95% CI 0.89 to 1.07, respectively). A more pronounced reduction in the proportion of days with anal sex with UCPs was observed after March 15, 2020 (OR 0.54, 95% CI 0.48 to 0.61) compared with the same period in the previous year (OR 0.92, 95% CI 0.83 to 1.01). When examining the proportion of days with anal sex across weeks, the changes during COVID-19 restrictions seemed to last for 8 weeks, and from mid-May 2020, levels returned to comparable with those before restrictions (Fig. 1). Similar observations were found in a sensitivity analysis among the 58 participants who filled in the app ≥90% of days during each month (see Table 3 and Figure 3, Supplemental Digital Content, <http://links.lww.com/QAI/B658>).

PrEP and Condom Use

Among 69 of the 103 participants (67.0%) who reported data before and after March 15, 2020, PrEP use decreased after March 15. Condom use with SPs, KCPs, and UCPs decreased in 35 (34.0%), 26 (25.2%), and 27 (26.2%) participants, respectively.

Using data from all 136 included participants, the average proportion of days per week on which PrEP use was reported decreased from 74% in the period before to 58% in the period after March 15, 2020 (P < 0.001) (Table 1). Patterns of PrEP use for each participant per day are depicted in Figure 2, Supplemental Digital Content, <http://links.lww.com/QAI/B658>.

Tables 3 and 4 tabulate the use of PrEP and/or condoms per individual anal sex act according to partner type during the periods before and after March 15, 2020. Figure 4, Supplemental Digital Content, <http://links.lww.com/QAI/B658> shows the distribution of the 4 possible prevention strategies across weeks. Compared with data before March 15, 2020, the average proportion of sex acts with UCPs during which PrEP was used was lower after this date (β = -0.36, 95% CI -0.72 to 0.00), but PrEP use during sex with SPs and KCPs did not change (β = -0.46, 95% CI -1.11 to 0.19 and β = -0.20, 95% CI -0.62 to 0.22, respectively) (Table 3). The proportion of sex acts with KCPs (β = -0.36, 95% CI -0.67 to 0.04) and UCPs (β = -0.24, 95% CI -0.46 to 0.03) covered by condoms was lower after versus before March 15, 2020, but condom use during sex with SPs did not change (β = -0.01, 95% CI -0.48 to 0.46). The proportion of sex acts with KCPs and UCPs during which PrEP and condoms were used decreased after compared with that before March 15, 2020 (P = 0.0259 and P = 0.0113, respectively, Table 4). The proportion of sex acts during which PrEP or condoms were not used increased for

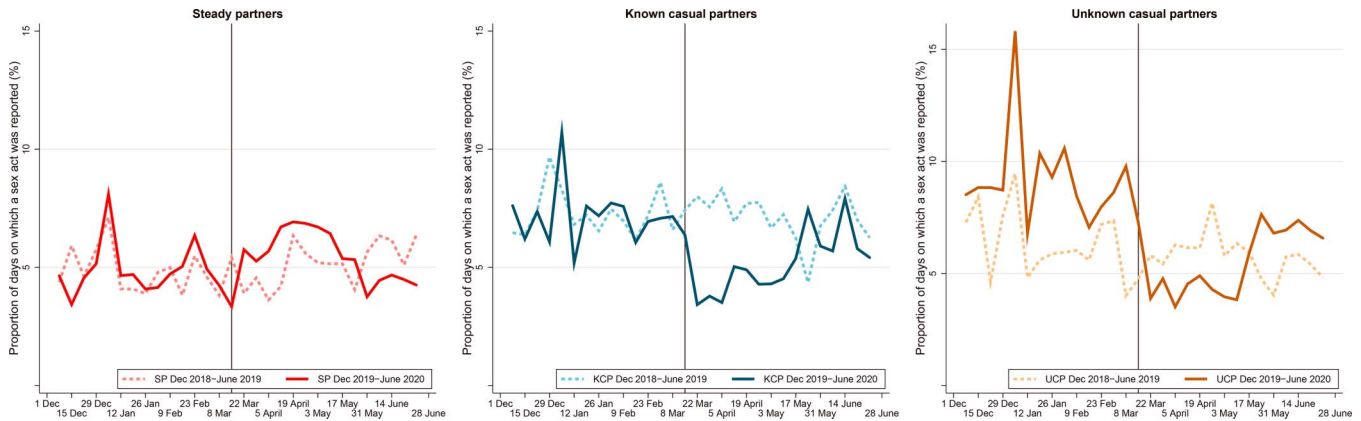


FIGURE 1. Mean proportion of days per week on which anal sex was reported per partner type over time in the 15 weeks before and after COVID-19 restrictions, per period, Amsterdam, the Netherlands. Dec, December; Feb, February; Jan, January; Mar, March.

all partner types, but this increase was not significant (all $P > 0.05$, Table 4).

DISCUSSION

Based on daily diary data from a mobile application used by MSM, we provide a longitudinal assessment of changes in sexual behavior of PrEP users after the implementation of COVID-19 restrictions on March 15, 2020 in the Netherlands. We observed that trends in sexual behavior after March 15, 2020 diverged by partner type. After the imposition of restrictions, the average proportion of days per week on which anal sex was reported with casual partners declined steeply, whereas anal sex with steady partners increased. Overall PrEP use decreased after restrictions, suggesting a reduced need or perceived reduced need for PrEP. Condom use during sex with casual partners decreased, whereas PrEP use remained largely comparable, apart from a slight reduction for sex with UCPs.

The observed shifts in partner types suggest that the implementation of COVID-19 restrictions, including the recommendation to limit sex to partners within the same household, likely steady partners,⁴ were followed by many of our participants. Because these patterns were not observed for SPs and KCPs in the same period 1 year before, and less

pronounced for UCPs, we argue that these shifts were attributed to COVID-19 restrictions. These findings substantiate the patterns found in a limited number of cross-sectional surveys in Australia, Brazil, the United States, and the Netherlands.^{7-10,17} Because of their cross-sectional nature, however, these studies were unable to adequately compare changes over time.

We found that the shifts in partner types were transient and most profound immediately after COVID-19 restrictions were announced on March 15, 2020. Once the most restrictive recommendations were relaxed from May 11, 2020,⁵ sexual behavior seemed to return to prelockdown levels for each partner type, although the recommendation of physical distancing was not lifted. This rebound in sexual behavior after COVID-19 restrictions were lifted has received little attention in previous studies. Some authors suggest that reductions in casual sex may have reduced HIV and STI transmission, and preliminary evidence would suggest this to be the case.^{17,18} However, if changes in casual sex are only short-term, their impact on STI incidence will be limited. It is indeed possible that because restrictions were implemented and much was unknown regarding severity and transmission of COVID-19, the perceived threat and severity of SARS-CoV-2 infection increased and led to the sudden change in

TABLE 2. Changes in the Mean Proportion of Days Per Week on Which Anal Sex was Reported Per Partner Type in the 15 Weeks Before Compared With After COVID-19 Restrictions, Per Period, Amsterdam, the Netherlands

	Steady Partner(s)			Known Casual Partner(s)			Unknown Casual Partner(s)		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
December 2019 to June 2020			0.0694*			0.0002*			<0.0001*
Before March 15	REF			REF			REF		
After March 15	1.26	1.10 to 1.44	0.0011	0.73	0.64 to 0.82	<0.0001	0.54	0.48 to 0.61	<0.0001
December 2018 to June 2019									
Before March 15	REF			REF			REF		
After March 15	1.07	0.96 to 1.19	0.239	0.98	0.89 to 1.07	0.589	0.92	0.83 to 1.01	0.077

*P value of the 2-way interaction between period and before/after restrictions using a multilevel logistic regression while adding a random intercept to account for baseline variation between participants.

TABLE 3. Changes in PrEP and Condom Use Per Anal Sex Act Per Partner Type Before and After the Implementation of COVID-19 Restrictions, From December 1, 2019 to June 30, 2020, Amsterdam, the Netherlands

	Steady Partner(s)			Known Casual Partner(s)			Unknown Casual Partner(s)		
	β^*	95% CI	<i>P</i>	β	95% CI	<i>P</i>	β	95% CI	<i>P</i>
PrEP use									
Before March 15	REF			REF			REF		
After March 15	-0.46	-1.11 to 0.19	0.166	-0.20	-0.62 to 0.22	0.348	-0.36	-0.72 to 0.00	0.0504
Condom use									
Before March 15	REF			REF			REF		
After March 15	-0.01	-0.48 to 0.46	0.978	-0.36	-0.67 to -0.04	0.0264	-0.24	-0.46 to -0.031	0.0248

*Effect estimates, 95% CI, and *P* values were obtained using bivariate probit regression.

behavior.^{19,20} The effect of these changes in sexual behavior on HIV and STI incidence should be further evaluated. Because, at our clinic, the need for STI screening during restrictions was mostly prioritized on the presence of STI-related symptoms, partner notification, or sex offence, asymptomatic STIs would no longer be detected, which would increase the probability of ongoing transmission. Understanding how to optimize STI screening during periods of social restrictions is, therefore, warranted.

After the implementation of COVID-19 restrictions, we additionally observed changes in use of HIV/STI prevention strategies with different partner types. The overall decrease in PrEP use after the implementation of restrictions was likely because of the decrease in sex acts with casual partners. Similarly, in previous analyses of AMPrEP, switching to a lower-frequency PrEP regimen and discontinuation of PrEP were found to be partly driven by less frequent sexual contact or fewer partners.²¹ PrEP use during sex with casual partners did not differ greatly before and after the implementation of COVID-19 restrictions, although a slight reduction was found for sex with UCPs. It is reassuring that PrEP was used during most of the sex acts with casual partners in a period when STI clinics were not as easily accessible for HIV testing and PrEP care.

On the other hand, the decrease in condom use during sex with casual partners deserves further attention. Although the downward trend in condom use could be an artifact of general declines in condom use among PrEP users,^{22,23} alternative explanations might also be relevant. Because participants limited the number of KCPs and UCPs during COVID-19 restrictions, perceived risk of HIV/STI may have been reduced in parallel, resulting in a reduction in condom use. Participants might have also expected less frequent sexual encounters with UCPs during COVID-19 restrictions and consequently stopped PrEP or did not have PrEP readily available. This could result in no HIV/STI prevention strategies being used when sex with a UCPs occurs spontaneously, particularly for men whose use of condoms was already low.

Based on these findings, there is a strong need for ongoing PrEP provision and STI screening and counseling in a subset of PrEP users with continued casual sex during COVID-19 restrictions. Reasons for not taking PrEP during restrictions, particularly with casual sex partners, need to be

established to provide input for ongoing PrEP and STI services during restrictions. A study from Brazil reported that lack of PrEP accessibility was the predominant reason for PrEP discontinuation during their SARS-CoV-2 epidemic.⁹ If it is also the case in the Netherlands, sexual health clinics should look for alternative ways to provide PrEP, such as online services, or share PrEP care and services evenly with general practitioners who remained accessible for consultations during COVID-19 restrictions.

The strengths of this study were the availability of longitudinal daily diary data on sexual behavior, which could be stratified by partner type and could allow evaluation of short-term changes. In addition, we were able to rule out any time-based effect aside from COVID-19 restrictions by comparing changes during the same dates 1 year before. Daily collected data from an app is, furthermore, less likely to be influenced by recall and social desirability bias compared with retrospective surveys.²⁴

However, the use of daily app data also has some limitations. First, the distribution of some characteristics known to influence sexual behavior, such as age and living situation, did differ between app users and nonapp users. Second, not all participants answered the questions in the app every day; app use decreased over time, and some participants stopped using the app during COVID-19 altogether. We did not account for these missing data because they were likely not at random but rather associated with absence of sex and PrEP use. Accounting for missing data would have likely further enlarged the difference between periods before versus after restrictions. However, the effect may be limited because we found similar patterns in sensitivity analyses among participants who filled in the app $\geq 90\%$ of days within each month, and demographic characteristics and sexual behavior were largely similar for participants who did and did not use the app after the implementation of COVID-19 restrictions. Third, we did not have data on sexual positioning during sex and whether condoms were used the entire sex act and can, therefore, not make inferences about HIV risk during individual CAS acts. Fourth, the AMPrEP study population is a selective group of older, highly educated, white, early PrEP adopters who had been taking PrEP for roughly 4 years before the COVID-19 epidemic, and results may not be generalizable to all MSM taking PrEP. Specifically, this cohort of experienced PrEP users has been extensively

TABLE 4. PrEP and Condom Use Per Anal Sex Act Per Partner Type in the 15 Weeks Before Compared With After the Implementation of COVID-19 Restrictions, as Reported in the App by 136 AMPrEP Participants From December 1, 2019 to June 30, 2020, Amsterdam, the Netherlands

	Steady Partner(s)			Known Casual Partner(s)			Unknown Casual Partner(s)		
	Before (n = 518)	After (n = 489)	P*	Before (n = 680)	After (n = 469)	P*	Before (n = 985)	After (n = 494)	P*
	n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
PrEP only	410 (79.2)	314 (64.2)	0.151	680 (88.7)	429 (91.5)	0.324	843 (85.6)	428 (86.6)	0.813
PrEP and condoms	14 (2.7)	15 (3.1)	0.765	61 (8.0)	15 (3.2)	0.0259	107 (10.9)	29 (5.9)	0.0113
Condoms only	4 (0.8)	2 (0.4)	0.442	7 (0.9)	6 (1.3)	0.658	9 (0.9)	9 (1.8)	0.404
No PrEP and no condoms	90 (17.4)	158 (32.3)	0.149	19 (2.5)	19 (4.1)	0.280	26 (2.6)	28 (5.7)	0.142

*P value obtained using bivariate probit regression.

counseled in safely starting and stopping PrEP and might, therefore, be more equipped to estimate their HIV risk and change their PrEP use accordingly^{21,25} compared with recent-initiation PrEP users. Therefore, the results of this study should be confirmed in other groups of PrEP users. Fifth, in this analysis, no data were available on TGP. Finally, because the outcomes assessed with the multilevel logistic regression models occurred frequently, the odds ratios obtained from these models cannot be interpreted as risk ratios.

CONCLUSIONS

In conclusion, the sex acts by MSM decreased with casual partners and increased with SPs in response to the Dutch COVID-19 restrictions, although these changes were transient. The decrease in sex with casual partners was paralleled with a decrease in PrEP use. However, condom use during sex with casual partners decreased. Continued sex with casual partners, although reduced, and the decrease in condom use with these partners indicate the importance of continued sexual health services, including STI screening and PrEP care, during COVID-19 restrictions. Putting infrastructure into place to make these services available, while safeguarding the potential risk of SARS-CoV-2 infection for patients and clinical staff (eg, online consultations or home-based testing), is of importance not only during the current pandemic but also for potential future pandemics.

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The AMPrEP data are owned by the Public Health Service of Amsterdam. Original data can be requested by submitting a study proposal to the steering committee of AMPrEP. The proposal format can be obtained from the corresponding author (lcoyer@ggd.amsterdam.nl or

amprep@ggd.amsterdam.nl). Requests for further information can also be submitted through the same email addresses. The AMPrEP steering committee will check each proposal for compatibility with general objectives, ethical approvals, and informed consent forms of the AMPrEP study and potential overlap with ongoing work. There are no other restrictions to obtaining the data, and all data requests will be processed in the same manner.

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