

# Associations between oral sex practices and frequent mouthwash use in men who have sex with men: implications for gonorrhoea prevention

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**Abstract.** *Background:* Rates of gonorrhoea continue to rise among men who have sex with men (MSM) in Australia and worldwide. Recently, it has been proposed that oropharyngeal gonorrhoea may play a role in its onward transmission and that mouthwash use may be an effective intervention for gonorrhoea prevention and control. The objective of this study was to determine the association between specific oral sex practices and frequency of mouthwash use. *Methods:* A questionnaire-based study was conducted among MSM attending the Melbourne Sexual Health Centre in Australia from March to September 2015. Logistic regression was performed to examine the association between frequent mouthwash use (i.e. daily or weekly mouthwash use) and four oral sex practices (tongue kissing, receptive fellatio with or without ejaculation, and insertive rimming) among MSM. *Results:* Of the 918 MSM included in the final analysis, 490 men (53.4%) were frequent mouthwash users. Participants aged 24–34 years were 2.13-fold (95% CI 1.52–2.98) and those  $\geq 35$  years were 2.64-fold (95% CI 1.83–3.83) more likely to use mouthwash frequently than those aged  $\leq 24$  years. The most common oral sex practice was tongue kissing ( $n = 874$ ; 95.2%), followed by receptive fellatio without ejaculation ( $n = 839$ ; 91.4%), receptive fellatio with ejaculation ( $n = 610$ ; 66.5%), then insertive rimming ( $n = 356$ ; 38.8%). No significant association was found between frequent mouthwash use and tongue kissing, receptive fellatio with or without ejaculation, or insertive rimming with regular or casual male partners in the previous 3 months. *Conclusions:* Younger MSM are less likely to use mouthwash. There is no association between engaging in oral sex practices and frequent mouthwash use among MSM.

**Additional keywords:** homosexuality, *Neisseria gonorrhoeae*, sexual practices, sexually transmissible infection.

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## Introduction

Rates of gonorrhoea continue to rise among gay, bisexual and other men who have sex with men (MSM) in Australia<sup>1</sup> and worldwide.<sup>2,3</sup> Apart from the clear morbidity associated with high rates of gonorrhoea, the higher rates of infection increase the risk of resistant strains developing and are the reason that both the World Health Organization and Centers for Disease Control and Prevention have called for collaborative action to reduce the burden of the infection and the use of antibiotics.<sup>4</sup>

It has been proposed that the oropharynx may play a larger role in onward gonorrhoea transmission among MSM.<sup>5,6</sup> Studies have shown that gonorrhoea can be cultured in human saliva,<sup>7–9</sup> suggesting that saliva is infectious and gonorrhoea could be transmitted via saliva during sex. An Australian study has also demonstrated that use of saliva as a lubricant during anal sex is a risk factor for anorectal gonorrhoea among MSM.<sup>10</sup> The risk of gonorrhoea transmission

from saliva, coupled with the fact that oropharyngeal gonorrhoea is often asymptomatic, places oropharyngeal gonorrhoea as a potential driver of gonorrhoea prevalence in MSM.<sup>5</sup>

If oropharyngeal gonorrhoea does play a greater role in transmission than what was previously thought, an intervention aimed at the oropharynx may be beneficial. However, to date, there has been no intervention targeting the oropharynx for gonorrhoea prevention and control. A small Australian randomised controlled trial (RCT) and laboratory study have found that a single dose of antiseptic mouthwash inhibited the growth of *Neisseria gonorrhoeae*.<sup>11</sup> This suggests mouthwash use could potentially be a preventive intervention for gonorrhoea control, and a larger RCT in Australia is underway to confirm this.<sup>12</sup>

Oral sex practice might be a confounding factor associated with mouthwash use due to personal oral hygiene.<sup>13</sup> In order to understand whether frequent mouthwash use is associated

with any particular oral sex practice, we undertook an analysis of an earlier study to determine the association between mouthwash use and specific oral sex practices (i.e. tongue kissing, insertive rimming and receptive fellatio).<sup>5</sup>

## Methods

### *Study population and setting*

A case-control study named the 'GONorrhoea Eradication' (GONE) study was conducted at the Melbourne Sexual Health Centre (MSHC), Victoria, Australia, between 30 March and 23 September 2015. MSHC is the largest public sexual health service in Victoria, which provided ~39 000 consultations in 2015, of which 38% of the consultations were for MSM.<sup>14</sup> The details of the study design and main findings were published elsewhere.<sup>15</sup> In brief, the GONE study was a 29-item multiple choice, paper-based questionnaire on mouthwash use and sexual practices with regular and casual partners in the previous 3 months among MSM. The primary aim of the GONE study was to determine the risk factors associated with oropharyngeal gonorrhoea.<sup>15</sup> The secondary analysis in the present study examined the association between oral sexual practices and frequent mouthwash use. MSM aged  $\geq 16$  years attending the MSHC during the study period who reported having sex with another man in previous 12 months were invited by clinicians to complete the questionnaire. Consent was implied by returning a completed questionnaire. Ethical approval was obtained from the Alfred Hospital Ethics Committee, Melbourne, Victoria, Australia (number 544/14).

### *Study measures*

Eligible men were given a questionnaire that asked about their frequency of mouthwash use, whether they had regular or casual male partners in the previous 3 months, how many regular and casual male partners they had in the previous 3 months, and the oral sex practices they engaged in with these partners. Four sex practices included in the questionnaire were tongue kissing, receptive fellatio (oral-penile sex, partner's penis in participant's mouth) with ejaculation, receptive fellatio without ejaculation, and insertive rimming (oral-anal sex, participant's mouth in or around partner's anus). For those participants indicating that they had a casual male partner/s in the previous 3 months, they were asked with how many casual partners they performed the previously mentioned sex practices. Demographic characteristics including age, country of birth and HIV status were collected using a computer-assisted self-interview as part of routine care at the MSHC.

### *Statistical analysis*

Univariable logistic regression was performed to examine the association between frequent mouthwash use and the four oral sexual practices, as well as with demographic characteristics. Age was categorised into three groups ( $\leq 24$ , 25–34, and  $\geq 35$  years), as per previous studies,<sup>1,16</sup> and a  $\chi^2$  test for trend was performed to examine the association between the age groups and sexual practices. The total number of male partners (including regular and casual partners in the previous 3 months) was divided by the median;  $<5$  or  $\geq 5$ . Mouthwash

use was categorised into 'frequent' and 'infrequent', where 'frequent' was defined as daily or weekly use and 'infrequent' as monthly, less than monthly, less than 6 monthly or never. All statistical analyses were performed using Stata (version 14.2, StataCorp, College Station, TX, USA).

## Results

A total of 1150 MSM attending the MSHC were invited to participate in the GONE study, of which 949 returned a questionnaire (82.5%) and 918 (79.8%) were included in the final analysis after excluding those with incomplete questionnaires (Fig. 1). The age of participants ranged from 19 to 77 years, with a median age of 29 (interquartile range (IQR) 25–36) years. The median number of male partners in the previous 3 months was five (IQR 2–9). More than half ( $n = 517$ ; 56.3%) of the participants were born in Australia, of which 260 men (50.3%) were frequent mouthwash users.

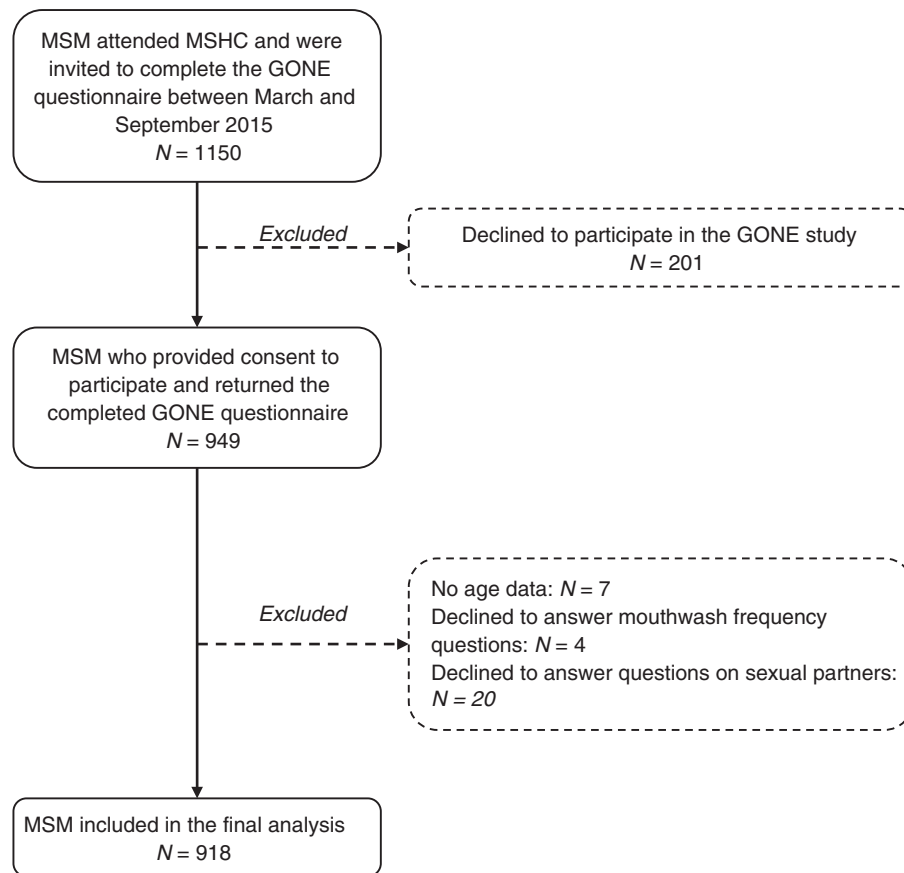
Of the 918 MSM, 874 (95.2%) reported tongue kissing with any sexual partner in the previous 3 months, 839 (91.4%) reported receptive fellatio without ejaculation, 610 (66.4%) reported receptive fellatio with ejaculation and 356 (38.8%) performed rimming. All four types of sexual practices did not differ by age group (Fig. 2).

There was a significant age pattern for frequent mouthwash use, from 37.6% among men aged  $\leq 24$  years to 56.1% among men aged 25–34 years and 61.4% among men aged  $\geq 35$  years ( $P_{\text{trend}} = <0.001$ ) reporting frequent mouthwash use. However, country of birth and HIV status were not associated with frequent mouthwash use (Table 1). Furthermore, the univariable analyses showed there was no significant association between frequent mouthwash use and tongue kissing, receptive fellatio with or without ejaculation or performing rimming with regular or casual partners.

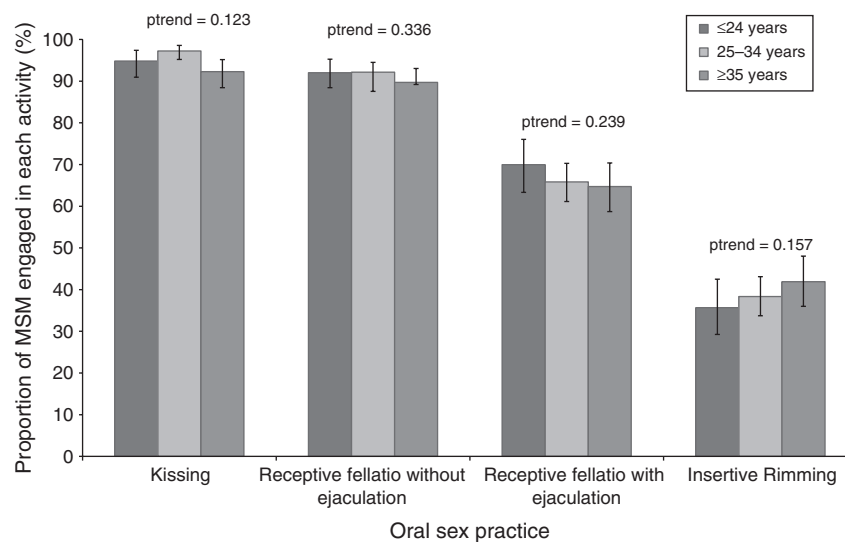
## Discussion

This is the first study examining the association between mouthwash use and oral sexual practices, and we found that frequent mouthwash use is not associated with engaging in oral sexual practices (i.e. tongue kissing, receptive fellatio (with or without ejaculation) or performing rimming) with regular or casual sex partners among MSM. Previous studies have shown that younger MSM are at a higher risk of acquiring oropharyngeal gonorrhoea compared with older MSM;<sup>1,16</sup> however, the absence of an association between age and oral sexual practices could not explain this association.

This study had several limitations. First, this study was conducted at one sexual health clinic and may not be generalisable to the entire MSM community. Second, this study asked only about frequency of mouthwash use as part of routine dental care, and did not ask if mouthwash was used before or after specific sex practices. Third, kissing without sex is relative common in MSM, particularly in younger MSM;<sup>5</sup> however, we did not collect data on the number of partners that men tongue kissed but did not have sex with. Finally, this study did not ask about condom use during oral sex or the use of dental dams for insertive rimming. It is possible that MSM who use condoms and dental dams are more concerned about personal hygiene and therefore may be more frequent mouthwash users.



**Fig. 1.** Flow chart of sample selection for the analysis. MSM, men who have sex with men; MSHC, Melbourne Sexual Health Centre; GONE, GONorrhoea Eradication (GONE) study.



**Fig. 2.** Proportion of men who have sex with men (MSM) who engaged in kissing, receptive fellatio without ejaculation, receptive fellatio with ejaculation and insertive rimming by age groups.

However, previous studies have shown that using condoms for oral sex<sup>13</sup> and dental dams for insertive rimming is rare in the MSM population.<sup>17</sup>

There is still substantial uncertainty and debate about whether sexual practices involving the mouth, other than penile-oral sex, transmit gonorrhoea, and more research will

**Table 1.** Associations between frequency of mouthwash use and demographics and sexual behaviours among 918 men who have sex with men  
CI, confidence interval; ref, reference; –, data not collected

	No. of individuals (%)	No. that use mouthwash frequently (%)	Univariate odds ratio (95% CI)	P value
Age (years)				
≤24	213 (23.2)	80 (37.6)	1	ref
25–34	433 (47.2)	243 (56.1)	2.13 (1.52–2.98)	<0.001
≥35	272 (29.6)	167 (61.4)	2.64 (1.83–3.83)	<0.001
Number of (casual and regular) partners in the previous 3 months				
<5	449 (48.9)	239 (53.2)	1.01 (0.78–1.31)	0.930
≥5	469 (51.1)	251 (53.5)	1	ref
Country of birth				
Australia	517 (56.3)	260 (50.3)	0.77 (0.59–1.01)	0.060
Overseas	354 (38.6)	201 (56.8)	1	ref
Unknown	47 (5.1)			
Known HIV status				
Positive	35 (3.8)	20 (57.1)	1.17 (0.59–2.32)	0.649
Negative	883 (96.2)	470 (53.2)	1	ref
Sexual activity with regular partner				
Tongue kissing				
Yes	483 (52.6)	265 (54.9)	0.24 (0.03–2.10)	0.198
No	6 (0.6)	5 (83.3)	1	ref
Receptive fellatio without ejaculation				
Yes	455 (49.6)	254 (55.8)	1.52 (0.75–3.08)	0.250
No	33 (3.6)	15 (45.5)	1	ref
Receptive fellatio with ejaculation				
Yes	363 (39.5)	205 (56.5)	1.14 (0.76–1.71)	0.521
No	126 (13.7)	67 (53.2)	1	ref
Insertive rimming				
Yes	356 (38.8)	197 (55.3)	1.00 (0.67–1.50)	0.982
No	134 (14.6)	74 (55.2)	1	ref
Sexual activity with casual partner in the previous 3 months				
Tongue kissing				
Yes	720 (78.4)	375 (52.1)	0.71 (0.35–1.44)	0.340
No	33 (3.6)	20 (60.6)	1	ref
Oral sex no ejaculation				
Yes	694 (75.6)	367 (52.9)	1.37 (0.77–2.42)	0.284
No	51 (5.6)	23 (45.1)	1	ref
Oral sex with ejaculation				
Yes	432 (47.1)	231 (53.5)	1.13 (0.84–1.51)	0.422
No	309 (33.7)	156 (50.5)	1	ref
Insertive rimming				
Yes	505 (55.0)	272 (53.9)	1.13 (0.84–1.51)	0.422
No	240 (26.1)	120 (50)	1	ref
Number of casual partners in the previous 3 months				
Tongue kissed	–	–	1.00 (0.98–1.02)	0.845
Oral sex no ejaculation	–	–	1.01 (0.99–1.03)	0.209
Oral sex with ejaculation	–	–	1.00 (0.98–1.03)	0.737
Insertive rimming	–	–	1.03 (0.99–1.07)	0.075

be required to answer this question.<sup>18</sup> Recent studies of MSM couples have shown that of men who were diagnosed with oropharyngeal gonorrhoea, 23–28% of their male regular partners also had oropharyngeal gonorrhoea.<sup>19</sup> Furthermore, tongue kissing without sex has been identified as a risk factor for oropharyngeal gonorrhoea in MSM.<sup>20</sup>

Oropharyngeal gonorrhoea is often asymptomatic<sup>21</sup> and has a relatively short duration of infection of ~3–4 months,<sup>22</sup> and thus annual screening of oropharyngeal gonorrhoea would not be effective in reducing asymptomatic gonorrhoea cases.<sup>23</sup> A novel intervention, such as the use of antiseptic mouthwash,

targeting the oropharynx would be warranted for gonorrhoea prevention and control. A previous *in vitro* study has shown a reduction in the amount of *N. gonorrhoeae* on the oropharynx after 1 min of exposure to two products of Listerine (Johnson & Johnson, New Brunswick, NJ, USA) mouthwashes,<sup>11</sup> and a mathematical model has estimated that mouthwash could potentially reduce oropharyngeal gonorrhoea by 82%, with 50% of mouthwash coverage and an additional 1.5% clearance of infection per use.<sup>24</sup> Although the present study estimated half (53.4%) of sexually active MSM use mouthwash daily, further studies are required to identify which brand of

mouthwash they use and how they use it (i.e. rinse vs gargle).<sup>25</sup> If mouthwash is proven to be effective for gonorrhoea prevention, a public health campaign should be launched to encourage its use. As this study indicates there is no association between performing any specific oral sex practices and mouthwash use, such a campaign should target all MSM regardless of which sex practices they engage in. In addition, it is important to target young MSM specifically because this group has the highest prevalence of oropharyngeal gonorrhoea but with the lowest coverage of frequent mouthwash use.<sup>16</sup> However, further studies are required before the implementation of this campaign.<sup>26</sup>

## Conflicts of interest

The authors declare that they have no conflicts of interest.

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