Prevalence and Factors Associated with Inconsistent Condom Use among Men Who Have Sex with Men (MSM) Who Use Mobile Geo-Social Networking Applications in Greater Tokyo

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Abstract: This study examined the prevalence and factors associated with inconsistent condom use among men who have sex with men (MSM) who use gay mobile geo-social networking applications (gay mobile apps) in Greater Tokyo. Among a sample of 1657 MSM recruited through advertisements on gay mobile apps, inconsistent condom use was reported by over one-third (37%) of participants with regular male partners, 18% with casual male partners, and 20% with female partners. In multiple regression analysis, inconsistent condom use with both regular and casual male partners was more commonly reported among participants without a university education, and among participants reporting lower self-efficacy for safer sex. Inconsistent condom use with casual male partners was more commonly reported among participants living in the central 23 wards of Tokyo. Inconsistent condom use with regular male partners was more commonly reported among participants who identified as a member of the gay community, and who only had male partners. These results indicate that a substantial proportion of Greater Tokyo gay mobile app users use condoms inconsistently, particularly with regular partners, and may be at risk for HIV. This paper provides useful information to help design tailored strategies to reduce inconsistent condom use.

Keywords: MSM; inconsistent condom use; gay mobile applications; HIV/AIDS prevention

1. Introduction

MSM (men who have sex with men) are estimated to make up between 4.1–4.6% of the male population [1] in Japan, but accounted for 72.7% of HIV cases between 2011–2015 among Japanese nationals [2]. MSM likely account for a greater proportion of HIV and AIDS cases in Japan than surveillance suggests due to underreporting of homosexual transmission [3]. MSM-related HIV surveillance in Japan faces a variety of difficulties including a lack of sustainable financing and limited researchers [4], while MSM uptake of prevention services is hindered by community stigma, Japanese heteronormative cultural values expecting marriage and children, and the limited experience and knowledge of the specific prevention needs facing MSM among health workers [3].

Condoms are one of the main tools for HIV prevention, with a high level of effectiveness at preventing the transmission of HIV and STIs when used correctly and consistently [5]. Despite the wide availability of condoms in Japan, where they are largely available through NGOs (non-governmental
organizations) and gay venues for free [6], condom use has remained inconsistent among MSM in Japan [2,7].

Gay geo-social networking applications (hereafter, gay mobile apps) use the global positioning systems (GPS) in smart phones to see other nearby users who they can contact, facilitating MSM meetings [8,9]. Since 2012 gay mobile apps have eclipsed gay bars as a space to meet potential sex partners in Japan [10] and provide access to MSM not accessible through venue-based sampling methods [8,11–14]. Although there is no research regarding comparing gay mobile app using MSM to non-app using MSM in Japan, previous studies in the U.S. and China have shown gay mobile app users to be at higher risk for STIs [15,16], and to have more sexual partners [9,12,16] when compared to non-app using MSM. Existing research on condom use is largely based on samples of MSM recruited at a range of gay venues [2,4,7], although it has been estimated that only 35% of MSM in Japan attend such gay venues [17]. It is therefore essential to better understand the use of condoms among MSM in Japan who use gay mobile apps. This study seeks to fill this gap, by examining the prevalence and correlates of inconsistent condom use among gay mobile app users in Tokyo, the city at the center of the HIV epidemic in Japan [18].

2. Materials and Methods

The survey initially recruited participants using a methodology previously used in the U.S. [8,19] by selecting and messaging nearby users with a link to the survey using the GPS function from 22 November 2016 to 16 January 2017, and recruited 215 valid participants. The gay mobile apps used for recruitment use geo-location to sort users by proximity, with the first profile the closest to the user. Users were displayed in a grid of photos, with three photos per row. The researcher was positioned in Tokyo centrally, launched the applications, and randomly selected one user from each row in a grid of photos until 50 previously uncontacted users were messaged with a link to the survey. Messages were logged in the app chat function, and previously messaged MSM were not contacted again. Questions regarding the survey were also answered via the app chat function. Slow recruitment due to frequent social networking services (SNS) scamming in Japan [20] and potential recruitment bias led to a change in recruitment strategy. A splash screen poster encouraging application users to respond to the linked survey was placed on the most popular gay mobile app in Japan, 9Monsters, for one week from 17 January to 23 January 2017 to supplement response numbers. This methodology was used previously with success in the U.S. [13,14]. The advertisement was displayed only to MSM who used gay mobile apps in Greater Tokyo. It was shown in rotation whenever the application was opened, and could be seen in the ‘advertising’ section in Greater Tokyo, recruiting a further 1442 participants for a total of 1657 valid respondents.

The survey was anonymous, with no identifying information obtained, and was self-administered online. Male participants of 18 years or older, who identified as MSM (defined as identifying as ‘gay’ or ‘bisexual’ or having sexual experience with other men) and gave participation consent were included in results for analysis. The questionnaire was translated from English into Japanese by a native translator and back-translated into English by an independent translator. Duplicate IP addresses and incomplete responses were checked and removed, informed consent was obtained from all survey respondents, and MSM helplines and website information for services was provided to all people who clicked on the survey link. Participants could opt into receiving the survey results by email and could also opt into a lottery for prizes of up to 80 USD in gift cards. In total, 1335 (81%) requested lottery entry, and 964 (58%) requested the survey results. The Human Research Ethics Committee at the University of Melbourne in Australia provided ethics approval (ID: 1646197).

Socio-demographics were measured by 12 items used in prior research in Japan [21], including age, gender, sexual orientation, marital status, birthplace, current residence, self-rated health, education, occupation, work hours, and intercourse partners. Gay mobile app use motivations were defined as ‘to find sex’, ‘to find friends’, ‘to find a serious relationship’, or ‘to avoid being identified as gay’ [22]. Gay community participation measured years and frequency of gay bar and gay event attendance,
frequency of gay bathhouse (hattenba) attendance, organized gay group activity participation in past six-months, and identity as a gay community member. Four questions about self-efficacy for safer sex were derived from previous instruments [23–25], and measured participant confidence in performing specific behaviors with a partner: ‘I feel confident in using condoms even when my partner doesn’t want to’, ‘I am able to avoid behavior that puts me at risk of HIV infection’, ‘I find it difficult to discuss condom use with partners’, and ‘I find it difficult to practice safer sex when I have been drinking’.

Respondents were asked three questions regarding frequency of condom use during penetrative or receptive anal intercourse with regular and casual male partners as well as sex with female partners. Condom use frequency was recorded as ‘never’, ‘rarely’, ‘most of the time’, and ‘always’. Following previous studies, inconsistent condom use was defined as ‘never use condoms’ or ‘rarely use condoms’, while consistent condom use was defined as ‘always use condoms’ and ‘use condoms most of the time’ [26]. Condom use analyses excluded those who did not have intercourse with each respective partner type.

All analysis was performed in SPSS v24 (IBM, Armonk, NY, USA). Descriptive statistics are presented for all variables. Correlates of condom use stratified by intercourse partner type were determined with logistic regression. Unadjusted and adjusted odds ratios (AOR) are presented, along with their 95% confidence intervals (CI). To develop a parsimonious model, only variables with a p-value less than 0.10 in univariate analyses were included in the multivariate analyses. Only models with acceptable diagnostics are presented; goodness of fit was assessed using the Hosmer–Lemeshow test, and collinearity was assessed against the variance inflation factor (VIF).

3. Results

3.1. Socio-Demographic Characteristics

The socio-demographic characteristics of the 1657 MSM using gay mobile apps in Greater Tokyo are displayed in Table 1. Over half (53.4%) resided in central Tokyo, and almost all (96.3%) respondents were born in Japan. The median age was 35, two-thirds (68.5%) were employed fulltime, over half (58.1%) had a university education, and a small minority (4.4%) were married to women. Most participants identified as homosexual (85.1%) and 14.1% as bisexual; 8.9% reported having both male and female sex partners. While the majority of respondents identified as male, 14 participants identified as MSM but were non-binary regarding gender or female-to-male (FTM) transgender. About half (56.8%) of the participants had ever attended a gay bar and half (47.6%) had attended a gay bathhouse (hattenba), with 13.2% having participated in a gay group activity in the past six months.

| Current residence          | n   | %   |
|----------------------------|-----|-----|
| Tokyo                      | 883 | 53.4|
| Greater Tokyo              | 553 | 33.4|
| Another prefecture         | 209 | 12.6|
| Another country            | 8   | 0.5 |
| Total                      | 1653| 100 |

| Birthplace                 | n   | %   |
|----------------------------|-----|-----|
| Japan                      | 1593| 96.3|
| Other                      | 62  | 3.7 |
| Total                      | 1655| 100 |

| Age                        | n   | %   |
|----------------------------|-----|-----|
| 18–25                      | 319 | 19.4|
| 26–35                      | 550 | 33.4|
| 36–45                      | 507 | 30.8|
| 46+                        | 270 | 16.4|
| Total                      | 1646| 100 |
Table 1. Cont.

|                                 | n   | %    |
|---------------------------------|-----|------|
| Gender                          |     |      |
| Male                            | 1641| 99.2 |
| Other                           | 14  | 0.8  |
| Total                           | 1655| 100  |
| Marital status                  |     |      |
| No                              | 1582| 95.6 |
| Yes                             | 72  | 4.4  |
| Total                           | 1654| 100  |
| Occupation                      |     |      |
| Full-time                       | 1133| 68.5 |
| Part-time                       | 185 | 11.2 |
| Student                         | 168 | 10.2 |
| Self-employed                   | 73  | 4.4  |
| Freelance                       | 16  | 1.0  |
| Unemployed                      | 69  | 4.2  |
| Other                           | 9   | 0.5  |
| Total                           | 1653| 100  |
| Education                       |     |      |
| High school or less             | 421 | 25.4 |
| Two-year technical school       | 274 | 16.5 |
| University                      | 800 | 48.3 |
| M.A.                            | 135 | 8.2  |
| PhD                             | 26  | 1.6  |
| Total                           | 1656| 100  |
| Intercourse partner             |     |      |
| Men                             | 1488| 91.1 |
| Men and women                   | 146 | 8.9  |
| Total                           | 1634| 100  |
| Sexuality                       |     |      |
| Homosexual                      | 1408| 85.1 |
| Bisexual                        | 233 | 14.1 |
| Other                           | 14  | 0.8  |
| Total                           | 1655| 100  |
| Health                          |     |      |
| Very unhealthy                  | 17  | 1.0  |
| Unhealthy                       | 114 | 6.9  |
| Average                         | 467 | 28.2 |
| Healthy                         | 816 | 49.3 |
| Very healthy                    | 240 | 14.5 |
| Total                           | 1654| 100.0|

3.2. Condom Use and Self-Efficacy for Practicing Safer Sex Characteristics

Inconsistent condom use was more commonly reported with regular male partners than with casual male partners or female partners (Table 2). Inconsistent condom use was reported by over one-third (37%) of participants with regular male partners, 18% with casual male partners, and 20% with female partners. There was low risk perception among respondents engaging in condomless anal intercourse (CLAI): of 882 respondents who felt that they avoided HIV risk behaviors, over half (53.7%) engaged in CLAI with a regular partner, one-third (33.0%) engaged in CLAI with casual partners, and over one-third (38.5%) engaged in condomless sex with female partners. Of respondents with both male and female partners, 11.3% of participants reported inconsistent condom use with both regular male and female partners, and 8.1% with both casual male and female partners.
Table 2. Frequency of condom use and self-efficacy for practicing safer sex.

|                              | n   | %    |
|------------------------------|-----|------|
| No anal sex with regular     |     |      |
| male partner                 |     |      |
| Never                        | 217 | 15.5 |
| Rarely                       | 302 | 21.5 |
| Most of the time             | 443 | 31.6 |
| Always                      | 442 | 31.5 |
| Total                       | 1404| 100  |
| How often do you use a condom |     |      |
| (penetrative and receptive   |     |      |
| anal sex)                    |     |      |
| with a casual male partner?  |     |      |
| Never                        | 35  | 2.6  |
| Rarely                       | 197 | 14.8 |
| Most of the time             | 615 | 45.8 |
| Always                      | 490 | 36.8 |
| Total                       | 1331| 100  |
| How often do you use a condom |     |      |
| (penetrative and anal sex)   |     |      |
| with female partners?        |     |      |
| Never                        | 29  | 10.1 |
| Rarely                       | 28  | 9.8  |
| Most of the time             | 68  | 23.8 |
| Always                      | 161 | 56.3 |
| Total                       | 286 | 100  |
| It’s difficult to talk about  |     |      |
| condom use with partners     |     |      |
| Strongly disagree            | 615 | 37.6 |
| Disagree                     | 561 | 34.3 |
| Neutral                      | 325 | 19.9 |
| Agree                        | 106 | 6.5  |
| Strongly agree               | 30  | 1.8  |
| Total                        | 1637| 100  |
| I feel confident in my ability|     |      |
| to use condoms when my partner |     |      |
| doesn’t want to use them     |     |      |
| Strongly disagree            | 103 | 6.3  |
| Disagree                     | 283 | 17.2 |
| Neutral                      | 588 | 35.7 |
| Agree                        | 399 | 24.3 |
| Strongly agree               | 272 | 16.5 |
| Total                        | 1645| 100  |
| I am able to avoid behavior  |     |      |
| that may put me at risk of   |     |      |
| HIV infection                |     |      |
| Strongly disagree            | 48  | 2.9  |
| Disagree                     | 153 | 9.3  |
| Neutral                      | 554 | 33.8 |
| Agree                        | 614 | 37.5 |
| Strongly agree               | 268 | 16.4 |
| Total                        | 1637| 100  |
| I find it difficult to       |     |      |
| practice safe sex when drunk |     |      |
| Strongly disagree            | 202 | 12.3 |
| Disagree                     | 274 | 16.7 |
| Neutral/disagree             | 451 | 27.5 |
| Agree                        | 556 | 33.9 |
| Strongly agree               | 159 | 9.7  |
| Total                        | 1642| 100.0|

*Analysis based on a subsample of 1404 people who have anal sex with a regular male partner, analysis based on a subsample of 1331 people who have anal sex with a casual male partner, analysis based on a subsample of 286 people who have sex with women.

Over nine-tenths (91.7%) of participants did not feel they have difficulty discussing condom use with partners, and two-fifths (40.8%) felt confident in their ability to use condoms when a partner does not want to. Just over half (53.9%) of respondents felt they could avoid behavior putting them at risk of HIV infection, and almost half (43.6%) of respondents felt that they had trouble having safe sex when drunk.

3.3. Correlates of Inconsistent Condom Use with Regular Male Partners

Multivariate logistic regression analyses found that inconsistent condom use with regular male partners was more frequently reported among participants who were married (AOR, 2.01; 95% CI, 1.09–3.71; Table 3) and who identified as a member of the gay community (AOR, 1.58; 95% CI, 1.13–2.22),
and less frequently reported among MSM who: were educated above high school education (e.g., for respondents with a B.A., adjusted odds ratio (AOR), 0.65; 95% CI, 0.48–0.88), had both male and female partners (AOR, 0.58; 95% CI, 0.36–0.93), were students (AOR, 0.51; 95% CI, 0.30–0.86) as compared to those with full-time employment, recently participated in organized gay community activities (AOR, 0.52; 95% CI, 0.35–0.77), were using gay mobile apps in order to make friends (AOR, 0.75; 95% CI, 0.56–1.00), and reported positive self-efficacy for practicing safer sex.

Table 3. Multivariate binary logistic regression for inconsistent condom use with regular male partners (n = 1404).

| Number of Respondents (n) | % Reporting Inconsistent Condom Use with Regular Male Partner | Unadjusted Odds Ratio (95% CI) | p-Value | Adjusted Odds Ratio (95% CI) | p-Value |
|---------------------------|-------------------------------------------------------------|-------------------------------|---------|-------------------------------|---------|
| **Age (years)**           |                                                             |                               |         |                               |         |
| 18-25                     | 271                                                         | 31.4                          | REF     | REF                           | REF     |
| 26–35                     | 482                                                         | 37.1                          | 1.15 (0.98–1.35) | 0.078 | 1.02 (0.83–1.26) | 0.823 |
| 36–45                     | 429                                                         | 37.8                          | 1.11 (1.00–1.23) | 0.059 | 0.96 (0.83–1.11) | 0.572 |
| 46+                       | 217                                                         | 42.9                          | 1.14 (1.04–1.25) | 0.006 | 1.05 (0.93–1.18) | 0.469 |
| **Place of Birth**        |                                                             |                               |         |                               |         |
| Other                     | 58                                                          | 27.1                          | REF     | REF                           | REF     |
| Japan                     | 1345                                                        | 37.4                          | 1.61 (0.90–2.88) | 0.112 |                   |         |
| **Education**             |                                                             |                               |         |                               |         |
| High School or less       | 360                                                         | 43.3                          | REF     | REF                           | REF     |
| Two-year university       | 232                                                         | 37.1                          | 0.94 (0.86–1.02) | 0.130 | 0.92 (0.84–1.02) | 0.101 |
| University                | 682                                                         | 35.0                          | 0.71 (0.54–0.92) | 0.009 | 0.64 (0.47–0.88) | 0.005 |
| Graduate degree           | 130                                                         | 29.2                          | 0.54 (0.35–0.83) | 0.005 | 0.75 (0.46–1.24) | 0.270 |
| **Employment**            |                                                             |                               |         |                               |         |
| Full-time work            | 968                                                         | 38.2                          | REF     | REF                           | REF     |
| Part-time work            | 157                                                         | 40.1                          | 1.08 (0.77–1.53) | 0.653 | 0.85 (0.56–1.27) | 0.428 |
| Student                   | 144                                                         | 23.6                          | 0.50 (0.33–0.75) | 0.001 | 0.52 (0.30–0.88) | 0.016 |
| Self-employed             | 82                                                          | 36.6                          | 0.93 (0.58–1.49) | 0.766 | 0.91 (0.54–1.54) | 0.729 |
| Unemployed                | 51                                                          | 41.2                          | 1.13 (0.64–2.00) | 0.675 | 1.18 (0.62–2.23) | 0.642 |
| **Current marital status**|                                                             |                               |         |                               |         |
| Single                    | 1340                                                        | 36.2                          | REF     | REF                           | REF     |
| Married                   | 63                                                          | 34.0                          | 2.07 (1.24–3.43) | 0.005 | 2.03 (1.10–3.76) | 0.024 |
| **Current residence**     |                                                             |                               |         |                               |         |
| Central Tokyo             | 765                                                         | 37.9                          | REF     | REF                           | REF     |
| Greater Tokyo             | 446                                                         | 36.1                          | 0.93 (0.73–1.18) | 0.034 |                   |         |
| Other prefecture          | 182                                                         | 35.7                          | 0.91 (0.65–1.28) | 0.086 |                   |         |
| **Intercourse partners**  |                                                             |                               |         |                               |         |
| Only men                  | 1280                                                        | 38.0                          | REF     | REF                           | REF     |
| Men and women             | 122                                                         | 27.0                          | 0.61 (0.40–0.92) | 0.018 | 0.54 (0.34–0.88) | 0.013 |
| **Health**                |                                                             |                               |         |                               |         |
| Fair/Poor health          | 498                                                         | 39.8                          | REF     | REF                           | REF     |
| Healthy                   | 904                                                         | 35.4                          | 0.83 (0.66–1.04) | 0.106 |                   |         |
| **Out to close friends**  |                                                             |                               |         |                               |         |
| No                        | 549                                                         | 36.6                          | REF     | REF                           | REF     |
| Yes                       | 838                                                         | 37.2                          | 1.03 (0.82–1.28) | 0.815 |                   |         |
| Identify as a member of the gay community | 236 | 32.6 | REF | 0.125 (0.93–1.68) | 0.144 | 1.50 (1.07–2.10) | 0.020 |
| Yes                       | 1155                                                        | 37.7                          | 1.14 (1.02–1.28) | 0.815 |                   |         |
| **Use gay apps for sex**  |                                                             |                               |         |                               |         |
| No                        | 511                                                         | 31.9                          | REF     | REF                           | REF     |
| Yes                       | 887                                                         | 39.9                          | 1.42 (1.13–1.78) | 0.003 | 1.15 (0.89–1.50) | 0.291 |
| **Use gay apps to find friends** | 339 | 41.9 | REF | 0.76 (0.59–0.97) | 0.030 | 0.70 (0.54–0.97) | 0.028 |
| No                        | 1053                                                        | 35.3                          | 1.15 (0.78–1.70) | 0.490 |                   |         |
| Identify as a member of the gay community | 1268 | 36.8 | REF | 0.76 (0.61–0.95) | 0.014 | 0.85 (0.66–1.10) | 0.218 |
| Yes                       | 115                                                         | 40.0                          | 1.15 (0.78–1.70) | 0.490 |                   |         |
| **Use gay apps to avoid being identified as gay** | 631 | 40.4 | REF | 0.76 (0.59–0.97) | 0.030 | 0.70 (0.54–0.97) | 0.028 |
| No                        | 756                                                         | 34.0                          | 0.76 (0.61–0.95) | 0.014 | 0.85 (0.66–1.10) | 0.218 |
| Yes                       | 37.2                          | REF                           |         |                               |         |
| **Use gay apps to find a serious relationship** | 36.8 | 36.8 | REF | 0.76 (0.59–0.97) | 0.030 | 0.70 (0.54–0.97) | 0.028 |
| No                        | 583                                                         | 37.2                          | REF     | REF                           | REF     |
| Yes                       | 817                                                         | 36.8                          | 0.98 (0.79–1.23) | 0.885 |                   |         |
| **Ever attended a gay bar** |                                                             |                               |         |                               |         |
| No                        | 583                                                         | 37.2                          | REF     | REF                           | REF     |
| Yes                       | 817                                                         | 36.8                          | 0.98 (0.79–1.23) | 0.885 |                   |         |
| **Participation in gay group/community or volunteer activities** | 38.9 | 38.9 | REF | 0.53 (0.38–0.75) | 0.000 | 0.51 (0.34–0.75) | 0.001 |
### Table 3. Cont.

| Number of Respondents (n) | % Reporting Inconsistent Condom Use with Regular Male Partner | Unadjusted Odds Ratio (95% CI) | p-Value | Adjusted Odds Ratio (95% CI) | p-Value |
|--------------------------|-------------------------------------------------------------|-------------------------------|---------|-------------------------------|---------|
| Hattenba attendance       |                                                             |                               |         |                               |         |
| No                       | 716                                                          | 34.9                          | REF     | 1.19 (0.96–1.48)              | 0.111   |
| Yes                      | 684                                                          | 39.0                          | REF     |                               |         |
| Confident in ability to use condoms when partner doesn’t want to |                                                             |                               |         |                               |         |
| No                       | 839                                                          | 49.8                          | REF     | 0.22 (0.17–0.28)              | 0.000   |
| Yes                      | 558                                                          | 17.6                          | REF     | 0.31 (0.23–0.41)              | 0.000   |
| Able to avoid behavior that puts me at risk of HIV infection |                                                             |                               |         |                               |         |
| No                       | 654                                                          | 51.4                          | REF     | 0.30 (0.24–0.38)              | 0.000   |
| Yes                      | 736                                                          | 24.0                          | REF     | 0.54 (0.41–0.71)              | 0.000   |
| Difficult to talk about condoms with partners |                                                             |                               |         |                               |         |
| No                       | 1280                                                         | 35.0                          | REF     | 0.32 (0.22–0.48)              | 0.000   |
| Yes                      | 112                                                          | 62.5                          | REF     | 0.45 (0.29–0.71)              | 0.001   |
| Difficult to have safe sex when drunk |                                                             |                               |         |                               |         |
| No                       | 785                                                          | 32.1                          | REF     |                               |         |
| Yes                      | 609                                                          | 43.7                          | REF     |                               |         |
| Attend regular drinking parties |                                                             |                               |         |                               |         |
| No                       | 314                                                          | 37.9                          | REF     | 0.95 (0.73–1.23)              | 0.699   |
| Yes                      | 1079                                                         | 36.7                          | REF     |                               |         |

#### 3.4. Correlates of Inconsistent Condom Use with Casual Male Partners

Multivariate logistic regression analyses found that the odds of inconsistent condom use with casual male partners were lower among MSM who: were educated above high school education (e.g., for respondents with a BA, AOR, 0.36; 95% CI, 0.24–0.53; Table 4), lived outside central Tokyo (e.g., for a prefecture outside Greater Tokyo, AOR, 0.54; 95% CI, 0.30–0.97), were using gay mobile apps in order to make friends (AOR, 0.65; CI, 0.45–0.94), and had higher self-efficacy for practicing safer sex. The odds of inconsistent condom use with casual male partners were higher among MSM who were using gay mobile apps in order to find sex partners (AOR, 2.08; 95% CI, 1.38–3.14).

### Table 4. Multivariate binary logistic regression for inconsistent condom use with casual male partners (n = 1331).

| Number of Respondents (n) | % Reporting Inconsistent Condom Use with Casual Partner | Unadjusted Odds Ratio (95% CI) | p-Value | Adjusted Odds Ratio (95% CI) | p-Value |
|---------------------------|--------------------------------------------------------|-------------------------------|---------|-------------------------------|---------|
| Age (years)               |                                                        |                               |         |                               |         |
| 18–25                     | 245                                                    | 14.3                          | REF     | 1.06 (0.85–1.32)              | 0.630   |
| 26–35                     | 453                                                    | 15.2                          | REF     | 0.97 (0.72–1.30)              | 0.828   |
| 36–45                     | 424                                                    | 19.3                          | REF     | 1.04 (0.85–1.26)              | 0.717   |
| 46+                       | 202                                                    | 22.8                          | REF     | 1.10 (0.93–1.30)              | 0.252   |
| Place of Birth            |                                                        |                               |         |                               |         |
| Japan                     | 1273                                                   | 17.8                          | REF     | 2.30 (0.91–5.82)              | 0.079   |
| Other                     | 57                                                     | 8.8                           | REF     | 0.76 (0.25–2.27)              | 0.625   |
| Education                 |                                                        |                               |         |                               |         |
| High School or less       | 323                                                    | 29.1                          | REF     |                               |         |
| University                | 652                                                    | 14.1                          | REF     | 0.30 (0.23–0.52)              | 0.003   |
| Graduate degree           | 132                                                    | 8.3                           | REF     | 0.32 (0.15–0.67)              | 0.002   |
| Employment                |                                                        |                               |         |                               |         |
| Full-time work            | 919                                                    | 16.9                          | REF     |                               |         |
| Part-time work            | 146                                                    | 24.0                          | REF     | 1.05 (0.62–1.77)              | 0.856   |
| Student                   | 135                                                    | 10.4                          | REF     | 0.80 (0.36–1.74)              | 0.565   |
| Self-employed             | 76                                                     | 14.5                          | REF     | 0.38 (0.17–0.85)              | 0.582   |
| Unemployed                | 53                                                     | 32.1                          | REF     | 1.38 (0.86–2.19)              | 0.118   |
| Current marital status    |                                                        |                               |         |                               |         |
| Single                    | 1264                                                   | 17.4                          | REF     |                               |         |
| Married                   | 66                                                     | 18.2                          | REF     | 1.05 (0.96–2.00)              | 0.871   |
| Current residence         |                                                        |                               |         |                               |         |
| Central Tokyo             | 732                                                    | 19.7                          | REF     |                               |         |
| Greater Tokyo             | 430                                                    | 15.3                          | REF     | 0.62 (0.43–0.90)              | 0.011   |
| Other prefecture          | 158                                                    | 13.3                          | REF     | 0.57 (0.31–1.03)              | 0.064   |
Table 4. Cont.

| Number of Respondents (n) | % Reporting Inconsistent Condom Use with Casual Partner | Unadjusted Odds Ratio (95% CI) | p-Value | Adjusted Odds Ratio (95% CI) | p-Value |
|---------------------------|--------------------------------------------------------|-------------------------------|---------|-----------------------------|---------|
| Only men                  | 1212                                                   | 17.8                          | REF     | 0.72 (0.42–1.26)            | 0.246   |
| Both men and women        | 118                                                    | 13.6                          | REF     | 0.64 (0.48–0.86)            | 0.003   |
|                           |                                                        |                               |         | 0.89 (0.63–1.25)            | 0.491   |
| Intercourse partners      |                                                        |                               |         |                             |         |
| Unadjusted Odds Ratio     |                                                        |                               |         |                             |         |
| p-Value                   |                                                        |                               |         |                             |         |
| Health                    |                                                        |                               |         |                             |         |
| Fair/poor health          |                                                        |                               |         |                             |         |
| Healthy                   | 472                                                    | 15.1                          | REF     | 0.64 (0.48–0.86)            | 0.003   |
|                           | 857                                                    | 21.6                          | REF     | 0.99 (0.74–1.33)            | 0.965   |
|                           |                                                        |                               |         | 0.92 (0.63–1.35)            | 0.677   |
| Out to close friends      |                                                        |                               |         |                             |         |
| No                        | 519                                                    | 17.7                          | REF     |                              |         |
| Yes                       | 794                                                    | 17.6                          | REF     |                              |         |
| Identify as a member of the gay community | | | | | |
| No                        | 217                                                    | 18.4                          | REF     |                              |         |
| Yes                       | 1101                                                   | 17.3                          | REF     |                              |         |
| Use gay apps for sex      |                                                        |                               |         |                             |         |
| No                        | 414                                                    | 10.6                          | REF     |                              |         |
| Yes                       | 911                                                    | 20.5                          | REF     | 2.17 (1.53–3.09)            | 0.000   |
| Use gay apps to find friends |                                                        |                               |         |                             |         |
| No                        | 340                                                    | 21.8                          | REF     |                              |         |
| Yes                       | 980                                                    | 16.0                          | REF     | 0.69 (0.50–0.95)            | 0.017   |
| Use gay apps to avoid being identified as gay | | | | | |
| No                        | 1202                                                   | 17.6                          | REF     |                              |         |
| Yes                       | 108                                                    | 18.5                          | REF     | 1.07 (0.64–1.77)            | 0.801   |
| Use gay apps to find a serious relationship | | | | | |
| No                        | 587                                                    | 19.5                          | REF     |                              |         |
| Yes                       | 498                                                    | 15.7                          | REF     | 0.76 (0.58–1.02)            | 0.064   |
| Ever attended a gay bar   |                                                        |                               |         | 0.95 (0.67–1.34)            | 0.756   |
| Participation in gay group/community or volunteer activities | | | | | |
| No                        | 1139                                                   | 18.3                          | REF     |                              |         |
| Yes                       | 190                                                    | 12.1                          | REF     | 0.62 (0.39–0.98)            | 0.040   |
| Hattenba attendance       |                                                        |                               |         | 0.65 (0.37–1.12)            | 0.117   |
| Confident in ability to use condoms when my partner doesn't want to | | | | | |
| No                        | 619                                                    | 13.6                          | REF     |                              |         |
| Yes                       | 707                                                    | 20.7                          | REF     | 1.66 (1.24–2.22)            | 0.001   |
| Confident in ability to use condoms when my partner doesn't want to | | | | | |
| No                        | 817                                                    | 24.8                          | REF     |                              |         |
| Yes                       | 506                                                    | 5.1                           | REF     | 0.16 (0.11–0.25)            | 0.000   |
| Difficult to talk about condoms with partners | | | | | |
| No                        | 643                                                    | 31.3                          | REF     |                              |         |
| Yes                       | 673                                                    | 4.3                           | REF     | 0.010 (0.07–0.15)           | 0.000   |
| Difficult to have safe sex when drunk | | | | | |
| No                        | 336                                                    | 33.6                          | REF     |                              |         |
| Yes                       | 16.1                                                   | 0.38 (0.25–0.58)              | 0.000   |
| Difficult to have safe sex when drunk | | | | | |
| No                        | 744                                                    | 13.0                          | REF     |                              |         |
| Yes                       | 377                                                    | 23.2                          | REF     | 0.50 (0.37 - 0.66)          | 0.000   |
| Attend regular drinking parties | | | | | |
| No                        | 296                                                    | 20.9                          | REF     |                              |         |
| Yes                       | 1024                                                   | 16.5                          | REF     | 0.75 (0.54–1.03)            | 0.077   |

3.5. Correlates of Inconsistent Condom Use with Female Partners

Multivariate logistic regression analyses found that the odds of inconsistent female partner condom use were lower among MSM who had a two-year university or technical degree (e.g., AOR, 0.75; 95% CI, 0.57–0.99; Table 5), and were higher among MSM who were married (AOR, 2.70; 95% CI, 1.09–6.69).
Table 5. Multivariate binary logistic regression for inconsistent condom use with female partners (n = 286).

| Number of respondents (n) | % Reporting Inconsistent Condom Use with Female Partner | Unadjusted Odds Ratio (95% CI) | p-Value | Adjusted Odds Ratio (95% CI) | p-Value |
|--------------------------|--------------------------------------------------------|-------------------------------|---------|-------------------------------|---------|
| Age (years)              |                                                        |                               |         |                               |         |
| 18–25                    | 73                                                     | 13.7                          | REF     | REF                           | REF     |
| 26–35                    | 111                                                    | 10.8                          | 0.89 (0.57–1.39) | 0.602 | 0.65 (0.38–1.11) | 0.113 |
| 36–45                    | 67                                                     | 35.8                          | 1.54 (1.16–2.03) | 0.002 | 1.19 (0.84–1.68) | 0.328 |
| 46+                      | 33                                                     | 33.3                          | 1.34 (1.05–1.72) | 0.019 | 1.00 (0.72–1.39) | 0.986 |
| Place of Birth           |                                                        |                               |         |                               |         |
| Japan                    | 276                                                    | 20.3                          | 2.29 (0.28–18.46) | 0.436 |                               |         |
| Other                    | 10                                                     | 10.0                          | REF     |                               |         |
| Education                |                                                        |                               |         |                               |         |
| High School or less      | 75                                                     | 29.3                          | REF     |                               |         |
| Two-year university      | 47                                                     | 12.8                          | 0.77 (0.60–0.99) | 0.039 | 0.75 (0.57–0.99) | 0.046 |
| University               | 132                                                    | 18.2                          | 0.54 (0.28–1.04) | 0.066 | 0.51 (0.23–1.13) | 0.096 |
| Graduate degree          | 32                                                     | 13.6                          | 0.45 (0.15–1.31) | 0.141 | 0.73 (0.20–2.63) | 0.633 |
| Employment               |                                                        |                               |         |                               |         |
| Full-time work           | 214                                                    | 22.0                          | REF     |                               |         |
| Part-time work           | 18                                                     | 22.2                          | 1.02 (0.32–3.23) | 0.980 | 1.02 (0.27–3.88) | 0.971 |
| Student                  | 37                                                     | 5.4                           | 0.20 (0.05–0.88) | 0.032 | 0.21 (0.04–1.09) | 0.063 |
| Self-employed            | 15                                                     | 29.0                          | 0.89 (0.24–3.28) | 0.859 | 1.57 (0.37–6.61) | 0.546 |
| Unemployed               | 2                                                      | 50.0                          | 3.46 (0.21–57.89) | 0.373 | 1.99 (0.06–64.1) | 0.699 |
| Current marital status   |                                                        |                               |         |                               |         |
| Single                   | 244                                                    | 15.6                          | REF     |                               | REF     |
| Married                  | 41                                                     | 46.3                          | 4.68 (2.31–9.47) | 0.000 | 2.70 (1.09–6.69) | 0.032 |
| Current residence        |                                                        |                               |         |                               |         |
| Central Tokyo            | 131                                                    | 21.4                          | REF     |                               | REF     |
| Greater Tokyo            | 116                                                    | 15.5                          | 0.68 (0.35–1.30) | 0.240 |                               |         |
| Other prefecture         | 39                                                     | 26.2                          | 1.45 (0.64–3.26) | 0.375 |                               |         |
| Out to close friends     |                                                        |                               |         |                               |         |
| No                       | 155                                                    | 17.4                          | REF     |                               | REF     |
| Yes                      | 129                                                    | 22.5                          | 1.38 (0.77–2.47) | 0.287 |                               |         |
| Identify as a member of the LGBT community |                            |                               |         |                               |         |
| No                       | 76                                                     | 21.1                          | REF     |                               | REF     |
| Yes                      | 210                                                    | 19.5                          | 0.91 (0.48–1.74) | 0.775 |                               |         |
| Use gay apps for sex     |                                                        |                               |         |                               |         |
| No                       | 119                                                    | 20.2                          | REF     |                               | REF     |
| Yes                      | 165                                                    | 19.4                          | 0.95 (0.53–1.72) | 0.871 |                               |         |
| Use gay apps to find friends |                                |                               |         |                               |         |
| No                       | 77                                                     | 28.6                          | 0.50 (0.27–0.93) | 0.028 | 0.68 (0.33–1.37) | 0.276 |
| Yes                      | 204                                                    | 16.7                          | REF     |                               | REF     |
| Use gay apps to avoid being identified as gay |                            |                               |         |                               |         |
| No                       | 239                                                    | 20.5                          | REF     |                               | REF     |
| Yes                      | 41                                                     | 17.1                          | 0.80 (0.33–1.91) | 0.613 |                               |         |
| Use gay apps to find a serious relationship |                            |                               |         |                               |         |
| No                       | 163                                                    | 22.7                          | REF     |                               | REF     |
| Yes                      | 119                                                    | 16.0                          | 0.65 (0.35–1.19) | 0.163 |                               |         |
| Ever attended a gay bar  |                                                        |                               |         |                               |         |
| No                       | 179                                                    | 17.9                          | REF     |                               | REF     |
| Yes                      | 105                                                    | 22.9                          | 1.36 (0.75–2.47) | 0.310 |                               |         |
| Participation in gay group/community or volunteer activities |                     |                               |         |                               |         |
| No                       | 265                                                    | 19.6                          | REF     |                               | REF     |
| Yes                      | 20                                                     | 20.0                          | 1.02 (0.33–3.19) | 0.967 |                               |         |
| Hattenba attendance      |                                                        |                               |         |                               |         |
| No                       | 169                                                    | 15.4                          | REF     |                               | REF     |
| Yes                      | 115                                                    | 26.1                          | 1.94 (1.08–3.50) | 0.280 |                               |         |
| Confident in ability to use condoms when my partner doesn’t want to |                              |                               |         |                               |         |
| No                       | 151                                                    | 26.5                          | REF     |                               | REF     |
| Yes                      | 135                                                    | 12.6                          | 0.40 (0.21–0.75) | 0.004 | 0.51 (0.23–1.11) | 0.090 |
| Able to avoid behavior that puts me at risk of HIV infection |                            |                               |         |                               |         |
| No                       | 116                                                    | 29.3                          | REF     |                               | REF     |
| Yes                      | 169                                                    | 13.6                          | 0.38 (0.21–0.69) | 0.001 | 0.53 (0.25–1.13) | 0.101 |
| Difficult to talk about condoms with partners |                            |                               |         |                               |         |
| No                       | 19                                                     | 31.6                          | REF     |                               | REF     |
| Yes                      | 265                                                    | 19.2                          | 0.52 (0.19–1.42) | 0.202 |                               |         |
| Difficult to have safe sex when drunk |                            |                               |         |                               |         |
| No                       | 174                                                    | 19.0                          | REF     |                               | REF     |
| Yes                      | 111                                                    | 21.6                          | 0.85 (0.47–1.53) | 0.585 |                               |         |
| Attend regular drinking parties |                          |                               |         |                               |         |
| No                       | 60                                                     | 25.0                          | REF     |                               | REF     |
| Yes                      | 224                                                    | 18.8                          | 0.69 (0.35–1.36) | 0.285 |                               |         |
4. Discussion

Condom use is an important determinant of HIV incidence among MSM, and to our knowledge, this is the first study to examine the correlates of inconsistent condom use among gay mobile app users in Japan. Factors associated with inconsistent condom use with regular and casual male partners varied. Inconsistent condom use with casual male partners was more commonly reported among participants without a university education, those living in the central 23 wards of Tokyo, and among participants reporting lower self-efficacy for safer sex. Inconsistent condom use with regular male partners was more commonly reported among participants without a university education, who identified as a member of the gay community, who only had male partners, and among participants reporting lower self-efficacy for safer sex.

Inconsistent condom use was more common than among previous surveys of gay mobile app users outside Japan [27]. Participants reported similar levels of inconsistent condom use with casual male partners, and more frequent inconsistent condom use with regular male partners than previous venue-based studies reporting on condom use consistency in Greater Tokyo [2]. As with previous findings [28,29], condom use was higher with casual male partners (82.6%) and female intercourse partners (80.1%) than regular male partners (63.1%). One-third (31.5%) of respondents reported always using a condom with a regular male partner, lower than neighboring countries such as Cambodia [30], but similar to China [31]. MSM practicing negotiated safety with regular partners (where regular partners agree not to engage in CLAI with outside partners after being tested with regular partners) [32] in HIV negative seroconcordant relationships (where both partners are HIV negative), are associated with low HIV incidence [33]. However, negotiated safety has not been strongly promoted among MSM in Japan. Participants not discussing or complying with negotiated safety is a risk factor for HIV transmission as MSM often were found to have both regular and casual partners concurrently [34], and condom use may become increasingly inconsistent as casual MSM relationships continue [35]. Findings are inconsistent with regards to the associations between regular partner HIV transmissions among MSM, and regular partners were estimated to account for 68% of MSM HIV transmissions in the U.S. [36], but only 10.6% in Australia where negotiated safety has been promoted as a key component of the HIV prevention response among MSM [37]. It is difficult to say to what extent CLAI with regular partners represents a risk unless we know the HIV status, pre-exposure prophylaxis (PrEP) status, and undetectable viral load (UVL) status of the regular partner. Neither Truvada (emtricitabine/tenofovir disoproxil fumarate) (FTC/TDF) nor generic versions of FTC/TDF are approved for prevention in Japan [38]. According to estimates, Japan failed to achieve the first two of the three UNAIDS/WHO (UNAIDS: The Joint United Nations Programme on HIV and AIDS) targets, with 85.6% of HIV-positive cases diagnosed; 82.8% of those diagnosed treated; and 99.1% of those treated experienced viral suppression [39]. U = U (undetectable = untransmissible) messaging was started in Japan in 2018, and had not yet begun at the time of this survey. Regardless, the unavailability of PrEP, and estimated 70.9% of people living with HIV/AIDS (PLWHA) who are undiagnosed or untreated, suggest that MSM engaging in inconsistent consistent condom use with both regular and casual partners may be at risk for HIV in Japan.

While condom use consistency with male partners was comparable to Korea [23], four-fifths of respondents (80.1%) used condoms consistently with female intercourse partners, higher than in MSM in Korea (48.6%; [23]), and China (29%; [40]). This presents less overlap and bridging possibilities for HIV to enter the Japanese heterosexual community through the MSM population, which is important for predicting the long-term pattern of HIV among heterosexuals in Japan [41]. Moreover, fewer respondents (40.8%) felt confident in their ability to use condoms when their partner does not want to, compared to 72.3% in Korea [23]. Further studies are needed to determine if this is a specific cultural trait of Japanese MSM or gay mobile app users in general. Moreover, because inconsistent condom use with both regular and casual male partners was reported among participants with low self-efficacy for practicing safer sex, strategies to increase self-efficacy for practicing safer sex such as
sexual communication situation-specific rehearsals [42] may improve condom use self-efficacy among MSM in Japan.

Consistent condom use among MSM reporting any anal sex with an HIV-positive partner was found to be 70% effective at preventing HIV infection among MSM [43]. However, condom use among MSM faces various physical challenges, including condom slippage and breakage [44], as well as availability. Condoms are available in all love hotels (short-stay hotels available for sexual activities common throughout Japan), and are provided to gay venues such as bars and gay bathhouses by NGOs in Japan. However, delivery of free condoms to gay mobile app users who do not attend gay venues is problematic. These results identify groups of gay mobile app users that report inconsistent condom use with male partners that can potentially be targeted by interventions. For example, similar to previous findings among MSM in the U.S. [45], education had a protective effect for respondents, and participants with no university education reported three-times the likelihood of inconsistent condom use with casual male partners than university-educated participants, likely due to limited sex education implementation in Japanese junior high and high schools [9]. A trial in Japan using an extended HIV education program in junior high schools has shown potential as an effective HIV prevention tool [46]. In order to reduce inconsistent condom use, sexual minority inclusive sex education programs should be implemented in Japanese middle and high schools.

Moreover, inconsistent condom with casual male partners was more frequently reported among participants living in Central Tokyo than in Greater Tokyo or other prefectures. In order to improve condom use consistency among these groups, in-app promotion of condom use, which has the potential to engage high risk MSM populations [47], could be implemented in central Tokyo in order to reach the large proportion of non-venue attending MSM. Inconsistent condom use was more frequently reported with regular male partners among participants who identified as members of the gay community and who only had male partners, possibly due to more inconsistent condom use with trusted partners [48]. Future condom use interventions targeting gay community MSM should therefore promote the importance of condom use with both regular and causal partners.

Studies show alcohol and drugs to be associated with HIV risk among MSM communities [49]. High rates of binge drinking [11] and alcohol use during sex [8] have been found among gay mobile app users. In this study over three-quarters of survey participants had access to regular drinking partners, and 43.6% of respondents had trouble having safe sex while drunk. Drinking is a common part of Japanese and South-East Asian masculinity and work culture, associated with female sex-worker (FSW) visits [50], and may be associated with HIV risk behaviors with male sex workers (MSW), or with mental stress from heteronormative expectations of FSW visitation and subsequent unwanted ‘outing’. Behavioral interventions that reduce alcohol consumption and increase self-efficacy for safer sex when intoxicated may be important adjunctive approaches in MSM and reduce HIV transmission among MSM in Japan [51].

Evidence shows that daily pre-exposure prophylaxis (PrEP) use reduces risk of getting HIV through sex among HIV-negative people by more than 90% [52]. When considering the levels of inconsistent condom use among Greater Tokyo MSM, legalization and subsidization of PrEP in Japan for high-risk populations such as MSM is likely to help prevent HIV among MSM who engage in CLAI for a variety of individual, structural, and social reasons [53]. Moreover, antiretroviral adherence successfully meets the UNAIDS 2020 target in Japan. Interventions that improve adherence to antiretrovirals in Japan could be used to develop adherence strategies for HIV-negative MSM prescribed PrEP. Frequent HIV testing, condom use with all partner types, and PrEP should all be promoted while appropriately scaling up surveillance before and after prevention strategy implementation among MSM in Greater Tokyo.

4.1. Limitations

The results presented were collected from gay mobile apps and, as is common when recruiting hidden populations online, it used a convenience sampling methodology, which was not based on a
probability principle. Respondents were recruited through an advertisement, and those who chose to participate may suffer from self-selection bias and be more interested in the future of the gay community in general. It is also not possible to exactly replicate the survey as it would be with a completely randomized methodology. This limits the possibility of these results being used to draw conclusions about the community, or gay mobile SNS users in Greater Tokyo as a whole from this data as it is not a representative sample. Nonetheless, the sample size obtained is substantial and the information provided on the correlates of condom use is informative for targeted interventions. In order to overcome this issue, future longitudinal studies and use of an online-respondent-driven survey method (ORDS) are recommended in order to create a statistically significant population profile. Secondly, the behaviors and attitudes reported may have been subject to social desirability bias where participants may downplay certain behaviors they believe to be undesirable [54]. However, because the survey was anonymous and online we expect that this effect had been minimized. This research only used a selection of popular gay mobile apps, and other gay mobile apps may be associated with different MSM subpopulations important for future research. Other gay mobile apps utilize GPS similarly, and this study method would likely be appropriate for future research in Japan. Lastly, there are only limited validated measures in Japanese available, and future research should also aim to validate scales for use in Japan to collect information on condom use and self-efficacy.

5. Conclusions

This research shows that a substantial proportion of Greater Tokyo gay mobile app users use condoms inconsistently, particularly with regular partners. Gay mobile app users are accessible and generally willing to participate in HIV research and prevention via apps. Unlike many gay mobile apps, Japanese app makers have shown willingness to discount prevention and research projects for MSM users. In light of limited MSM research and prevention funding in Japan, and size of the gay mobile app user base, utilization of popular gay apps to promote condom use among all partner types and HIV testing facilities may be an effective prevention policy to target Japanese MSM.

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