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Social Capital, HIV Risk-taking Behaviors and Suicidal Ideation among Gay Mobile App Using Men Who Have Sex with Men in Greater Tokyo

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Abstract: Social Capital, HIV Risk-taking Behaviors and Mental Health among Gay Mobile App Using Men Who Have Sex with Men in Greater Tokyo

Suicide is a major public health problem in Japan, where suicide rates are among the highest in the world. Globally, men who have sex with men (MSM) report elevated rates of suicidal ideation and attempts compared to their heterosexual peers. However, there is a paucity of research regarding suicidal ideation among MSM in Japan, where MSM continue to experience significant stigma and discrimination.

Although Japan is a country of low HIV prevalence, the majority of newly reported HIV and AIDS infections are within the MSM population, placing a significant financial strain on national health system already struggling with an aging population. Furthermore, an estimated two-thirds of Japanese MSM are not attached to the gay community, and previous studies have largely sampled gay venues, potentially under-representing many men in this population.

Significant health disparities exist between MSM and the general population in Japan. Social capital is an important determinant of HIV risk and positive health outcomes. However, there is limited research investigating how alter (possessors of actual resources embedded in social capital networks) sexuality mitigates HIV-risk taking behaviors or the distribution of access to resources embedded in social capital networks.

The aim of this research is to strengthen our knowledge of HIV risk-taking behaviors, mental health, and social capital among this hidden population. I therefore conducted a cross-sectional study of 1,657 MSM users of gay mobile apps in Greater Tokyo, utilizing an anonymous, online survey to examine the following core research questions:

1) What are the prevalence and correlates of HIV testing and condom use among gay mobile app using MSM in Greater Tokyo?

2) What is the distribution of resource access through heterosexual and MSM social capital networks among gay mobile app using MSM in Greater Tokyo?
3) How are MSM and heterosexual social capital associated with HIV risk-taking behaviors among gay mobile app using MSM in Greater Tokyo?
4) What are the prevalence and social correlates of recent suicidal ideation among gay mobile app using MSM in Greater Tokyo?

The prevalence of lifetime and six-monthly HIV testing was 72.8% and 29.7% respectively. In multiple regression analysis, higher lifetime HIV testing was associated with older age, education, HIV knowledge, anal intercourse with regular and casual male partners, and gay venue attendance. Testing was negatively associated with regular male partner condom use, marriage, residing outside central Tokyo, and having both male and female partners. These results indicated that MSM who use gay mobile apps in Greater Tokyo do not meet the CDC yearly testing recommendations for high risk populations.

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 Greater Tokyo gay mobile app users use condoms inconsistently with regular partners, and may be at risk for HIV. Considering limited HIV prevention funding in Japan for MSM, moderate levels of HIV testing and condom use, and

the large number of gay mobile app users, utilization of popular gay mobile apps to promote HIV testing and consistent condom use regardless of partner type may be an effective prevention policy to target non-community attached MSM.

The separation of alter sexual identity revealed differences in the prevalence and correlates of access to resources embedded in MSM and heterosexual social capital among MSM in Greater Tokyo. Regression models revealed that heterosexual social capital access was positively associated with youth, educational attainment, fulltime employment, health, being out to close friends, and bisexual behavior. MSM social capital access was positively associated with being out to close friends, identifying as a member of the gay community, and ever attending a gay bar or event. MSM social capital access was negatively associated with being a student, living outside of central Tokyo, bisexual behavior, and using gay mobile apps for sex, or for a serious relationship.

MSM and heterosexual social capital were associated with different HIV-risk taking behaviors. Respondents were grouped into three levels of social capital (high, medium, and low). High social capital respondents were defined as 1.0 standard deviation (SD) above the overall mean, low social capital respondents as one SD below the overall mean, and medium social capital respondents in between. Multivariate models revealed that participants reporting high heterosexual social capital were twice as likely to use condoms consistently with casual male partners. Participants who possessed high MSM social were twice as likely to have undertaken HIV testing in their lifetimes, but were half as likely to use condoms consistently with regular male partners than participants reporting low MSM social capital. Due to observed mixed associations between social capital and HIV risk behaviors, policy interventions aiming to close

the HIV-risk gap for Greater Tokyo MSM should not blindly promote MSM social capital without considering potential negative outcomes.

Recent suicidal ideation, measured as suicidal thoughts in the preceding two weeks, was reported by almost one-third (31%) of participants. Participants who reported unemployment or part-time employment (compared to full-time employment) and knowing a heterosexual person who restricted their freedom or excluded them from a group had higher odds of suicidal ideation. Being aged 46 years or older, reporting good health, and having a medium or high level of access to social capital networks with other MSM were associated with reduced odds of suicidal ideation.

These findings provide evidence for the urgent need to scale up surveillance, mental health, and HIV interventions among MSM in Greater Tokyo. HIV and Suicide prevention interventions with MSM in Greater Tokyo and similar urban settings in Japan should work to enhance MSM social networks as a protective factor; promote consistent condom use with all partner types; and enhance current efforts to address stigma and discrimination in the community.

Declaration

This is to certify that:

I. This thesis comprises only my original work towards the completion of a Doctor of Philosophy.

II. Due acknowledgement has been made in the text to all other material used.

III. This thesis is fewer than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices.

Adam Hill Rolander Date: 26/02/2019

Preface

In my role as a PhD student, I was responsible for obtaining ethics approval for this study, development and administration of the survey, statistical analyses, and writing all chapters contained within this thesis under the supervision of Associate Professor Leah Ruppanner and Senior Research Fellow Gregory Armstrong from March 2015 to March 2019. This thesis includes two chapters that were accepted and published in peer reviewed journals in December 2018 and January 2019. These two peer reviewed journal articles are presented in this thesis accompanied by seven other chapters including an introduction, a literature review, a methods chapter, a results chapter, and a conclusion chapter. The published journal articles were written by the candidate and based on analyses of the data gathered in the cross-sectional survey in 2016 – 2017 during this project.

For this thesis project, I was responsible for:

1) The preliminary study design.

2) Developing the ethics application inclusive of research questions, methods, and data collection.

3) Survey design and subsequent translation of results from Japanese to English.

4) Overseeing the budget and applying for grants.

5) Developing the questionnaire used in the study, including selection and testing of appropriate validated measurement tools in Japan such as the Subjective Happiness Scale and promotional materials.

6) Designing the statistical analyses approach and undertaking all analyses of the data to be

included in this thesis in SPSS 24.

7) Independently writing a full draft of each chapter and the two published articles prior to circulating them to the co-authors (Gregory Armstrong and Benjamin R Bavinton) and my principle supervisor, Leah Ruppanner, for review.

8) Submitting the two published articles to PLOS ONE and IJERPH and responding to peer reviewer comments.

9) Performing all editing in response to reviews by co-authors, peer reviewers and editors.

I contributed over 85% of the two journal articles presented in this thesis. There were two co-authors across the two publications; Dr Gregory Armstrong (PhD)[a], Dr Benjamin R Bavinton (PhD)[b]

[a] Nossal Institute for Global Health, School of Population and Global Health, The University of Melbourne, Victoria, Australia

[b] The Kirby Institute, University of New South Wales, Sydney, NSW, Australia

The paid assistance of a proof-reader, Lesley Champion, who has no specific knowledge of sociology and the research contained within this thesis, conformed to the limits provided in Melbourne University's Editing of Research Theses by Professional Editors and the Australian Standards for Editing Practices.

Associate Professor Leah Ruppanner was the principal investigator for this study and supervised me throughout the development and implementation of the study design and the preparation of the journal articles and thesis chapters. Senior Research Fellow Gregory

Armstrong was the co-supervisor for this study and likewise supervised me throughout the development and implementation of the study design and the preparation of the journal articles and thesis chapters. Professor Benjamin R Bavinton co-supervised me during the preparation of the journal articles and the thesis chapters. All co-authors reviewed the final manuscripts before they were submitted for publication.

Acknowledgements

I would like to sincerely thank my incredible supervisors, Professor Leah Ruppanner, Professor Gregory Armstrong and Professor Benjamin R Bavinton, for their unwavering support and guidance over the past four years.

Most importantly, I would like to express my gratitude to the researchers in Japan who have laid the groundwork for this research, and the thousands of participants in Japan, who provided such incredible feedback, contributed in countless ways, and made this study possible.

Finally, I would like to thank Lesley for being my Champion, Matthew for inspiring me to do better, and Yannick and Ratty for providing absolutely no help but love.

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Abbreviations

AIDS	Acquired immune deficiency syndrome
AOR	Adjusted odds ratio
ART	Antiretroviral therapy
ARV	Antiretroviral
CLAI	Condomless anal intercourse
FSW	Female sex worker
FTC	Emtricitabine
FTM	Female to male transgender
GBM	Gay and bisexual men
LGBTI	Lesbian, gay, bisexual, transgender, intersex
HHST	Home HIV self-testing
HIV	Human immunodeficiency virus
HREC	Human research ethics committee
MTF	Male to female transsexual
MSM	Men who have sex with men
MSW	Male sex worker
OR	Odds ratio
PrEP	Pre-exposure prophylaxis
nPEP	Non-occupational post exposure prophylaxis
RDS	Respondent driven sampling
RNA	Ribonucleic acid
RCR	Romantic committed relationship
TasP	Treatment as prevention

TDF	Tenofovir disoproxil fumarate
UAI	Unprotected anal intercourse
UNAIDS	United Nations Programme on HIV and AIDS
US	United States of America
UK	United Kingdom
VIF	Variance inflation factor
WHO	World Health Organisation
(95%) CI	95% Confidence interval

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1. Introduction

1.1 Background

1.2.1 The Significance of the MSM Population for the HIV Epidemic in Japan

Men who have sex with men (MSM) are estimated to make up between 4.0 - 4.6% of the male population (1,2) in Japan, but are disproportionately burdened by the human immunodeficiency virus (HIV) (3). In 2016, 1,011 HIV (965 males; 46 females) and 437 acquired immunodeficiency virus (AIDS) (415 males; 22 females) cases were reported. MSM made up 78% of all Japanese male HIV cases, and the majority were in their 20s to 40s. The actual number of HIV cases transmitted through MSM is considered to be higher than the reported number due to stigma (4). Although Japan is a country with low HIV prevalence and risk, MSM-related HIV prevention suffers from lack of sustainable financing, high social stigma and discrimination, low numbers of researchers specializing in HIV among MSM (5), important but still comparatively underdeveloped partnerships between government departments, clinicians, NGOs, and MSM communities (6), and limited knowledge of specific prevention needs facing MSM among everyday health workers. Furthermore, an estimated 982,300 MSM (65.4%) are not attached to the gay community (7), and previous studies have focused on the gay community-attached MSM population using traditional venue-based sampling techniques that have failed to access this hard-to-reach population, potentially causing the HIV epidemic in Japan to be underestimated. This thesis therefore focuses on both the gay-community-attached and non-attached MSM populations in Japan at the center of the HIV epidemic.

1.2.2 The Significance of Gay Mobile App Users for the HIV Epidemic in Japan

Gay geo-social networking applications, henceforth referred to as gay mobile apps, have users who are both attached and non-community-attached. They have been found to potentially provide access to MSM not traditionally accessible through venue-based surveys (8–12). 9Monster and other Geo-social applications use global positioning systems (GPS) in mobile phones to allow users to search through a grid of nearby users based on their proximity, and to contact and meet nearby users, enabling MSM to encounter each other more quickly and easily (12,13). Gay mobile apps have very quickly become one of the most popular ways to arrange sex among MSM globally (14) in and Japan (15). Although Grindr is currently the most popular gay mobile application in the world with almost 3 million active daily users (16), Japanese application use varies significantly from the West. In 2017, the most used application was 9Monster, with 300,000 Japanese users as of April 2017 (17). While gay internet use has been extensively researched (18), there is a distinct lack of research about gay mobile apps using MSM outside the US, Australia, and China (19). Existing research has shown gay mobile app users to have higher numbers of sexual partners (8,20), and higher rates of HIV testing (8,19) than non-app using MSM. This research therefore utilizes a gay mobile app based cross-sectional survey to investigate levels of social capital, HIV testing and condom use among gay mobile app using MSM. Understanding social capital, testing rates and condom use among this hard-to-reach population of gay mobile app using MSM helps our understanding of different MSM subgroups, and in doing so enables us to better profile the Japanese HIV epidemic and potentially tailor prevention strategies for different MSM populations.

1.2.3 Knowledge Gaps in MSM Research

1.2.3.1 Social Capital and HIV

It is well established that social capital is associated with reduced HIV and STI prevalence (21) through a variety of mechanisms including increased condom use (22) , fewer

sex partners (23), lower late HIV testing in NYC and Philadelphia (24,25), diffusion and promotion of health promotion information (25). However, some studies have also shown social capital to be associated with negative HIV outcomes such as increased HIV risk-taking behaviors (26), or exclude individuals, potentially leading to high levels of HIV risk-taking among excluded non-members (27). The different outcomes for HIV risk reflect how a variety of mechanisms mitigate the effects of social capital on HIV risk outcomes. This research therefore conceptualized a new model to identify which of these various mechanisms are significantly associated with social capital and HIV risk. Taking into account criticism of previous studies, this research therefore 1) separates cause (social capital access) from effect (HIV risk outcomes), 2) separates MSM and heterosexual alters (possessors of actual resources in social network) in order to examine how alter sexual identity mitigates social capital and HIV risk outcomes, 3) conceptualizes and measures both positive and negative social capital outcomes, 4) controls for socio-demographic cofounders, and 5) uses the resource generator (28), a theoretically grounded, quantifiable and comparable social capital measurement tool in order to address this research gap and criticism of previous studies and to examine associations between social capital and HIV risk among gay mobile app users.

1.2 Objectives

Due to the importance of Social capital as a determinant of both HIV risk and health, and the dearth of information about MSM gay mobile app users in Japan, this research was designed with the following objectives:

First, this study aims to provide the first description of socio-demographic characteristics of MSM who use gay mobile apps in Japan. Gay mobile app users have been observed with differing socio-demographic and HIV risk behaviors than non-users, and these findings will provide a fuller profile of this MSM sub-population in Japan.

Second, this study aims to examine the prevalence and correlates of HIV testing and condom use among gay mobile app users in Greater Tokyo. This is the first study outside of the US and China to examine HIV testing and condom use prevalence and correlates for gay mobile app users and expands the existing literature on this high-risk subpopulation while also providing information to help design tailored strategies to increase condom use and testing rates.

Third, this study aims to examine how access to social capital resources is distributed among MSM in Greater Tokyo. It will explore social capital resource distribution and power dynamics for MSM in Greater Tokyo, identifying what kinds of social capital resources (instrumental resources or expressive actions) MSM have access to, how social capital resources are accessed through MSM and heterosexual alters, and whether and how social capital network access correlates vary between MSM and heterosexual alters to specific social capital resources.

Fourth, this study aims to explore the associations between social capital and HIV risk behavior outcomes. It will explore how MSM and heterosexual alters influence social capital and HIV risk behavior, as well as examine how different forms of social capital are associated with HIV risk behaviors. This study contributes to the social capital literature as the first research to investigate how alter sexual identity mitigates HIV risk behavior outcomes.

Fifth, this study aims to examine the associations between social capital and suicidal ideation. Social capital is considered a mental health determinant, but the mechanisms that influence positive and negative mental health outcomes are still not well understood. This research will examine how MSM and heterosexual alters affect social capital and suicidal ideation outcomes, and identify prevalence and other risk factors associated with social capital among this population. This is the first study investigating self-rated health and social capital among MSM in Japan.

1.3 Structure of Thesis

Chapter 1 Introduction provides an overview of the thesis background, rationale, objectives and structure.

Chapter 2 Literature Review provides a literature review of the two key concepts in this thesis: social capital and HIV/AIDS. The social capital literature review provides the foundations and development of the concept of social capital as both an individual and community attribute. It then discusses the structure, outcomes and important forms of social capital, such as bonding, bridging, and negative social capital, followed by validated methods of measuring social capital, and concludes by providing a theoretical framework of social capital for this research that deals with a variety of criticisms aimed at previous research utilizing the concept. The literature review of HIV first describes the global HIV/AIDS epidemic, discussing how MSM are a particularly susceptible population, and discusses the epidemic in Japan, including the low levels of HIV surveillance, and strong societal homophobia. MSM susceptibility to HIV is then explored, discussing the biological, behavioral, and social causes. HIV interventions, including biomedical, behavioral, structural, and combination packages conclude the HIV literature review.

Chapter 3 Methods provides a detailed description and justifies the selection of study participants and survey methods. In summary, this is a cross-sectional study conducted in Greater Tokyo, Japan, to examine prevalence and associations of HIV risk, suicidal ideation, and social capital among gay mobile app using MSM. It explains why using gay mobile apps was deemed the best method for reaching non-gay-community-attached MSM, and discusses various methodologies for recruiting hidden populations before selected sampling methods are explained in detail. Participants, incentives, initial and subsequent recruitment strategies, and the survey itself are explained in detail. Data management, statistical analyses, and ethical considerations are also described extensively.

Chapter 4: Results describes various aspects regarding participants in this study (MSM who use gay mobile apps in Greater Tokyo). Socio-demographic characteristics are described, followed by the prevalence of sexual behaviors that carry risks for the transmission of HIV and other STIs, including the relatively low levels of condom use with male partners, and low levels of lifetime and recent HIV testing among participants. Finally, high levels of psychological distress and suicide ideation are also highlighted, concluding with a description of levels of self-efficacy for safer sex and social capital.

Chapter 5: Prevalence and Correlates of Lifetime and Recent HIV Testing describes levels of lifetime and recent HIV testing, and factors associated with testing among gay mobile app using MSM in Greater Tokyo. Firstly, results show that less than three-quarters of respondents had ever been tested for HIV, and less than one-third in the last six-months. In multiple regression analysis, higher lifetime HIV testing was associated with older age, education, HIV knowledge, central Tokyo residence, gay-community attachment, and anal intercourse with regular and casual male partners. Testing was negatively associated with regular male partner condom use, marriage and having both male and female partners. The prevalence of lifetime HIV testing was well below the UNAIDS goal of having 90% of HIV positive people aware of their serostatus and the chapter concludes with information to help design tailored strategies to increase testing rates. This chapter was published in PLOS ONE on January 23rd 2019 and reproduced here under open access permissions.

Chapter 6: Prevalence and Correlates of Inconsistent Condom Use examines the prevalence and factors associated with inconsistent condom use among men who have MSM who use gay mobile geo-social networking applications (gay mobile apps) in Greater Tokyo. 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 chapter also provides useful information to help design tailored strategies to reduce inconsistent condom use. This chapter was published in IJERPH on December 10th 2018.

Chapter 7 Distribution of Access to Social Capital Resources among MSM in Greater Tokyo identifies social capital resource distribution and power dynamics for MSM in Greater Tokyo, what kinds of social capital resources MSM have access to, how social capital resources are accessed through MSM or heterosexual alters and networks, and which MSM have access to specific social capital resources in Greater Tokyo. These findings are discussed in detail.

Chapter 8 HIV risk behavior outcomes associated with access to resources embedded in MSM and heterosexual social capital networks among MSM in greater Tokyo examines how alter sexual identity mediates associations between social capital and HIV risk among gay mobile app users in Greater Tokyo. Findings show that MSM social capital access is positively associated with HIV testing. However, MSM social capital access was also associated with lower condom use with regular and casual male partners. Heterosexual social capital access was not significantly associated with condom use or HIV testing when controlling for self-efficacy for safer sex. Negative, bonding, and bridging social capital are also investigated, and are found associated with both protective and risky behavior outcomes. These mixed

associations between social capital and HIV risk behavior among Japanese MSM, and the implications for both social HIV interventions and social capital theory are discussed.

Chapter 9 Social Correlates of Recent Suicidal Ideation Among Men Who Have Sex with Men in Greater Tokyo investigates the prevalence and social correlates of suicidal ideation among MSM in Greater Tokyo. Recent suicidal ideation, measured as suicidal thoughts in the preceding two weeks, was reported by almost one-third (31%) of participants. Participants who reported unemployment or part-time employment (compared to full-time employment) and knowing a heterosexual person who restricted their freedom or excluded them from a group had higher odds of suicidal ideation. Being aged 46 years or older, reporting good health, and having a medium or high level of access to social capital networks with other MSM were associated with reduced odds of suicidal ideation. Implications from these results for suicide prevention interventions with MSM in Greater Tokyo and similar urban settings in Japan are discussed, including the use of MSM social networks as a protective factor, and enhancement of current efforts to address stigma and discrimination in the community.

Chapter 10 Conclusion closes the thesis. It first summarizes the key findings of the study and discusses the implications. Recommendations for future surveillance research among Tokyo gay mobile app using MSM, and potential interventions are outlined.

1.4 Summary

This is the first study to measure social capital and risky behaviors among gay mobile app users in Japan. The findings provide new insight into the concentrated HIV epidemic in Japan, particularly as previous research has mainly focused on physical gay venues, and missed the large population of non-community attached MSM. By investigating how alter sexual identity mitigates social capital and HIV risk behavior outcomes, this research provides new insight into our understanding of mechanisms that influence social capital and health and behavior outcomes, enriches social capital theory, and lays a framework for future international

studies. These findings also provide rich data on MSM at high risk for HIV, and provides surveillance for fine-tuning of available risk-reduction intervention programs.

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2. Literature Review

This chapter provides an overview of social capital literature in order to provide readers with a theoretical foundation from which to assess the findings in this study.

2.1 Social capital literature review

2.1.1 Founding Figures in Developing Social Capital Theory: Initial conceptualization of social capital as resources embedded in relations between individuals

Pierre Bourdieu (1930 – 2002) created the first systematic analysis of social capital, defining it as: "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" (1). First published in French in provisional notes to the *Actes de la Recherche en Sciences Sociales* in 1980, Bourdieu's theory was not published in English until 1985, hidden in a text on the sociology of education. His concept has therefore been under-utilized both in English speaking countries and the health social capital field (2–5) in comparison to the commutarian definition of social capital as "Features of social organizations, such as networks, norms, and trust, that facilitate action and cooperation for mutual benefit" (6) This is unfortunate as Bourdieu's concept of social capital has a clarity of measurement not available in Putnam's (7), and avoids the tautology that inevitably emerges from not separating the sources of social capital from its effects (4,8,9).

Bourdieu described social capital as an agent of class reproduction, reproducing social inequality across generations by exploiting the convertibility of capital to disguise economic exchanges. For example, because inheritance is heavily taxed in France, rich parents may invest in their children's future by paying for tutors and private education. This advanced education

provides children with an advantage in university examinations (cultural capital), and connections with other students at private institutions with access to a variety of useful resources in their social networks, thus expanding their social capital and reproducing social inequality generationally (1). According to Bourdieu, capital is convertible between three forms: (1) economic capital, immediately and directly convertible into money; (2) cultural capital (dispositions of mind and body, cultural goods, and educational qualifications) convertible on certain conditions to economic capital; and (3) social capital, made up of social obligations ('connections'), which is convertible, in certain conditions, into economic capital (1). Converting one form of capital into another is subject to a transaction cost, including the risk of no returns. This transaction cost varies depending on the extent to which the process of converting one form of capital to another conceals what is fundamentally an economic exchange. For Bourdieu, social capital was therefore a property of individuals accessing resources possessed by others in a network for personal gain. As opposed to later commutarian concepts of social capital, Bourdieu did not see access as equally distributed throughout a community.

James Coleman (1926 – 2005) saw social capital as "paralleling the concepts of financial capital, physical capital, and human capital - but embodied in relations among persons" (10). Coleman used the concept of social capital to create a new theoretical orientation that combined the theory of social action in which "the actor is socialized and action is governed by social norms, rules, and obligations" (10), and the theory of rational action, in which actors consistently choose the self-determined best choice of action independently, thereby forming a paradigm of rational choice "without the assumption of atomistic elements stripped of social relationships" (10). He identified three forms of social capital: (1) obligations and expectations, which depend on trustworthiness of the social environment; (2) information-flow capability of the social structure; and (3) norms accompanied by sanctions, stressing the

importance of network closure in facilitating the first and last forms. Although Coleman saw the consequences of social capital as primarily positive, he also theorized that while it could be beneficial for some actors in a network, it could be negative for others, citing the use of social capital information channels in order for competing companies to create price-fixing monopolization to the benefit of shareholders and detriment of consumers as an example. While Coleman's focus on network closure, shared norms and reciprocal trust has been particularly influential for social capital researchers, his functionalist conceptualization of social capital, defining it by its function as, "not a single entity but a variety of different entities, with two elements in common: they all consist of some aspect of social structures, and they facilitate certain actions of actors – whether persons or corporate actors – within the structure" (10) has drawn criticism as tautological (4,11), and labeled as 'social capital version 1.0' (3)

Nan Lin defined social capital as "investment in social relations by individuals through which they gain access to embedded resources to enhance expected returns of instrumental or expressive actions" (9). He divides the returns of social capital into 'instrumental returns' and 'expressive actions'. Instrumental returns are resources not currently possessed by the ego, such as economic investment tips and subsidized loans, political, and social returns (4). Expressive actions help to consolidate and maintain currently possessed resources, preventing possible losses, with the returns grouped as physical health, mental health, and life satisfaction (12). Within the field of public health and social capital, expressive actions are generally investigated as they are considered more intrinsically linked to physical and mental health outcomes. This research will use theoretically grounded forms of social capital aggregated through individual social capital indicators to investigate whether expressive actions and instrumental returns are associated with different HIV risk behavior and mental and physical health outcomes. More concretely, I will investigate whether social capital access is associated with higher self-rated health, self-rated happiness, and HIV testing as well as lower suicide

ideation and condomless anal intercourse (CLAI). Expressive actions are measured using individual social capital questions regarding access to everyday resources not currently possessed by the ego through heterosexual and MSM alters grouped into an indicator. Similarly, instrumental returns are measured by questions regarding trust and shared norms, values and opinions, grouped into a single indicator measuring heterosexual and MSM access.

According to Alejandro Portes, "social capital refers to the capacity of individuals to command scarce resources by virtue of their membership in networks or broader social structures" (4). Portes is not only a proponent of social capital as resources embedded in relations between individuals, he is also one of the most well-known critics of Robert Putnam's framework of social capital as a community attribute (4). Portes also proposed four 'negative' outcomes of social capital: downward leveling norms, restricted freedoms, excessive claims, and exclusion as I will explain later in this chapter (13). The labeling of 'negative social capital' has, however, come under criticism for being post-hoc subjective (11) and for not being a valid form of capital, as other forms of capital such as economic capital cannot be negative. The term 'alternative social capital outcomes' will therefore be used for this thesis, as described by Kalijee and Chen (2011).

"Conceptualized in its individual form, social capital refers to all possible kinds of resources potentially owned by social network members, which may become available to a focal individual as a result of mutual investments in a shared past, of which social relationships with these network members form evidence" (14). Using this definition of social capital in this research enables us to investigate "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" (1) and identify social capital resource distribution inequality and power dynamics among MSM in Greater Tokyo.

2.1.2 Subsequent conceptualization of social capital as a community attribute in public health

Individual social capital, henceforth referred to as network social capital, theorists such as Bourdieu and Lin contrast with Robert Putnam's (1993) macro-level definition. Unlike Coleman, for whom community ties were important for the *benefits provided to individuals*, such as community norms that enable elderly individuals to be out alone at night, Putnam conceived social capital as a property of nation states equally benefiting all members. When the concept of social capital was exported to other disciplines, it became an *attribute of community* itself – benefits not provided to individuals, but to the collectivity in form of reduced crime rates, lower corruption, and better governance (15). Accordingly, "This conceptual stretch, initiated by political scientist Robert Putnam [defined as "Features of social organizations, such as networks, norms, and trust, that facilitate action and cooperation for mutual benefit"] (6), made it possible to speak of the "stock" of social capital possessed by communities and even nations and the consequent structural effects on their development…social capital as a property of cities and nations is qualitatively distinct from its individual version, a fact that explains why the respective literatures have diverged" (4).

Despite its dominant usage in health research, for example, the World Bank defines social capital using a community attribute definition: "social capital means the norms and social relations embedded in the social structures of societies that enable people to coordinate action to achieve desired goals" (16) as well as economics and political science fields), the framework for community social capital has faced four main criticisms.

Firstly, theoretical frameworks of social capital as a community attribute can be undermined in cases where individual social capital creates rules purportedly beneficial to the community by individual political and business connections that enable private rather than public gains (4,10). This is because "a given form of social capital that is valuable in facilitating

certain actions may be useless or even harmful for others… context specific nature of social capital means access to social resources is not brokered or distributed evenly" (7). Macro level social capital frameworks cannot analyze individual level social capital, and must therefore suppose that all social capital is equally distributed and creates equally positive returns for all members of a society, which opposes the theorized inequality inherent in both an individual's position within a social network, and the network's status itself within the social hierarchy (1,2,4,9). In turn, the key to understanding how social relations facilitate individual and collective actions lies in a conception of social capital that recognizes its use value on specific social contexts in which it is found (7).

Second, a Putnamian social capital community attribute framework commences with the effect, resulting in a tautological final statement. For example, when contrasting successful and unsuccessful cities, "social capital is simultaneously a cause and an effect as a property of communities and nations rather than individuals; social capital leads to positive outcomes, such as economic development and less crime, and its existence is inferred from the same outcomes. Cities that are well governed and moving ahead economically do so because they have high social capital; poorer cities lack in this civic virtue" (4).

Third, Putnamian frameworks have received significant criticism for theorizing all returns of social capital as positive. Adler and Kwon (2002) describe the position as 'one-sided', citing research by (17), that "social capital has risks that can sometimes outweigh its benefits for the focal actor". Kawachi (3) cites research showing that bonding social capital can have both positive and negative effects depending on the network (a close group of poorly behaved teens can make the situation worse), while Carpiano (18) found that social capital forms (social support, social leverage, informal social control, and neighborhood organization participation) were directly associated with both positive and negative health outcomes. Takahashi & Magalong (19) describe 'disruptive' social capital within '(un)healthy socio-

spatial interactions' in immigrant Filipino gay men with HIV, in which social capital in alternative groups leads some to social support and decreased health risk behaviors, while others are led into drug use and higher risk behaviors. Portes therefore theorized four potential negative outcomes of social capital (13,15) that I will describe in detail later in the 'outcomes of social capital' section.

Fourth, Putnam faced initial criticism for the immeasurability of his framework. He made it quantifiable by stating that "for every political system, a higher rate of exposure of the general population to printed media, and a higher participation in nonpolitical associations and a high level of general trust leads to greater levels of civicness and better policy outcomes." This measure was criticized by Fukuyama (8) for being too simplistic, stating "it is necessary to have a more precise measure of social capital than Putnam's methodology". Fukuyama, defining social capital as "the ability of people to work together in groups and organizations", took Putnam's theory of community social capital in which he counts groups in civil society, *n*, to track memberships in *t*, the different kinds of groups such as sports clubs, bowling leagues, literary societies, political clubs, etc.:

$$\text{Social Capital} = \sum \boldsymbol{n_t}$$

Fukuyama added a social cohesion measure, *c*, 'Radius of trust' (r_p),), the proportion of members of the group sharing tight bonds of trust and able to interact with each other on the basis of shared norms and values, and the radius of distrust, r_n, the amount that a network does not accept network outsiders:

$$\text{SC} = \sum \left(\left(\frac{\mathbf{1}}{\boldsymbol{r_n}} \right) \boldsymbol{r_p c n} \right)_{\boldsymbol{t}}$$

This measure is much improved, although it suffers from the fifth important criticism of Putnam's concept of social capital as a community attribute: the lack of control features for socio-demographic cofounders, for example gender, age, sexuality, ethnicity, community duration, social class (2,15,18).

This research project utilizes a network (individual) social capital framework as opposed to Putnamian macro-level theoretical framework in order to overcome these criticisms. This project's social capital framework therefore 1) measures social capital of individuals, and can therefore investigate social capital access inequality and can be aggregated into high and low access groups, 2) avoids tautology and clearly separates cause (social capital access) from effect (HIV risk behavior outcomes), 3) conceptualizes and measures both positive and negative social capital outcomes, 4) controls for socio-demographic cofounders, and 5) uses the resource generator, a theoretically grounded, quantifiable and validated social capital measurement tool (see social capital measurement).

2.1.3 A multi-level framework of social capital as resources embedded in relations between individuals and as a community attribute

Kawachi (3) posits social capital in relation to health as defined as both social cohesion at a community level and as resources embedded in networks at an individual level. More emphasis has been given in health literature to the social cohesion definition (2,3,18,20), which is important for network members, regardless of active participation (3). Both frameworks can be useful for our understanding of the relationships between social processes and health, and both point to the existence of valued resources (capital) inherent as the byproducts of social relations.

Kawachi (3) suggests a multilevel framework for social capital, conceptualizing it as both a property of individuals in a network and of communities. According to Adler and Kwon

(2002), the differences between theoretical approaches that define social capital as the resources individuals have access to and can mobilize through their social network ties, and those that define social capital as a community resource that exists within the contents of those ties, is largely a matter of perspective within the unit of analysis. They state: "the relations between an employee and colleagues within a firm are external to the employee but internal to a firm… the behavior of a collective actor such as a firm is influenced both by its external linkages to other firms and institutions and by the fabric of its internal linkages: its capacity for effective action is typically a function of both" (2002; 21). Even Portes, one of Putnam's staunchest critics, contends that, theoretically, there is no problem with the concept of social capital as a community resource, simply with the limited theoretical implementations thus far: "there is nothing intrinsically wrong with redefining it as a structural property of large aggregates. This conceptual departure requires, however, more care and theoretical refinement than that displayed so far" (4).

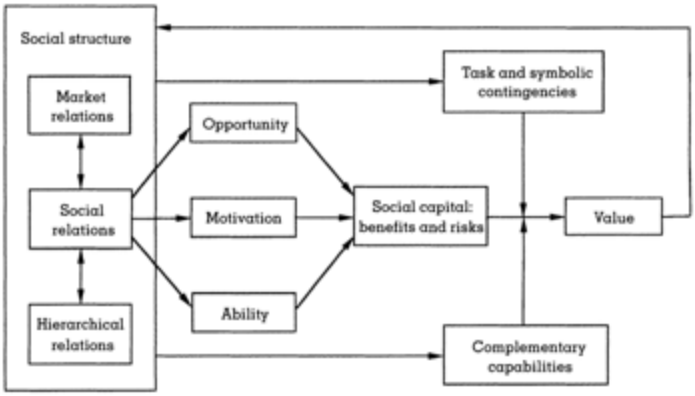
According to Kawachi (3), "multi-level approaches have proved useful in two fundamental ways: (a) by enabling researchers to demonstrate whether social cohesion has an independent contextual effect on belonging to the social group; (b) by permitting researchers to explicitly test for cross-level interactions between community social cohesion and individual characteristics, such as socioeconomic status, race/ethnicity, and gender… adopting a multi-level framework implies that variations in health outcomes are determined by both individual risk and protective factors, as well as community risk and resilience factors. As such, interventions to mitigate adverse health outcomes can be offered at both the individual and community levels."

Although this research therefore uses a multi-level, or integrative, definition of social capital as both an individual and community attribute: 'social capital is the resources available to individuals, a network, or a community. Its source lies in the structure and content of the

actor's social relations. Its effects flow from the information, influence, and solidarity it makes available to the actor' adapted from (21). Social capital can therefore be used for both individuals and collective groups, and this research therefore measures individual level social capital, as well as including the potential for measuring aggregated community attributes such as shared values, opinions, and norms.

2.1.4 Social Capital Structure

Within Adler & Kwon's framework, "social capital is the resource available to the actors as a function of their location in the structure of their social relations" (21). Expanding the distinction between economic and social exchange (22,23), social relations themselves exist within a social structure consisting of market relations (money and services are exchanged for money), hierarchical relations (obedience to law and orders in exchange for financial and physical safety), and social relations (favors and gifts are exchanged) (21). Market relations and hierarchical relations both exert and receive influence with social relations, as most concrete relationships will contain all three types of relation (for example working together leads to friendships outside of work). Coleman describes this process of multiplex relationship formation within social capital as the *appropriationality* of social capital. Here *appropriationality* of social structure relations refers to the fact that one form of relationship tie, such as friendship, can be used in other situations, such as for work advice or financial support (10). Given the correct combination of *opportunity* (4,9,15), *motivation*, and alter *ability* (possessing the necessary information/skills/resources for the situation) enables an actor to form social capital through social relations. Without opportunity and motivation, it is unlikely that the social capital will be provided, and without ability, the social capital will not be useful for the situation. The created social capital contains both benefits and risks, and ultimately a positive or negative value as can be seen in Figure 1.



Source: (Adler & Kwon, 2002)

Figure 1 Conceptual model of social capital

Opportunity, defined as access to network ties, and the awareness of resources in the network (7) enable an actor access through social ties for social capital transactions. Bridging ties and network holes provide the opportunity to access resources not currently possessed (9,24). Bonding ties and network closure provide opportunity to access, to maintain and strengthen the resources currently possessed. Social ties aggregated to a community level provide an opportunity for individuals to work together (that is social leverage) (21).

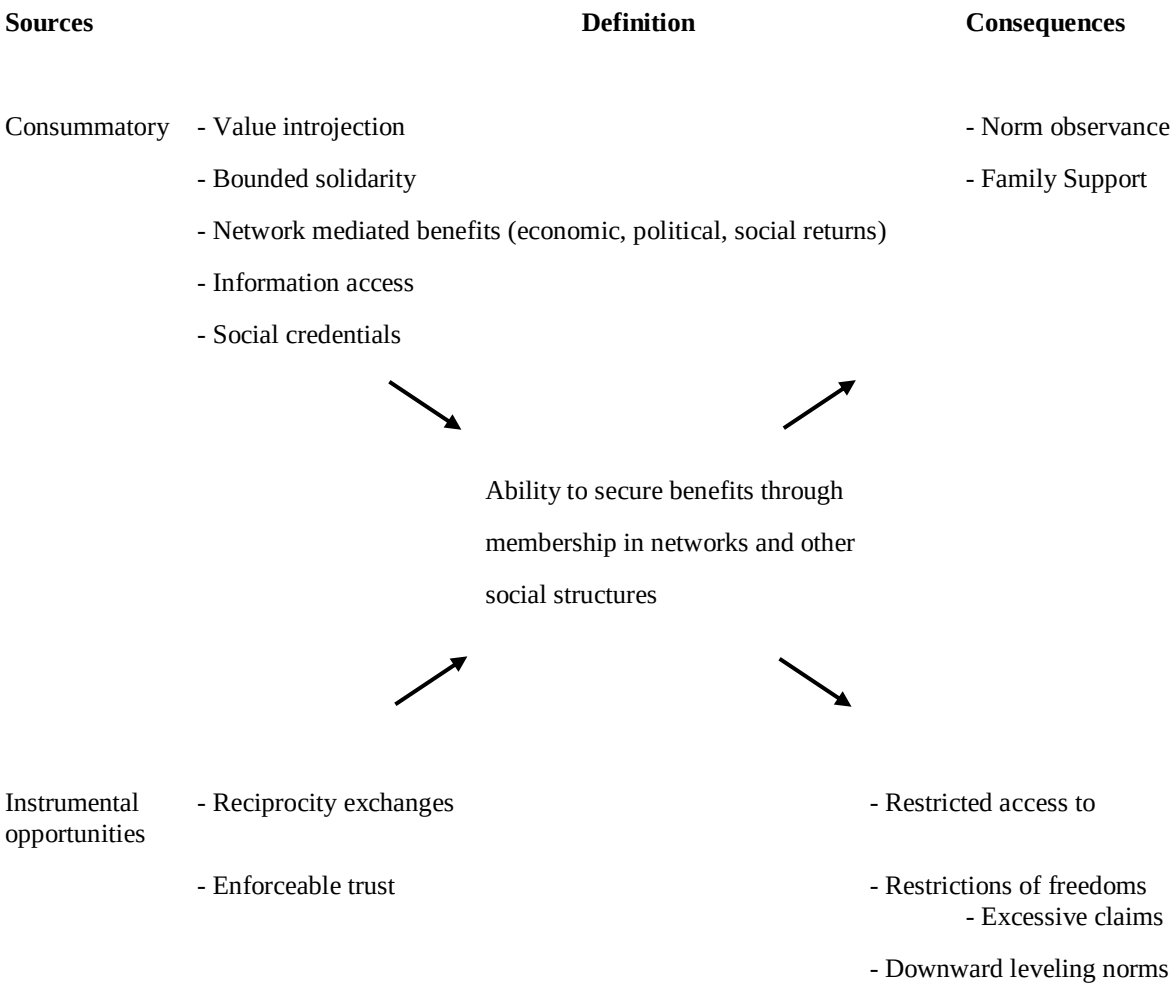
Motivations to make resources available to actors are not uniform (4). Portes divides motivations for resource possessing actors to make these available to other network members into consummatory and instrumental categories. Consummatory motivations consist of value introjections and bounded solidarity. In value introjections, norms and values become appropriable by others or a collective as a resource (for example to walk home at night or to have protected intercourse without fear because the community is following safety norms and looking out for each other.) Portes notes that this must not be overstated, referring to Wang's 1961 theory of the over socialization conception of human action. Bounded solidarity consists of altruistic actions by network members due to a common fate. Examples of bounded

solidarity can be seen by the San Francisco gay community in the 1980s through the creation of protective networks and norms, and volunteering. Instrumental motivations consist of reciprocity exchange and enforceable trust. Reciprocity exchange, based upon the theory of George Simmel in 1902, posits that those with group affiliations and social exchange donors provide access to valued resources in the expectations of future repayment (4). Examples include any kind of reciprocity exchange, for example, helping someone move with the expectation of a future favor. Enforceable trust involves the expectations of repayment not based on knowledge of the recipient but on both actors in a common social structure. Returns may come from the collective, as status and honor, and are guaranteed by the community. Recipients therefore get access to resources they may otherwise not have through their direct network ties, and donors get approval and expedited transactions guaranteed by the network. As Bourdieu (1) states, there is no direct timeframe, and the payment may be returned in a different form. Small closed networks such as the gay communities can enforce norms more than with non-attached MSM. Okinawan *moai*, or rotating credit exchanges, are an example of enforceable trust. In Okinawan *moai*, members of the collective give money each month without worry that another member will simply run off with the group's investment. This is because each member is not necessarily bound by a close knowledge of the recipient, but because both actors are in the common Okinawan social structure which is tightly bonded and cannot be escaped without leaving Okinawa and cutting one's family ties as well (all are multiplex ties of work, family, and friends.)

The strength of social capital is defined not only by the amount of network ties, but the abilities of those with whom the ties are connected, and their latent human capital (1,9). It is possible to measure the potential for instrumental returns (economic, political, and social returns) (9) using the position generator and Lin's theoretical framework that 'network resources are represented by wealth, power, and status'. However, because expressive action

returns are more important to health outcomes than instrumental returns, and wealth, power, and status have little impact on expressive action returns (a surgeon provides similar emotional support to a cleaner regardless of societal status), the network tie position measuring methodology posited by Lin is of limited use for health and social capital research (11,20).

This research will investigate whether MSM and heterosexual alters are associated with different HIV risk outcomes, and conceptualizes that the motivations (consummatory and instrumental) to make resources available to actors not being equal as one of the key mechanisms. For example, resources embedded in social capital networks accessed through MSM alters may be associated with higher HIV testing due to bounded solidarity and positive value introjections, whereas this may not be the case when accessed through heterosexual alters as neither bounded solidarity nor positive value introjections exist within heterosexual social capital networks. Examining determinants within the network structure and network ties for whether social capital leads to positive or negative returns is a main focus of this research. Figure 2 shows the sources and consequences of social capital:



Source: (4)

Figure 2: Actual and Potential gains and losses in transactions mediated by social capital

2.1.5 Forms of social capital: Bonding, bridging, and social control social capital

Bonding Social Capital: A form of strong social capital ties is created by belonging to a homogenous network of like-minded individuals such as a university fraternity or a cult. This form of social capital was coined as bonding social capital, and contrasted to bridging social capital (25). It was also referred to as 'integration' (26), and 'social glue' (27). Bonding social capital consists of the ties between individuals in a group (that is the MSM population). This "set of norms or values in communities that allow for mutual cooperation to exist" can produce a common mindset that can be used for social benefit – for example regular condom usage with

sex partners (8). However, bonding social capital (measured as strength of trust and shared norms and values with others with same race and educational background and associational ties) in disadvantaged communities was linked to mental and physical distress and can be a heath liability rather than a force of health promotion as it is often assumed to be (3).

Bridging social capital: Unlike inclusive bonding ties, bridging ties refer to the building of social connections between heterogeneous groups. Bridging ties are linked to diverse, unpossessed resources, and instrumental returns (9), whereas bonding ties are linked to the reinforcement of possessed resources and emotional support, or expressive actions (9). Bridging connections can be brokered between disconnected segments, and it is the weak ties and outliers who exist between two networks that possess new resources and potential jobs (24). According to Kawachi, "Distinguishing between bonding and bridging social capital helps us understand how social capital promotes – or harms – the health of individuals" (3).

Social support: Defined by Carpiano as social capital that members can draw upon to cope with daily problems such as access to physical resources like borrowing a car or money (2008). This definition as access to physical resources sets it apart from other definitions such as bonding social capital that is linked to emotional support and trust, as the physical resources are associated with daily hardship, and differing alter motivations than bonding and bridging social capital.

This thesis uses specific individual social capital indicators from the resource generator that can be grouped to form a variety of theoretically defined and comparable positive specific sub dimensions of social capital including bonding and bridging and social capital. By separating these, I am able to investigate whether various concepts of social capital are associated with differing HIV risk behavior outcomes when controlling for socio-demographic covariates.

2.1.5.1 Negative Social Capital

As mentioned previously, social capital frameworks that theorize all returns of social capital as positive have come under significant theoretical and empirical criticism (3,18,19,21). Portes proposed four 'negative' outcomes of social capital: downward leveling norms, restricted freedoms, excessive claims, and exclusion. Kaljee & Chen (28) use the less subjective term 'alternative social capital', while Leenders and Gabbay (17) label it 'social liability'.

The reproduction of social capital is a process that creates boundaries (1,4). These boundaries can result in exclusion, which can lead to fragmentation and separation from the main part of society (29). It can also lead to exclusions such as being wary of outsiders and thus not inviting non-community attached MSM to gay social events, or non-MSM researchers into the community.

Downward leveling norms exist where suffering and prejudice against a group creates solidarity. Because individual actor successes damage this cohesion, downward leveling norms exist in which all members continue to reproduce poor actions, and individual actors must escape to succeed (4). If the Tokyo gay community does not get checked regularly for STIs, and only gets tested when an illness is visible, an individual actor may be influenced through these downward leveling norms to do the same. If an individual actor were observed regularly attending STI testing, breaking the community norms, they could be perceived as frequently with STI infections or highly promiscuous by other MSM.

Restricted freedoms exist in small communities that demand conformity (4), or in the gay community where a member may not be able to act as they wish, or on a larger scale, may not feel free to act as they wish as they are defined by Japanese socially constructed

expectations of masculinity. Excessive claims can also be made on members of a community, taking too much of their time, and increasing stress as well as taking too much money and preventing entrepreneurship (4). Like other forms of capital, creating social capital requires an investment of human labor. There is an inevitable risk of overinvestment of human capital for the returns received (21), and the potential for no returns at all (1). Bonding social capital may be beneficial for some groups, but for others, such as children, it weakens the control by the adults, and is therefore a form of 'alternative social capital' (4). Considering these potential negative social outcomes, blindly strengthening social capital could lead to potentially worsening a given situation.

Despite the importance of distinguishing between kinds of social capital, there is limited research regarding how MSM and heterosexual social capital networks may be associated with differing condom use and HIV testing outcomes. This thesis fills the research gap and examines how MSM and heterosexual social networks mitigate associations between cognitive, structural, bridging and bonding social capital and HIV testing and condom use behaviors among MSM in this sub-population.

2.1.6 Social Capital Outcomes

A variety of social capital outcomes have been theorized and are briefly illustrated as follows:

2.1.6.1 Instrumental and Expressive Outcomes

Nan Lin defines social capital as "investment in social relations by individuals through which they gain access to embedded resources to enhance expected returns of instrumental or expressive actions" (9). Separated from the resources themselves, he divides the returns of

social capital into ‘instrumental’ and ‘expressive actions’. Instrumental returns “significantly add to an individual’s personal resources such as his cultural, human, material and political capital (can provide information for jobs or investment opportunities that are not available to an individual on the market” (14,20). These are resources not currently possessed by the ego, such as economic investment tips and subsidized loans, political, and social returns (4). Lin defines social return as the ego’s reputation within the network, in which both the ego and alter acknowledge the transaction asymmetry and debt, creating social credit for the alter (9). Furthermore, the identity of one’s social network to the ‘outside world’ can work to show the potential resources available for an actor through their network ties (for example hiring an employee because of their family connections and potential to use them in the future), becoming a form of ‘social credentials’ and a public acknowledgement of an actor’s claim to resources (9,30).

Expressive action returns are “unique resources that are not possible to be produced or purchased satisfactorily on an individual basis, for example love, friendship, emotional support” (9,30) and help to consolidate and maintain possessed resources, preventing possible losses (1,9). This research will examine whether different forms of social capital are associated with different HIV risk behavior outcomes.

Lin separates these into the categories of physical health, mental health, and life satisfaction. Accordingly, Lin posits physical health as the maintenance of physical functional competence, and mental health as the capability to withstand stress and keep emotional balance. Life satisfaction indicates satisfaction with life, such as family, marriage, work and community and neighborhood environments (9).

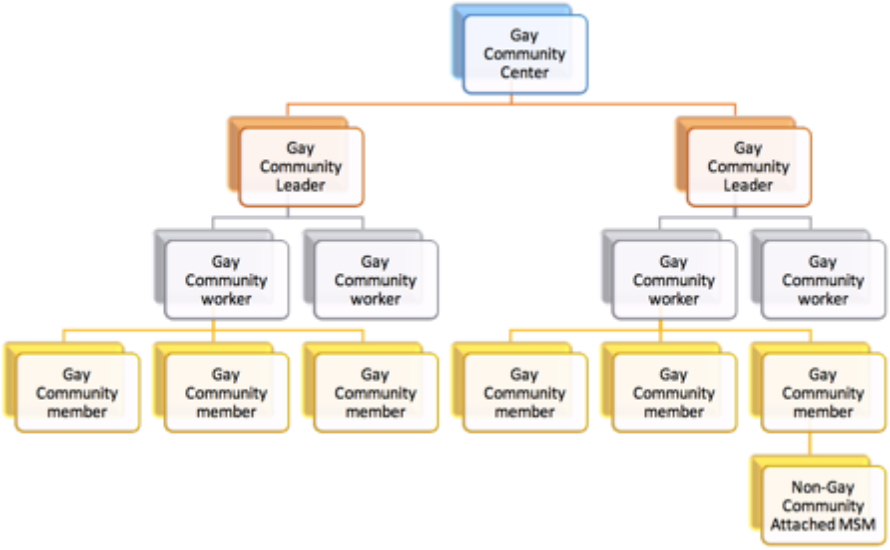
Lin conjectures that instrumental and expressive actions often support each other. Physical health offers capacity to handle workload in order to reach economic and social status.

Both economic and social status is necessary to maintain physical and mental health (exercise, diet, stress reduction). Denser networks with close strong reciprocal relations may raise the possibility of mobilizing others to protect existing resources and expressive returns (9).

This project uses this theoretical background to investigate whether and how MSM social capital expressive actions and instrumental return outcomes are associated with condom use and HIV testing among MSM in Japan.

2.1.6.2 Facilitated flow of information

For Coleman, "an important form of social capital is the potential for information that inheres in social relations…social relations that constitute a form of social capital that provides information that facilitates action" (10). Thus, Coleman sees social relations as a way for actors who possess social capital in the form of relationships with other, more knowledgeable members of a network, to gain access to information they would not normally put the time and effort into using their own resources to learn for themselves. For example, MSM who are not active socially in the gay community, and therefore do not normally access information about new HIV prevention methods such as PrEP, or availability of free anonymous STI testing at gay community centers from gay community center meetings, newsletters etc., can access information through well informed MSM (likely gay community members), by simply asking them about the situation, rather than researching themselves. Figure 3 shows a potential information channel:



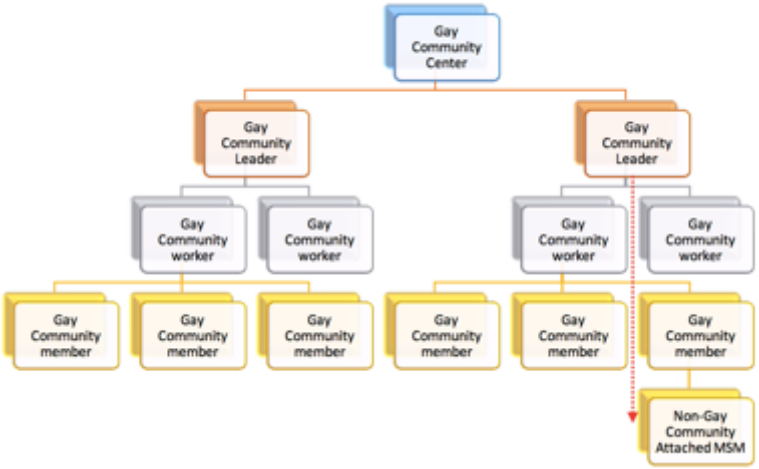
Source: adapted from Fukuyama, 1997

Figure 3: Tokyo MSM HIV Information Network

The diagram does not include a variety of influences to the network that shape the efficiency of the information channels. Although the information channel theoretically passes from the gay community center to the community leaders, then community workers, then community members, and finally non-community attached MSM, this is potentially subverted by other factors.

Informal power networks such as patronage networks are networks that exist within, and often subvert, a formal network authority structure based on other (often stronger) ties, such as the emotional or family ties existing in love and friendship. Within the patronage network, through shared norms, values, and reciprocity, information passes readily, but the outer boundaries constitute a membrane through which information passes less readily (8). As can be seen in Figure 4, information may pass directly from a community leader to a non-attached community member who he shares some other connection with, subverting formal

network structure, and giving non-community attached MSM access to information even a community worker may not have.



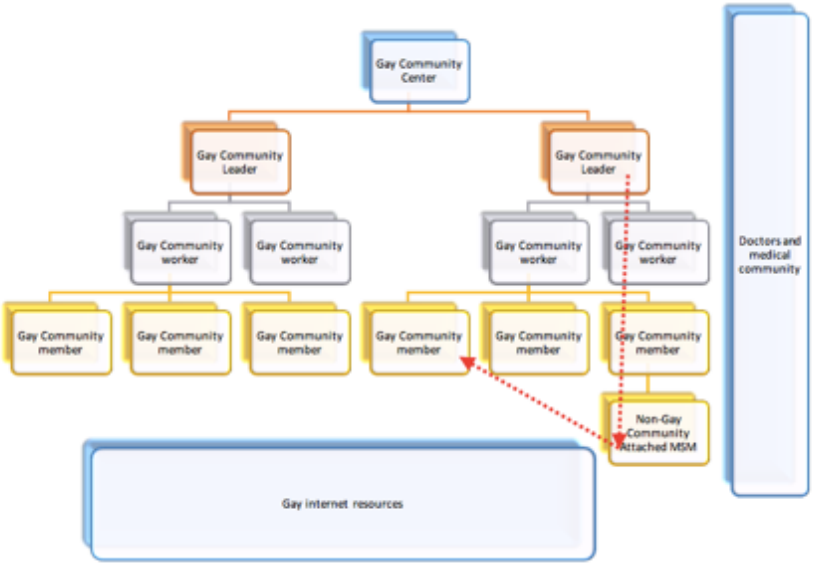
Source: adapted from Fukuyama, 1997

Figure 4: Tokyo MSM HIV Patronage Network

The importance of 'weak ties' and 'network holes' is often cited as an important source of social capital. The theory has been brought to the forefront of social capital theory by Burt (31) and Granovetter (32), stressing that it is weak ties that bring the most value to information networks. Whereas a community with very strong homogeneous ties may be unaccepting of outside ideas and unwilling to change, community outliers who exist between two or more community networks are capable of bringing in new and important information: "It is the deviant individuals straddling different communities that bring heterodox ideas ultimately responsible and necessary for the group to adapt to changes in its environment" (8). Network ties giving actors access to innovative ideas and potential job resources is useful for financial well-being and job satisfaction (important factors for an individual's mental and physical health). However, in Japan, the medical community is closely attached to the gay community through NPOs and gay centers which have close working relationships with medical

researchers. Novel HIV prevention technologies such as PrEP are therefore unlikely to be introduced through weak ties, but through existing strong bonding ties between the medical and gay communities.

The source trustworthiness affects the mobilization of social capital facilitated by the ego receiving information from an alter. According to the 2017 Tokyo MSM survey data, 25% of respondents replied that they would be likely to follow advice about practicing safe sex from a gay community center compared to 38% from a doctor and only 10% from regular and casual sex partners combined. Furthermore, while 87% of respondents received HIV information from a gay internet resource, only 16% would follow the advice. It is clear therefore that *access is not equal to mobilization* (4). An amended MSM information network would look like the following, Figure 5.



Source: adapted from Fukuyama, 1997

Figure 5: Full Tokyo MSM HIV Patronage Network

The networks and social channels above are based upon the concept of rational actors and rational capitalism, wherein actors act according to their best personal interests. However, networks, understood as informal ethical relationships, are therefore associated with phenomena like nepotism, favoritism, intolerance, inbreeding, and non-transparent personal arrangements (8). Furthermore, some actors do not act 'rationally' in their best interests or altruistically (Max Weber, 1978), for example Fukuyama (1997), proposed the scenario of an employee not enacting the best solution for the company if it will end in his losing his job. A further example in the gay community could be shown through MSM who actively seek becoming HIV positive, or who knowingly spread HIV to others in order to reduce HIV/AIDS stigma. Finally, it should be noted that the possible exclusion of non-gay-identifying researchers by the gay community (a 'negative' side of MSM bonding social capital) (4) further complicates matters and trust of information entering the networks.

Based on this network theory, I hypothesize that high MSM social capital access will be associated with higher HIV knowledge and more frequent lifetime and recent HIV testing due to the influence of facilitated information flows, and heterosexual social capital access will have minimal impact as there is limited information for HIV in the heterosexual community. I set out to assess the reliability of these theoretically grounded hypotheses in this thesis.

2.1.7 Social Structure that Facilitates Social Capital

Foley & Edwards (7) state that "in examining the role of national and transnational social movement organizations in producing social resources and making them available as social capital to wide ranging constituencies through their organizational infrastructures, communication networks and mediating collective identities has shown that national social movement organizations build upon and extend the social resources inherent in community based organizations. By developing movement structures and collective identities, national

social movements knit together a dispersed membership and facilitate collective and individual participation in the public sphere". It is a perquisite for an individual to access social capital that they are first aware that a resource exists (7). Gay community centers and volunteer organizations, through their physical and online presence, facilitate information flow capabilities of social capital.

2.1.7.1 Norms and Effective Sanctions

The existence of any norm between "a number of individuals only becomes social capital to the extent that others in the community may draw upon those normative dispositions in formulating expectations, making plans and carrying out their activities" (7). The social context of how such norms, values and opinions are distributed among a population and to whom they are available varies greatly and affects their use value. Safer sex norms can help prevent STIs if adhered to and respected by the community. HIV prevention is not effective just by delivering information. The spread of HIV is closely connected to social and cultural norms and behaviour, and "social capital addresses these social relations and the capacity for action that is required to deal with the pandemic" (33). However, even if safer sex norms are adhered to by the gay community, they may still hinder particular individual actors who may find safe sex less enjoyable than unprotected sex, highlighting the tension between effective sanctions and individual self-interest in adherence to social norms.

2.1.7.2 Network Closure

According to Coleman (10), certain social structures facilitate certain forms of social capital; particularly, "closure of the social structure is important not only for the existence of effective norms but also for another form of social capital: the trustworthiness of social

structures that allows the proliferation of obligations and expectations". Network closure exists as relationships that exist in more than one social situation, for example two parents who are also neighbors and can therefore exchange information about their children's activities, or two MSM who are regulars at the same gay bar, and are also members of the same basketball club. Max Gluckman (1967) described network closure as multiplex relations as opposed to simplex relations where the two actors only have one social tie. A multiplex relation allows resources from one context to be appropriated for use in others. According to Coleman, multiplex relationships lead to higher levels of trustworthiness through the development of shared norms, expectations and obligations, and the ability to create sanctions for members who do not conform to these norms. Fukuyama also posits, "the quality of the feedback and information obtained through their networks depends upon the credibility of the information provider. This sort of quality is only assured with individuals with whom you share common backgrounds and work experiences" (8). For example, if an MSM is a member of a gay basketball team in which the members practice the norm of safe, responsible sex with non-regular sex partners, and is seen by another member of the team having unprotected sex at a *hattenba*, the other member of the team may let the other members know, and the MSM may be ostracized from the group as a form of punishment. Such potential forms of sanctions would not be possible in a network made up of only simplex relationships, and the relational trust that develops from such groups following norms would not develop either. However, even norms such as these, in which safe sex is practiced, may be better for the network as a whole, but on an individual level it may prevent members from enjoying themselves freely, and thus comes at a cost to individual freedom.

In a family, if there is only one parent or both parents are absent, Coleman (10) describes this as a structural deficiency. Even if both parents are present, if the parents do not have a good relationship with children, the social capital to form norms and sanctions and trust

will develop only in weak forms. This analogy can be added to the MSM community, where multiplex relationships may exist, but if members do not form close bonds and attachments, there is little influence of shared norms or fear of sanctions.

Lin explains that network closure is necessary for certain outcomes and for preserving or maintaining resources (expressive actions). He sees bridges and network holes as being better for searching for and obtaining resources not presently possessed (instrumental actions) (9).

This research will use individual and aggregated indicators to test whether the concepts of norms and sanctions, appropriable social organizations, and network closure are related to reduced HIV risk behavior outcomes.

2.1.8 Measuring social capital

"Although still enmeshed in debates about the meaning of "social capital", health researchers are also gradually realizing the explanatory potential of this concept to health outcomes. However, the translation of this idea into valid and reliable quantification has proven to be cumbersome, as the number of leads that can be followed in matters of operationalism and measurement have proved labyrinth; this has resulted in many incomparable measures and instruments" (20). According to Kalijee and Chen (28) "Large-scale survey studies on social capital and population health are often based on one or two questions, tapping into social participation and trust as a proxy for social capital in general. Given the complexities of both alternative and positive social capital, adolescent and young adult risk behavior and health outcomes, more comprehensive, culturally, and developmentally appropriate instruments are required."

This research therefore uses social capital measures which contain multiple questions, including multiple indicators for specific subdomains in order to identify which quality of

social capital is responsible for an effect (20). Furthermore, this research will also examine the power dynamics and how people access – or are denied access – to network based resources should be identified (2), by examining social capital access as a dependent variable as opposed to independent variable in *Empirical Chapter 3: How is Access to Social Capital Resources Distributed to MSM in Greater Tokyo?*

2.1.8.1 Measure Construction

Van der Gaag and Webber (20) list the potential value of the following principles for social capital measures for health: social network structure, presence of specific alters, volume, diversity, and social resources. Social network structure, in which 'structural holes' (24) and new resources and information are attained is of limited help for health compared to network closure. The presence of specific alters as posited by (9) also has limited value for health research. Volume of network ties is seen as less important than who you know and the diversity, as one alter is generally enough to access a resource, and more distant alters require higher access costs. Diversity can be useful as one can access different resources in specific situations (31,32,34). For example, while knowing a doctor may be useful for medical advice, knowing someone without a university degree may be useful as they have access to a truck to help you move, or have knowledge about fixing vehicles or a different source of resources or life outlook. Social resources may refer to any collection of resources owned by network members. Social capital therefore includes financial capital (money), human capital (education and skills), cultural capital (symbolic knowledge), and political capital (power) of network members. Specific indicators should be used for these specific outcomes (20). A list of concrete, potentially useful, culturally appropriate social resources for each capital collection can be formed into a basis for a social capital questionnaire item (Burt, 1992; Granovetter, 1973; Lin, 2001).

(35) describe egocentric measures and relevance to measuring social capital in Figure 6 (36).

Measure	Relevance
Tie strength (Quality of support)	Network members who have multiple qualities provide higher social support to ego.
Tie strength (Frequency of contact)	Increased interaction with members may enhance ego's social capital.
Tie strength (Closeness)	Weak ties may link people across groups and enhance social capital. In contrast, strong ties may restrict ego from critical resources.
Tie strength (Multiplexity)	Multiplex ties enhance social capital because stronger ties may result from connections that are multi-purposed (i.e. a friend and co-worker).
Heterogeneity	Knowing diverse people may enhance resources available to ego.
Compositional Quality	Types of social support garnered from network members may improve social capital for ego.
Compositional Quality	Specific qualities of members are proxies for social capital such as friends who help ego with personal problems, financial support, or emotional wellbeing.
Size	Large networks may provide more diverse resources and increase the likelihood of social support allotted to ego.
Density	Dense networks influence ego's behavior through social sanctioning. Less dense networks restrict new information from being available to ego, which could reduce social capital.

Source: (Zarwell, 2016)

Figure 6: Egocentric Measures for measuring social capital

2.1.9 Mobilizing social capital vs. Accessing social capital

It is important to distinguish between mobilizing and accessing social capital (9,20). Not all social capital that can be accessed is mobilized, and access and mobilization of results therefore give very different results. Healthy people do not mobilize health resources despite access to them. Furthermore, mobilization questions require a 'retrospective time perspective' that creates unreliable memory effects. Van der Gaag & Webber (20) therefore recommend using access rather than mobilization social capital measures.

2.1.10 The Resource Generator

The "construction of single social capital indicators from resource generator data can proceed in a theory guided fashion (a single volume/diversity indicator can be constructed from its data as the sum score of access to all different items, whereas multiple indicators could be constructed for all sub domains included in its items)" (20). Examples of multiple indicators (2,18) are:

1) Social Support – social capital that members can draw upon to cope with daily problems.

2) Social leverage – social capital assists members to access information for HIV and limit socio-economic hardship.

3) Informal social control – keeps people in order and promotes communal safety.

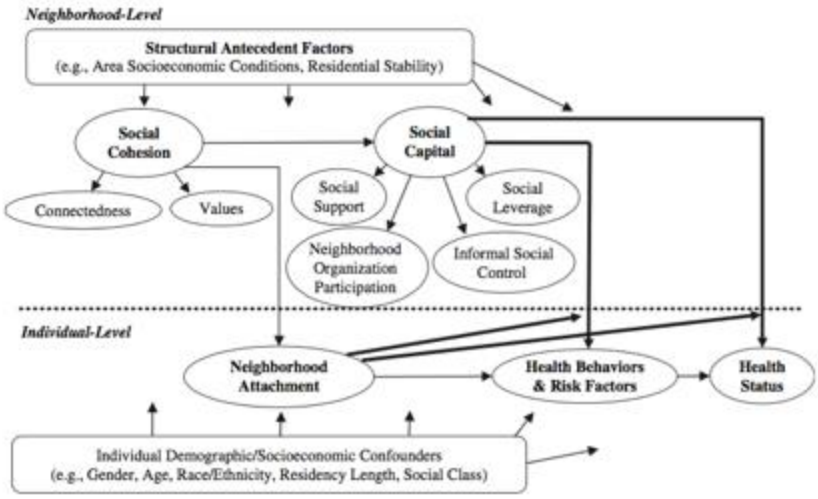
4) Community Organization Participation – Residents formally organized for collective activity for addressing community issues.

Van der Gaag & Webber (20) state that the resource generator can be used to focus health efforts in the future: "if specific resources are identified through indicators as useful in a particular population for preventing illness or enhancing recovery from it, more specific interventions can be designed to maximize the availability of, or access to, them" (20).

Using a multi-level framework consisting of the resource generator, a measure theoretically grounded in Bourdieusian micro-level resources accessed by individuals in social networks and access inequality. The resource generator measures different individual social capital indicators and can and can identify advantaged and disadvantaged groups with access to information or specific network resources. Other measures include meso-level measures of community social capital linked to health-related outcomes – such as shared norms, social cohesion, network closure, and relational trust. Adopting a multi-level framework implies that variations in health outcomes are determined by both individual risk and protective factors, as

well as community risk and resilience factors, testing whether the effects of social capital are being overstated in importance for health and risk factors when compared to other socio-demographic controls, reaching 'spurious conclusions' (15).

As such, interventions to mitigate adverse health outcomes can be offered at both the individual and community levels as in Figure 7:



Source: Carpiano, 2006

Figure 7: Theoretical Neighborhood and Individual Level Confounders Influencing Health

2.1.11 Implications for social capital theory

Critical consensus among current social capital network theorists is that it is necessary to theoretically define and separate: the possessors of social capital (making demands), the sources of social capital (agreeing to demands), the actual resources themselves, and directionally established outcomes (including alternative social capital). (2–4,7,9,11,18).

This research will examine:

1) If source of social capital access (either MSM or heterosexual) is associated with different HIV risk behavior, physical and mental health outcomes.

2) If different theoretically defined forms of social capital are associated with different HIV risk behavior, physical and mental health outcomes.

3) If social capital access is unequal throughout the MSM community in Greater Tokyo.

In answering these research questions, this research will provide empirical evidence if HIV risk behavior and physical and mental health outcomes differ depending upon alter identity (source of social capital), the resources themselves (bonding or bridging), and if social capital access is equally available for all MSM in the community. It is hoped that this will provide much needed quantitative evidence support for specific social capital frameworks, and add a critical voice to the current modus-operandi for social capital and health research which do not define separate alters, use only one individual indicator for social capital, and assume that social capital access is equal for all members of a community.

Drawing upon existing social theory, I develop the following theoretical framework for social capital associations with HIV risk behaviors and mental and physical health outcomes as Figure 8:

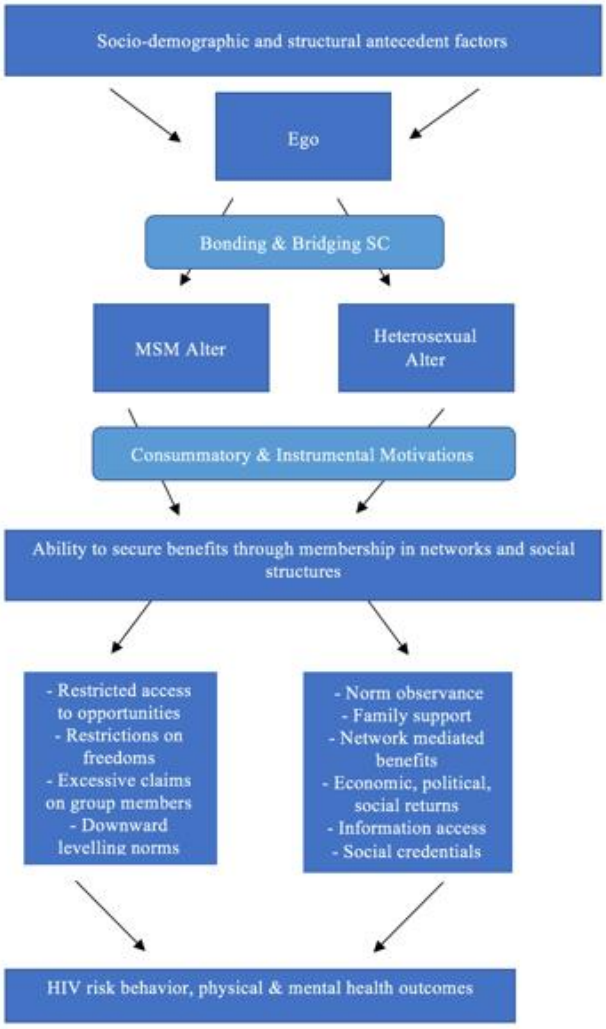


Figure 8: Novel Theoretical Framework for Social Capital Associations with HIV Risk Behaviors and Mental and Physical Health

2.2 HIV/AIDS Literature Review

This section provides an overview of the HIV/AIDS literature in order to provide readers with a theoretical foundation from which to assess the findings in this study.

2.2.1 The Global HIV/AIDS Epidemic

UNAIDS (Joint United Nations Programme on HIV/AIDS) (37) estimates that 76.1 million [65.2 million–88.0 million] people have become infected with HIV, and 35.0 million

[28.9 million–41.5 million] people have died from AIDS-related illnesses since the start of the epidemic. In 2016, there were an estimated 36.7 million [30.8 million–42.9 million] people living with HIV (PLWH), 34.5 million [28.8 million–40.2 million] of whom were adults, 17.8 million [15.4 million–20.3 million] of whom were women. In 2016, 1.8 million [1.6 million–2.1 million] people worldwide became newly infected with HIV, compared to 3.0 million [2.6 million – 3.4 million] in 2000, and 1 million [830 000–1.2 million] died from AIDS-related illnesses worldwide, compared to 1.9 million [1.7 million–2.2 million] in 2005. As of June 2017, 20.9 million [18.4 million–21.7 million] PLWH were accessing antiretroviral therapy, up from 17.1 million [15.1 million–17.8 million] in 2015 and 7.7 million [6.8 million–8.0 million] in 2010. At the end of 2016, US$ 19.1 billion was available for the AIDS response in low and middle-income countries, compared to US$ 4.8 billion in 2000.

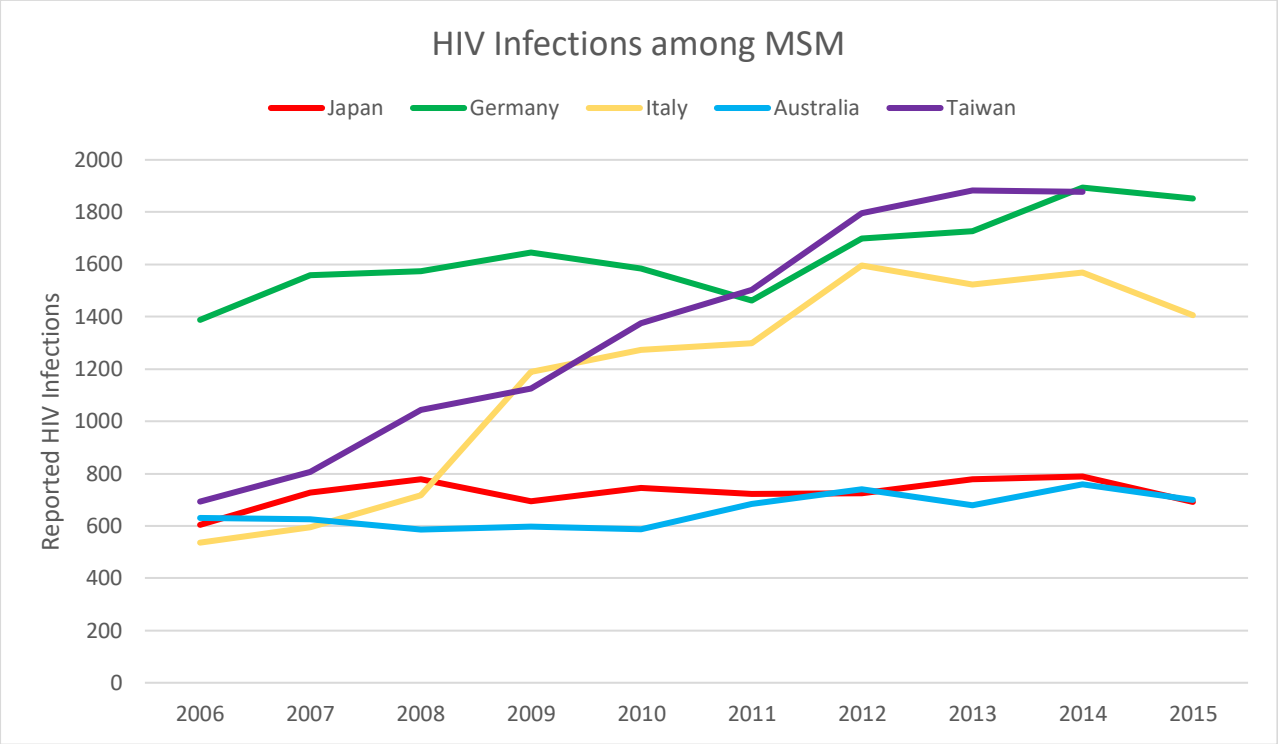
2.2.2 The HIV/AIDS Epidemic in Asia and the Pacific

In 2016, Asia and the Pacific had 5.1 million [3.9 million–7.2 million] PLWH, the highest region after Eastern and Southern Africa, with 19.4 million [17.8 million–21.1 million] PLWH, and 6.1 million [4.9 million–7.6 million] in Western and Central Africa. Asia and the Pacific had an estimated 270 000 [190 000–370 000] new HIV infections in 2016, a decrease of 13% compared to 2010, and 2.4 million [2.1 million – 2.5 million] accessing antiretroviral therapy. Whereas heterosexual sexual intercourse is the dominant mode of HIV transmission in Eastern and Southern Africa, and Central and South America, transmission through MSM is the predominant route of transmission in North America, Australia, and Japan (37).

2.2.3 HIV Epidemic among MSM

The HIV/AIDS epidemic was first recognized among MSM in the 1980s, and MSM populations have continued to be at high risk for HIV through the present day (38). Globally, while MSM accounted for 12% of new HIV infections in 2015, MSM populations accounted

for much higher proportions of the HIV epidemic in countries with low levels of HIV such as Japan, where HIV prevalence among MSM approaches 100-times that of the general population (39), and accounted for 74% of new Japanese HIV infections in 2015 (40).



Source: Ichikawa (2017)

Figure 9: HIV Infections among MSM across Economically Developed Nations with Low Levels of HIV

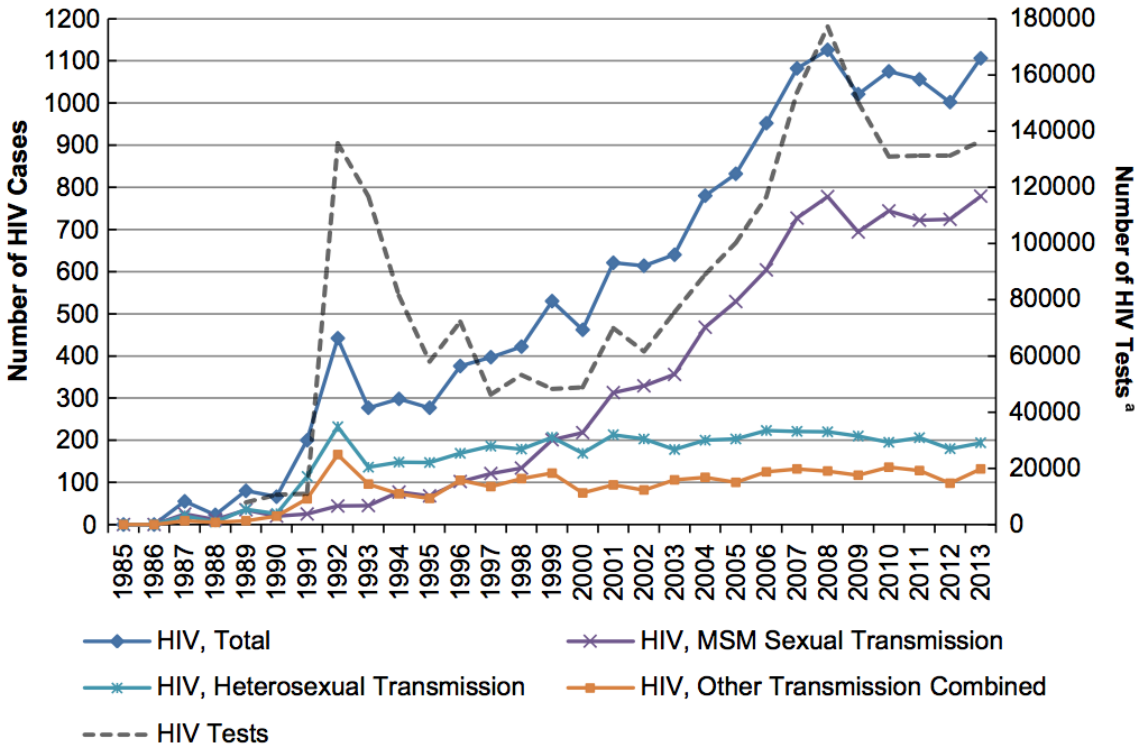
2.2.4 Epidemiology of HIV in Japan

According to a stratified sample of 103,085 men between 20 – 59 years old in a 2011 Rakuten internet survey, the MSM population estimate in Japan is over 1,502,000, or 4.6% of the male population, and is the center of the HIV epidemic with over 96 times the rate of HIV infection than the general population (39), accounting for over 78% of new Japanese male HIV cases (41). In comparison, MSM account for 56% of people living with HIV (PLWH) in the US, and have an estimated 44 times the rate of HIV infection than other males (42). Japan is generally perceived as a country with low HIV prevalence and risk (43). However, a distinct

lack of social science and qualitative research (44), and a large MSM population that does not attend gay venues (an estimated 982,300 MSM or 65.4% Japanese MSM do not attend gay venues (39)), where the majority of previous MSM surveillance has taken place, may have caused the HIV epidemic in Japan to be underestimated. This research aimed to give a better understanding of factors associated with HIV risk behaviors and HIV testing as outlined by Gilmour (2012), and to recruit and profile a sample of the large app using non-gay-community-attached MSM population as opposed to previous research which was focused predominantly on gay community participating MSM.

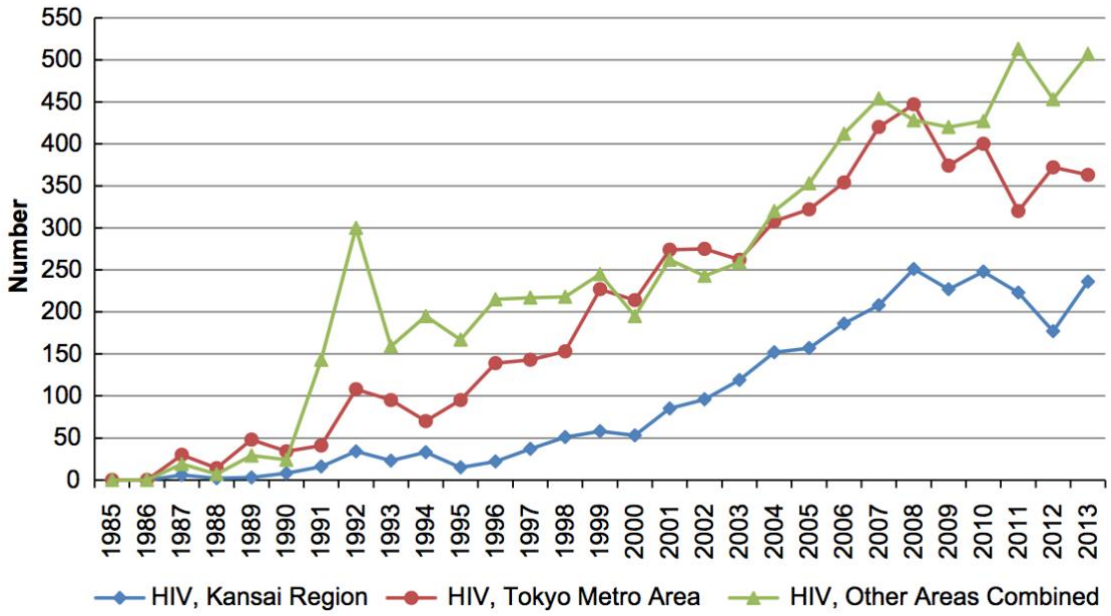
The total number of reported cases of HIV infection increased until 2008, and remained around 1,000 thereafter, while MSM transmission also increased until 2008, and has remained around 800, over 70% of total infections (Figure 10). HIV infections through heterosexual and other transmission have remained roughly stable at 200 and 100 since the *yakugai AIDS* jiken blood transfusion scandal in the late 1980s when 1432 hemophilia patients were infected. HIV testing rates also increased steadily until 2008 and have been slowly decreasing from nearly 180,000 to 118,000 in 2016 attributed to less HIV testing advertising campaigns, and redirection of resources from HIV prevention to AIDS care and the subsequent closure of free testing centers (44).

HIV infections increased in the *Kanto* (Greater Tokyo) and *Kansai* (Osaka and surrounding areas) regions until 2008 when they appear to have stabilized at around 400 and 250 annually (Figure 11). HIV infections from other areas in Japan combined has continued to increase through 2013, surpassing 500 new cases. The Greater Tokyo region has historically been the region with the greatest number of reported HIV cases in Japan.



Source: Distefano (2016)

Figure 10: MSM and heterosexual HIV transmission and testing (1985 – 2013)



Source: Distefano (2016)

Figure 11: HIV transmission (1985 – 2013) by region

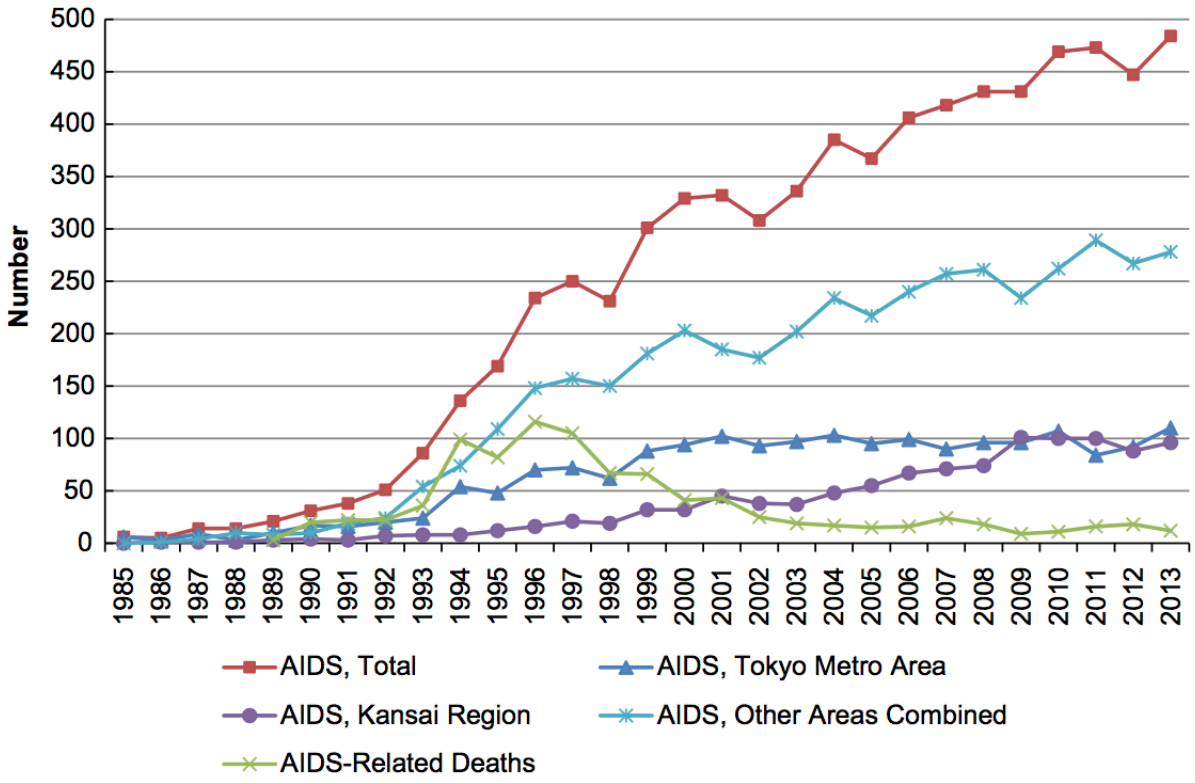
2.2.5 Trends in AIDS Outbreaks in Japan

Unlike HIV infections, which seem to have levelled off since 2008, total new AIDS cases have continued to increase. Reported new AIDS cases have remained stable around 100 in both Greater Tokyo since 2000, and Kansai since 2009. New AIDS cases have continued to increase in other prefectures up to almost 250 in other prefectures in 2013 (Figure 12).

Of the 49,273 newly reported cases of HIV in 2011 in the USA, 32,052 (65%) were AIDS (HIV Surveillance Reports, 2011). The same year in Japan, only 31% of reported new HIV cases were AIDS. However, this does not necessarily mean that the late diagnosis of HIV is less of a problem in Japan than in the West. This disparity from the reported national rate is due to two factors:

Firstly, smaller health care centers where around 40% of HIV tests take place (Nagashima: IASR 34:254 via Tateyama, 2013) are not capable of differentiating HIV and AIDS (unlike hospitals), and thus many of the new AIDS cases in Japan are reported as HIV. Furthermore, cases initially diagnosed as HIV are not changed to AIDS even if AIDS is later developed.

Secondly, Japan's definition for AIDS differs from the CDC (Center for Disease Control) guidelines in the USA. Whereas the CDC deems anyone with a CD4+ T-lymphocyte count of <200 cells/μL, CD4+ T-lymphocyte percentage of total lymphocytes of <14, or documentation of an AIDS-defining condition as having AIDS, Japan only deems people showing symptoms to have AIDS, and the numbers are therefore markedly lower than that of the USA.



Source: Distefano (2016)

Figure 12: Reported new AIDS cases and deaths (1985–2013) by region

2.2.6 Current Situation

According to the National Institute of Infectious Diseases (NIID), 1,011 HIV (965 men and 46 women) and 437 AIDS (415 men and 22 women) new cases were reported in 2016 in Japan. Of the 1,011 HIV cases, 885 were Japanese (857 males; 28 females) and 126 were non-Japanese (108 males; 18 females). HIV/AIDS in Japan is therefore largely a male epidemic, and Japanese males made up 85% of the total HIV cases and 86% of the total AIDS cases. MSM made up 73% (735/1,011) of all HIV cases and 78% of all Japanese male HIV cases. Most were in their 20s to 40s. Heterosexual contact made up 14% of all HIV cases among men. Among Japanese women, heterosexual transmission was reported for 79%, and unknown for 21% of cases. No case attributed to congenital infection was reported in 2016. One Japanese male case attributed to infection through intravenous drug use (IDU) was reported in 2016 as is typical each year (NIID, 2016).

Until 1992, the majority of infections were reported as acquired abroad, but since then most infections have been acquired in Japan. In 2016, 83% of all HIV cases (838/1,011) and 88% of HIV cases with Japanese nationality (783/885) were infected in Japan.

The number of people receiving HIV tests at health centers and other facilities managed by local governments was 118,132 in 2016, which was slightly lower than that in 2015 (128,241). Among those tested, 421 were HIV positive in 2016 (slightly lower than the 463 positives in 2015), corresponding to 0.36% positivity (the same rate of 0.36% was reported in 2015). Although HIV positivity tested in health centers was 0.28% (248/88,773), positivity tested in facilities other than health centers was 0.59% (174/29,359), higher than in the health centers. 119,382 people accessed counselling services provided by the local governments in 2016, a slight decrease from the 135,282 in 2015 (135,282). Testing-as-prevention strategies are therefore highly important for HIV prevention. Despite this, the volume of HIV tests in Japan has reduced by 35% to 118,000 in 2016 due to fewer advertising campaigns and redirection of resources from HIV prevention to AIDS care, and the subsequent closure of free testing centers (44). Considering the network of health services providing free testing and access to treatment in Greater Tokyo, HIV testing is still infrequent compared to other countries with similar services. Furthermore, only one third (32%) of patients newly diagnosed with HIV went for voluntary testing; over half (53%) were reported due to presence of other diseases, unchanged from 2000 - 2004 (45), indicating no increase in awareness of HIV testing importance. In order for HIV infection rates in Japan to remain stable within the MSM community, it is vital for the MSM population in Japan to be tested regularly.

2.2.7 Situation for MSM HIV Surveillance and Prevention in Japan

Under Japan's healthcare system, the healthcare costs of residents of Japan with HIV are largely covered by national insurance. Monthly expenses for non-generic anti-retroviral therapy medications (ART) amount to roughly 200,000 yen/month, (2,400 AUD/month), of

which the patient is responsible for paying 30% under the Japanese national insurance system. For comparison purposes, the average net salary in Tokyo is 325,000 yen/month (4000 AUD/month). However, HIV patients with AIDS or a CD4 count of under 500 are considered disabled, and pay between 0 and 20,000 yen (240 AUD) per month. As HIV patients may now live for 40 years with antiretroviral treatment, the lifetime treatment cost for one HIV positive patient on the Japanese healthcare system may be estimated at 96,000,000 yen (1,200,000 AUD).

Considering that 78% of the reported HIV cases in 2016 were Japanese MSM, the Japanese national health service will spend approximately 73,500,000,000 yen (850,000,000 AUD) for reported MSM-transmitted HIV cases in the long-term. With an increasingly elderly population and low birth-rate, Japan's national healthcare system desperately needs to stave off large expenses. HIV has already damaged economies in Africa (46), and, as it is most widely affecting Japanese males between 20 to 40 years-old, a key demographic contributing to economic prosperity. Effective HIV prevention among this population may provide some economic as well as humanitarian benefits. ART sales treating Japanese people living with HIV (PLWH) amount to a small fraction of revenues for Japanese Pharmaceutical corporations. However, it should be noted that HIV/AIDS prevalence is very low in Japan compared to many other countries, and Japan's GPD is the third largest in the world, thus the financial impact of effective HIV/AIDS prevention in Japan is not as strong as in many developing nations. It is also important to state that the removal of PLWH from national health coverage would almost certainly lead to the spread of HIV in Japan in light of our present knowledge that undetectable viral loads suppressed by ART therapy are untransmissible (U=U). Policies intended to stop helping HIV/AIDS patients with public funds have increased infection rates, and treatment as prevention (TasP) strategies are cost effective. Current MSM HIV prevention funding is limited and insufficient. Further funding for effective HIV interventions among Japanese MSM would

most likely have significant humanitarian and potentially financially beneficial outcomes in Japan.

2.2.8 HIV/AIDS Education and Treatment

Japan is heteronormative (a perspective from which heterosexuality is assumed, rather than one of many possibilities). Homosexuality is presented in Japanese media largely as cross-dressing (2008). Although homosexuality and crossdressing are largely accepted in comedic roles within the media and *soto*, (outside), it is much less accepted within one's own *uchi* (one's inner social circles and family) (48) . Non-heterosexual sexual identities were observed in research as embarrassing and hidden from the public sphere and daily life (48).

The general population in Japan is slowly becoming more educated regarding homosexuality; whereas four-fifths (83.1%) of 30-year-old MSM had learned nothing about homosexuality in school, half (54.2%) of MSM under 20 years of age had received information regarding homosexuality in school. However, only one-fifth (18.2%) of participants under the age of twenty that had received information regarding homosexuality in school reported that it was positive information (49). Sex-education in Japan is limited; in high schools, most programs are taught by physical education teachers and the HIV education does not mention condom use. Safer anal sex is not mentioned. A trial in Japan using an extended HIV education program in junior high schools has shown potential as an effective HIV prevention tool (50), although attempts at extending the HIV and sexual education program in schools is opposed by Japanese politicians as promoting promiscuity.

HIV care in Japan is excellent, and almost nine-tenths (88.2%) of HIV and AIDS patients considered their medical care to be sufficient or quite sufficient, resulting in over 99% of PLWH in Japan on ART therapy being virally suppressed. However, very few (13%) PLWH reported that measures to reduce discrimination against PLWH was sufficient (Wakabayashi et al, 2009).

2.2.9 Stigma and discrimination

Okama, 'faggots' in English, are regulars on Japanese variety shows, and cross dressing has been a part of Japanese culture since kabuki transitioned into an all-male performance, when adolescent males took over the female roles in an attempt to limit prostitution among kabuki actresses in 1629. Likewise, transgendered roles have existed in *Kumi-Odori* in Okinawa since 1719. However, in a 2013 gay mobile app survey of 187 Okinawan MSM, less than 20% had come out to their families (51). The low rate of coming out to family members, in contrast with the relatively high acceptance and prevalence of non-binary genders and sexualities in Japanese media, is representative of the incongruent Japanese attitudes towards those within, and those outside of their close social and familial networks.

Previous findings show that over one-third (37.2%) of MSM experienced being called 'homo' or 'faggot' in school (Hidaka et al., 2005). Hate crimes against sexual minorities are rarely reported in Japan, and sexual minority discrimination is described by Kazama and Kawaguchi (2010) in their analysis of Japanese media's reporting of homosexual hate crimes that occurred on February 17th, 2002, when an MSM was murdered by two teenage boys who had previously been targeting MSM at a popular gay cruising spot. News coverage did not report the murder as a hate crime, with headlines writing, "We just wanted money to play; that was the only reason given by a 14-year-old and 15-year-old boy arrested for murdering a 30-year-old man" (48), or TV Asahi's "Young boys target the socially weak," following the article with a 'related' attack on a homeless man by three young boys directly after the first. Kazama described the reasoning for not giving a description of the incident as a hate crime as, "[if] described as a hate crime, the victims' sexuality would come under scrutiny, and it was likely to have avoided being mentioned in order to not inflict a second wound on the victim's family" (48).

Possibly because of the prevalence of transgender and gay men on Japanese variety shows, Japanese university students reportedly thought that homosexuals were "fashionable and cool". However, when asked about how they would feel if a close family member were homosexual, for instance, a parent or sibling, they replied "that's disgusting… I couldn't believe it to be possible" (48), the dichotomy of which is again indicative of the acceptance of homosexuality in the realm of media and fantasy (*Soto*, outside) and lack of acceptance in one's personal life (*Uchi*, inside).

Homosexuality in Japan is often regarded as shameful to one's family, and coming out would likely bring potential social exclusion from heterosexual family, friends, school and work networks. While studies show that in many Western countries coming out about one's sexuality is associated with positive health and well-being this was not the case in Japan (51). However, with the upcoming 2020 Olympics, progress towards a more LGBTI friendly society is being made. Shibuya Ward adopted ordinances to recognize same sex unions (52), and an anti-discrimination ordinance in Tokyo aimed at curtailing hate speech towards sexual minorities (53,54). It remains to be seen if these laws will be utilized and expanded beyond Tokyo.

2.2.10 MSM Susceptibility to HIV

MSM are one of the populations most burdened by HIV in the world due to a variety of biological, behavioral, and social factors. In brief, biological factors that contribute to HIV risk among MSM include higher HIV transmission efficacy through anal intercourse, sexual role diversity, and asymptomatic STIs. Behavioral factors include a variety of behaviors associated with condomless anal intercourse (CLAI), frequent partner change and concurrent sex partners. Societal factors include stigma which can lead to internalized self-negativity and depression, substance abuse, and other behaviors associated with HIV risk, as well as delayed HIV testing and initiation of antiretroviral therapy (55). Structural factors include laws such as

illegality of homosexuality, which limit MSM access to condoms and HIV testing facilities. I will now discuss these biological, behavioral, social and structural factors that contribute to the high levels of HIV among MSM throughout the world in more detail.

2.2.10.1 Biological and Epidemiological Causes of MSM Susceptibility

Estimates of the risk of HIV transmission by sex act vary due to differences in the prevalence of behavioral and biological co-factors in the populations studied (56). Measurement accuracy is further hindered because participants often practice a variety of sex acts (57), and seroconversion and subsequent transmission to a partner, number of sex acts, and potential HIV risk co-factors are rarely accurately known (56). Although quantifying HIV transmission risk per sex act or per partner is complicated, and results vary quite widely, studies agree that anal intercourse is a higher risk act than vaginal intercourse, and receptive intercourse (both vaginal and anal) is a higher risk act than insertive intercourse. Oral intercourse has consistently been reported as very low, though not zero, risk of transmission (57,58).

Risk of acquiring HIV per unprotected or rare condom use sex act with an HIV-positive partner not on antiretroviral therapy (ART) and with an average viral load of an individual with an untreated chronic HIV infection is as follows for anal intercourse: both receptive and insertive anal intercourse carry higher risk for transmitting HIV than vaginal intercourse. Receptive anal intercourse is estimated to have between 5 to 18 times higher risk of HIV transmission than receptive vaginal intercourse, which has a per sex act risk estimated to be 0.08% - 0.19% (57), due to a higher density of lymphoid follicles (HIV target cells) and susceptibility to abrasions in rectal than vaginal mucosa. Mid-range estimates of per act receptive anal intercourse HIV transmission risk are estimated to be between 1.4% - 1.69% (58,59) and 0.07% per-act for insertive anal intercourse. However, the per act risk was much

higher than summary measures for some MSM, with 15% of seroconversions occurring after engaging in receptive anal intercourse only once or twice in a study of 2,000 MSM (60). Furthermore, because many MSM are sexually versatile, they can become infected as a receptive partner and then once infected, transmit to a separate partner as the insertive partner (55).

HIV transmission through oral intercourse is difficult to quantify due to it often being combined with other sex acts. Four of ten studies reported a non-zero estimate of risk for unprotected oral sex (61), and it has also been associated with the resurgence of syphilis. Genital piercings have also been found associated with HIV transmission for insertive oral sex among MSM (62).

STIs

Much evidence suggests that STIs increase the infectiousness of HIV-positive people and the susceptibility of HIV-negative individuals. However, it is a complex relationship due to the presence of confounders. STIs such as genital ulcers and syphilis were found associated with an increased risk of HIV infection by a factor of 2 to 3 times (63). However, these studies suffer from serous limitations such as self-reporting of STIs, and, confounding with sexual behavior, a risk factor for both HIV and STIs cannot be controlled for.

Viral Load

Plasma viral load is the strongest predictor of sexual transmission of HIV, and ten-times the plasma load has been found associated with a 2.5 to 2.9 times increase in transmission (64), although there is limited quantitative data regarding the relationship between HIV viral load and HIV transmission efficacy through anal intercourse (61,65,66).

Stages of Infection

Primary and late-stage HIV infection have elevated viral load in plasma and genital secretions (67). Primary stage HIV infections have an elevated viral load due to a high degree of viral replication before an immune response has time to develop. Primary infection is also associated with concomitant STIs and lack of awareness of HIV serostatus (68,69). Heterosexual transmission was estimated to be 26 times higher in the primary stage than asymptomatic infection, and high infectiousness was estimated to last for the first three months after seroconversion. High infectiousness for late stage infection lasted from 19 to 10 months prior to death, and was estimated at 7 times higher than asymptomatic infection (59,70) though it is not clear if this is the same for MSM. Primary HIV infections are estimated to cause anywhere from 1% to over 90% of infections. Primary HIV infections are more important in populations with more concurrent partnerships and frequent partner change (70), while late-stage infection probably account for less infections as they are more likely to know of their serostatus and report less sexual intercourse and fewer partners (71).

HIV-1 Genetic Subtype

HIV subtype and sexual transmission have shown inconsistent results, although subtypes C and E have been found to have higher rates of heterosexual transmission than subtype B.

2.2.10.2 Behavioral Causes of MSM Susceptibility

Behavioral co-factors among some MSM, such as early sexual debut, high numbers of sexual partners, long cumulative period of new partner acquisition (72) high concurrent (when a person has multiple sexual partners at the same time) sexual partnerships (MCPs) (73,74), have been suggested as associated with differing levels of HIV transmission. However, the effect of co-factors is difficult to quantify and appears to vary depending on social and cultural

influences. For example, while in the US regular partners were estimated to account for 68% of HIV transmissions among MSM (75), regular male partners only accounted for 11% of HIV transmissions among MSM in Australia (76), and in Amsterdam, HIV was mainly transmitted by unprotected receptive anal intercourse (URAI) with casual sex partners (77). Behaviors associated with anorectal mucosal injury risk such as rectal douching, anal insertion of foreign objects, and receptive fisting, were also associated with HIV infection (78).

High rates of alcohol and recreational drug use are prevalent in some communities of MSM. Alcohol and drugs can increase the likelihood that people will engage in unprotected sex and have a higher number of sexual partners (79), possibly due to a combination of community norms and as a compensation mechanism for discrimination according to the community health model.

2.2.10.3 Social Causes of MSM Susceptibility

Wide health disparities between LGBTI and general populations globally cover a variety of health problems ranging from STIs and HIV, to smoking, alcohol, and drug use, mental health and suicide, and cancers for which the underlying systemic cause of these disparities is homophobic stigma and discrimination. Although the impact of social factors such as discrimination on HIV is not as direct as mental health, underlying social causes still play a pivotal role in MSM susceptibility and engagement with necessary health services.

Social factors such as internalized homophobia due to stigma, has been found associated with lower engagement in prevention and increased risk behaviors (80). Internalized homo-negativity is associated with depression, and disregard of sexual partner's wellbeing, associated with risk behaviors. Internalized homo-negativity and stigma is also associated with shame, which is linked to alcohol and substance abuse; themselves associated with risk behaviors such as lower condom use and increased sexual partners (79). A fear of

discrimination and negative reactions from health workers is associated with lower access for essential HIV prevention service uptake such as HIV testing -, and subsequent isolation from health care providers and systems cause difficulty with aspects of HIV treatment such as adherence to medication (81).

Sexual assault is frequent among MSM worldwide and in Japan (82). Higher likelihood of torn skin from violent assault, multiple perpetrators, and high seropositivity among rapists may increase a rape survivors' HIV risk by a factor of 2.4 – 27.1.

Although homosexuality is not criminalized in Japan, there is a lack of unified protections for sexual minorities. Furthermore, 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 (83).

2.2.10.4 Socio-demographic Causes of MSM Susceptibility

Age, education, sexuality, residence and community attachment have all been found in previous research to be factors associated with condom use and HIV testing. Age has been observed associated with lower habitual condom use with regular and casual male partners, but higher rates of both lifetime and recent HIV testing due to more time to be tested, and to have engaged in riskier behaviors (69,84). Education has been found to have a protective effect for MSM (69), and previously found to be associated with higher regular and casual partner condom use among MSM in the US (85). Sexual identity has been found to be associated with higher HIV testing; bisexual identifying MSM have been found to have lower HIV testing rates than gay identifying MSM due to a lack of support for a positive result, and greater HIV stigma (84). Sexual identification and behaviors have been found to be discordant, and this research therefore looks at both sexual identity and sexual behaviors (partner sex) separately. Rural

residency has been found significantly associated with lower lifetime and recent (past year) HIV testing among MSM due to less MSM HIV information access and higher levels of stigma (86), as well as lower HIV knowledge and condom access (87). Gay community attachment is associated with increased HIV testing due to lower stigma from a positive result and more access to HIV information disseminated through the gay community (84). In this research, I examine whether different forms of community attachment, defined as gay bar attendance, organized gay community activity participation, *hattenba* (bathhouse) attendance, and identity as a gay community member, are associated differently with condom use and lifetime and recent HIV testing.

2.2.11 Biomedical HIV Interventions

PrEP & PEP

Evidence shows that Pre-exposure prophylaxis (PrEP) can reduce new HIV infections among HIV-negative MSM by 90% depending on adherence (88). When considering the low consistency of condom use among Greater Tokyo MSM, legalization and free distribution of PrEP in Japan to high-risk populations such as self-identified high-risk MSM may help prevent HIV among MSM who engage in CLAI for a variety of individual, structural, and social reasons. Moreover, antiretroviral adherence successfully meets the UNAIDS 90% 2020 target in Japan (89). Proven 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 in order to reduce HIV among MSM in Greater Tokyo while appropriately scaling up surveillance among MSM before and after prevention strategy implementation. Following the Australian PrEP guidelines, in which PrEP users are tested for HIV and STIs every three-months leads to a reduction in HIV and STIs, and this would be an important step in its introduction into Japan.

Post-exposure prophylaxis (PEP) uses short-term antiretroviral therapy (ART) taken within 36 – 72 hours of potential exposure for 28 days to reduce the risk of acquisition of HIV. Non-occupational PEP (nPEP), has an important role to play in HIV prevention efforts (90), particularly used in combination with other biomedical and behavioral prevention packages.

HIV Testing as Prevention

Increasing HIV testing in an MSM population has positive effects for both HIV prevention and care. It is well documented that people who learn they are HIV positive take preventive action to reduce the risk of transmission to others (91), and testing is associated with a 68% efficacy for lowering UAI in meta-analysis (92). Moreover, placing MSM on antiretroviral therapy early is a crucial prevention strategy (93,94), and if the 90-90-90 UNAIDS targets are achieved by 2020, the HIV and AIDS epidemic could end by 2030, with significant health and financial benefits globally (95).

Condoms & Lubricants

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 (96). However, condom use among MSM faces various physical challenges, including condom slippage and breakage (97), as well as availability. Condoms are available in all love hotels, and are provided to gay venues such as bars and bathhouses by NGOs in Japan. However, delivery of free condoms to gay mobile app users who do not attend gay venues is problematic. Furthermore, negotiating condom use with partners is difficult for some MSM.

Silicone or water based lubricants are recommended for anal sex as they reduce condom breakage and strain. However, limited studies have suggested a link between these lubricants and STIs (98). While water and silicone based lubricants are still recommended for anal

intercourse, research is currently underway to assess whether and which lubricants are specifically associated with higher STI transmission efficacy.

Antiretroviral (ART) Therapy

Antiretroviral drugs are medication that are active against retroviruses. Antiretroviral therapy (ART) consists of the combination of antiretroviral (ARV) drugs to maximally suppress the HIV virus and stop the progression of HIV disease. There have been massive reductions observed in deaths and new infections with the use of ARV, particularly in early stages of the disease. The WHO currently recommends ART for anyone with HIV as soon as possible after diagnosis without any restrictions of CD4 counts (99). ART has also been found to reduce transmission efficacy of HIV from an infected person to someone who is uninfected: in a meta-analysis of 11 studies, there were no observed transmissions from people on ART with an undetectable viral load, including no cases of within-couple HIV transmission after a year among 1238 serodiscordant MSM and heterosexual couples (100). In order to achieve viral suppression, 90% or greater adherence is often deemed as being required. In North American studies, only 59% of those on HAART reported an intake of 90% or more prescribed ART (101), although in Japan these levels appear to be met (89).

Circumcision

Male circumcision has been found to significantly decrease risk of female-to-male HIV sexual transmission (102), and it was found that among insertive MSM in Sydney, uncircumcised MSM were ten-times more at risk for HIV than circumcised MSM (103). However, most results have been inconclusive whether circumcision can play a role in preventing HIV among MSM (104,105), and some studies even found that post-circumcision sex was associated with increased HIV transmission among MSM.

2.2.12 Behavioral Interventions

Person-to-person HIV behavioral interventions are designed to promote change in sex behaviors such as increase condom use, PrEP adherence, and reduce CLAI and number of sex partners, resulting in a reduction in chances of HIV acquisition. Behavioral interventions are typically performed in a traditional counseling relationship, one-to-one, at an individual level, in small groups, or a defined community. Behavioral interventions intend to promote individual behavior change and at a community level, to influence positive individual beliefs regarding community norms. Behavioral interventions vary in size, but also in deliverer type (volunteer, peer, or paid professional), and by delivery venue (gay venue, community center, internet etc.), and intervention content (106). Intervention content covers a range of HIV reducing behaviors such as decreased substance use, safer sex self-efficacy and partner negotiation strategies, regular HIV testing, sexual partner reduction, consistent and correct condom use, biomedical intervention uptake and consistent usage. Individual, group, and community HIV behavioral interventions were found effective in meta-analysis at reducing the odds of CLAI by 43%, 27%, and 35% respectively, and increasing the odds of condom use for the group approach by 81% (106). Findings were applicable to MSM aged 20 years or older, across a range of settings and populations, assuming that interventions are appropriately tailored to the cultural and societal needs and characteristics of the MSM population. Furthermore, group and community HIV behavioral interventions were cost effective and resulted in cost savings (106). However, in recent years these findings have been criticized and standalone behavioral interventions are not considered sufficient to reduce HIV transmission among MSM (107). Studies show alcohol and non-injection drug use to be drivers for HIV among MSM communities (108). High rates of binge drinking (109) and drug and alcohol use during sex (110) have been found among gay mobile app users in the US. Drinking is a common part of Japanese and South-East Asian masculinity and work culture, and is associated with female sex-worker (FSW) visits (111),

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 or drug interventions that reduce alcohol consumption may therefore be important adjunctive approaches in MSM and reduce HIV transmission (92).

Herbst et al. (2007), describes behavioral interventions in more detail as follows:

"Individual interventions seek to influence HIV risk behavior one individual at a time. Through the "one-on-one" approach, these interventions assist a client in changing his HIV risk behavior by modifying his attitudes, beliefs, motivation, and self-efficacy; providing facts or information about HIV/ AIDS or STDs; or influencing moods, emotions, or feelings. These interventions typically involve individualized risk-reduction counseling or motivational interviewing delivered by a well-trained counselor, educator, peer, or other professional"

"Group interventions for MSM also seek to influence the HIV risk behaviors of individuals, and are designed to promote positive behavior change among individuals by modifying attitudes or beliefs, and providing facts or information about HIV. Many group-level interventions also include individual-level components (for example, HIV counseling and testing). Group interventions often contain group discussions, and use the support of the group peer influence to help influence behavior positively."

Furthermore, skill development through demonstrations, role playing, and practice, and skill-building exercises teach correct condom use, risk reducing decision making, and safer sex negotiation, or utilize cognitive-behavioral therapy to assess personal risk and create risk reduction goals and monitor their own progress.

Community interventions attempt to influence MSM HIV risk behavior by influencing norms, attitudes values, and context of risk behaviors within a defined community (106). through establishing peer norms supporting safer sex, it is possible that positive norms of risk-reduction may be maintained more favourably than in the case of individual interventions. One

example of a community-level intervention approach utilizes community peer leaders, and trains them to influence others around them with positive sexual risk reducing norms. Those influenced by community peer leaders then diffuse the information to others close to them, diffusing positive community norms throughout the community.

2.2.13 Structural Interventions

USAID defines a structural approach to HIV prevention as "selecting a set of interventions that use structural factors to reduce HIV risk at the individual and/or group level. [These] factors are elements outside individual knowledge or awareness that have the potential to influence people's vulnerability to HIV infection" (USAID, 2018), such as social (for example, stigma, gender inequality); legal-political (for example, laws and regulations); cultural (for example, religious beliefs); and economic (for example, lack of livelihood opportunity) factors (112). In developed countries such as the US and Japan, effective structural prevention strategies include comprehensive sex education, universal condom availability, expanded syringe access for drug users, health care coverage, and stable housing. Because Japan, unlike the US, has universal healthcare and housing, these structural interventions are not necessary. However, in Japan, sex education is extremely limited and non-existent regarding sexual minorities (Hidaka, 2008; Rolander 2013, PrEP is not yet approved despite the benefits it could provide for MSM in Japan, and stigma is still very high for both HIV and homosexuality, with limited codified protections available for sexual minorities.

Comprehensive Sex Education with Access to Condoms

Comprehensive sex education is essential for effective HIV and STI prevention. Access to correct sexual health information is a human right (113). These programs include respectful acknowledgement of gender and sexual diversity, health promotion and disease prevention information and tools for engagement in safer sex among young people, including YMSM. As

mentioned earlier, sex-education in Japan remains limited, and although a trial in Japan using an extended HIV education program in junior high schools has shown potential as an effective HIV prevention tool (50), it did not include health promotion and safer sex tools for YMSM which are important to reduce rising HIV infection rates among this specific high risk population in Japan.

Effective HIV Prevention: Culturally and Population Specific HIV Prevention Packages

Regional HIV epidemics vary greatly depending upon a variety of societal and cultural factors, thus a "one size fits all" HIV prevention strategy is likely to be ineffective (114). Recently, there has been a shift to HIV prevention packages that use a combination of culturally and population appropriate behavior change and biomedical strategies, social justice and human rights interventions, and HIV/STI testing and ART adherence strategies. The reason for the shift to these prevention packages that combine biomedical, behavioral, and structural prevention strategies is complex and stems from a combination of factors. Firstly, there is no single strategy that has been found to be completely effective for preventing HIV (115) and interventions with modest levels of effect may lead to more substantial efficacy overall when combined (Aurbach and Cotes, 2000). Secondly, biomedical interventions are affected by behavioral factors such as adherence and risk, thus sociobehavioral interventions may strengthen their effectiveness (116). Lastly, even when the modality under investigation does not show a positive effect, recent randomized HIV prevention trials have shown a reduction in HIV incidence and sexual risk taking in the trial population (115). It is the intention of this thesis to assess the most appropriate and cost-effective prevention package for Greater Tokyo MSM who use gay mobile apps.

2.2.14 Summary

The majority of newly reported HIV and AIDS infections are by MSM, and HIV testing rates have been dropping in Japan since 2008. Studies have observed consistent condom use among MSM falling, and neither PrEP nor PEP are available in Japan, hence regular HIV testing and consistent condom use are necessary tools for HIV prevention. Furthermore, an estimated two-thirds of Japanese MSM are not attached to the gay community, and previous studies have largely sampled gay venues, thus, previous studies may have under-represented men in this population.

Social capital is an important determinant of HIV risk and positive health outcomes. However, there is limited research investigating how alter (possessors of actual resources embedded in social capital networks) sexuality mitigates HIV-risk taking behaviors or the distribution of access to resources embedded in social capital networks associated with positive health outcomes.

Addressing these research gaps is a key reason for this study, and it is hoped that the findings from this study will provide the groundwork for future social interventions addressing the disproportionately high levels of HIV and suicidal ideation among both community attached and non-attached MSM, as well as the underlying societal stigma, discrimination, and heteronormativity that play such a pivotal role in perpetuating these health disparities

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3. Methods

This chapter will describe how this study employed a cross-sectional survey to investigate complex relationships between social capital and MSM sexual health. It will discuss the participants and data collection methods used in the study, as well as describing the various steps taken in analysing this data.

3.1 Study Site

In 2017, Greater Tokyo had a population of roughly 37.8 million, the most populated metropolis in the world, and over 1.5 times the population of Australia. Greater Tokyo consists of the 23 wards making up central Tokyo, and the surrounding prefectures of Chiba, Saitama, Yokohama, and Kanagawa. In this study, all respondents gave their current prefecture of residence which were aggregated into Central Tokyo, Greater Tokyo, and other prefectures for analysis purposes. Greater Tokyo is currently, and has always been the center of the HIV/AIDS epidemic in Japan, and the highest population of MSM in Japan.

Table 1: Estimated Gay Venues Per Person in Japan

City	Population	Gay venues per person
Central Tokyo	8,949,447	1/22,486
Greater Tokyo	37,126,000[1]	1/93,281
Central Osaka	2,666,371	1/18,016
Sapporo	1,914,000	1/59,812
Kyoto	1,474,000	1/122,833
Fukuoka	1,464,000	1/33,272
Hiroshima	1,174,000	1/55,904

[1] http://www.worldatlas.com/citypops.htm

Miyazaki	400,583	1/200,291
Morioka	298,348	1/49,724
Aomori-Shi	299,520	1/99,840
Miyazaki	400,583	1/200,291
Ishigaki Island	48,000	1/16,000
Naha	315,954	1/9,546

3.2 Overview of the study design

From November 29th 2016 to January 23rd 2017 two anonymous cross-sectional surveys were undertaken designed to strengthen our understanding of social capital among MSM in greater Tokyo and Kyushu, and the implications of this for the mental health of these MSM and the mitigation of HIV transmission risk. Ethics approval was provided in Australia through the Human Research Ethics Committee at the University of Melbourne: Ethics ID: 1646197. Local approval was provided in Japan through the Ministry of Justice and the University of the Ryukyus.

3.3 Justification of Methodology

The National HIV Behavior Surveillance (NHBS) was created in 2003 by the CDC. It rotates surveillance in annual cycles for surveillance of three different populations at increased risk of HIV: MSM, persons who inject drugs (PWID), and heterosexuals at increased risk for HIV infection (HET). During the MSM cycle, time location sampling (TLS) is used. During the PWID and HET cycles, a respondent driven sampling methodology (RDS) is used because these populations are more easily accessed through traditional survey methods. Venue-based time-space (VBS) sampling and time-location sampling methodologies are mainly used in researching hard-to-reach MSM populations. Time-location sampling and has traditionally

been an effective method to sample hidden populations such as MSM and PWID. In this method, a partial sampling frame is constructed through finding non-hidden venues or institutions through which members of the target population can be found. After a probability sample of venues and times frequented by the target population is selected, researchers go to the selected venues at the selected times and interview a representative sample of those in attendance.

Although TLS is effective, repeatable (albeit with limitations), and can track changes over years, it is biased towards gay-venue institution attending MSM (community-attached MSM), creating a survey bias against one of the research aims, to examine both gay-community-attached and non-attached MSM. These methodologies face difficulties in Japan, where venue-based and online convenience sampling methodologies are predominantly used. In Japan, face-to-face interviews with MSM can be very difficult because of stigma, busy schedules, and time and funding limitations. Interviewing MSM would also be ethically ambiguous in parks and locations used by MSM for clandestine sexual activity. Sampling bias could be introduced if the researcher was not Japanese, as it could potentially skew towards foreigner-friendly MSM. However, Japanese mobile app rates are rising steadily, with nearly 100% of Japanese under 30 using a smart phone, and over 70% of the population (1) and this provides new opportunities for reaching hidden populations. Because mobile app users consist of both attached and non-community-attached MSM, an online-sampling methodology provides access to hard to reach and under investigated respondents (2). Further, this methodological approach allows for the most suitable means to address the research questions by accessing a broader range of MSM. An adapted online time-space sampling (OTSS) methodology, used successfully in previous research (3,4), was therefore utilised for this research, as described in sampling.

An online respondent-driven-survey (RDS) methodology was also considered for this project. RDS is based on long-chain recruitment whereby members of the target population

participating in the study refer other members of the target population to the study, allowing researchers to recruit highly-stigmatized groups who do not congregate in well-known places. RDS succeeds in sampling hidden populations without the venue bias of time sampling (5,6). Starting with an initial number of participants (seeds), who have given researchers the number of MSM acquaintances in their social networks (acquaintances are generally defined as someone who you would greet by name in the street if you were to meet them), from which the second wave of respondents is drawn. Participants directly recruit peers, possibly penetrating to social regions restricted to insiders. (6). RDS uses data gathered in the sampling process to make inferences about social network structure, and attempts to calculate unbiased population estimates (6). By implementing an ORDS methodology used successfully in Southeast Asia (7,8) but never in Japan, it was considered possible to provide the first accurate survey results of the MSM population in Tokyo, reaching previously under-sampled MSM without the sampling biases of the chain-sampling and convenience sampling methodologies used previously. ORDS has, however, been criticized as providing inaccurate population estimates for MSM sampling when compared to injection drug users (IDU) sampling. Because ORDS requires respondents to list their MSM network size, and MSM network numbers can be very high, this can create significant inaccuracies in data. Criticism has also been brought against the RDS methodology's statistical validity claims, as confidence intervals are misleadingly narrow (9). Moreover, although successful ORDS project results have been published, the success-to-failure ratio is skewed strongly towards failure, and MSM HIV prevention experts consulted at the University of New South Wales in 2016 strongly recommended not using an ORDS methodology, citing their own lack of success with the method. For this project, given funding and other considerations, ORDS was therefore not used, although the author still believes there is potential in the methodology for Japan in a potential future research project.

3.4 Participants

Inclusion criteria for participants were that they were 16 years or older (participants under 18 were later removed for statistical purposes), were self-reported MSM (defined as having current or previous sexual experience with other MSM, identifying- as MSM, and/or are sexually attracted to other men), and had provided online consent to participate in the survey. A consent form and plain language statement appeared at the beginning of the survey (see Appendix 2 for English and Japanese language consent forms and plain language statements and surveys). Participation was voluntary and anonymous.

3.5 Incentives

Participants were provided with the potential to win a small, locally adapted incentive for completing the survey. 20 prizes of 1500 yen, two prizes of 5000 yen, and one prize of 10,000 yen was awarded by random lottery to participants who chose to enter the lottery and gave a valid email address. Participants could also choose to receive a survey results report. All participants were provided with details for a local suicide help line and local MSM and HIV information centers.

3.6 Sampling

Subjects were recruited using the geo-location feature of gay mobile apps, similar to methods previously used to recruit Grindr users in the US (3,4). Popular gay mobile apps were used (e.g. jack'd, Hornet, Grindr, 9Monster) that were used in a previous similar study recruiting MSM in Japan (10), and were recommended during piloting in order to gain access to the most MSM. Gay mobile apps use geo-location to sort users by proximity, with the users closest to the researcher displayed at the top of a grid of photos with 3-4 photos per row. The researcher was positioned in Tokyo centrally, launched the most popular app in Japan and

randomly selected one user from each row until 50 previously uncontacted users were messaged with a link to the survey each day. These recruitment messages consisted of a greeting and short message regarding the purpose of the survey and link. Messages were logged by the app chat functions, hence previously messaged users were recorded and not messaged again. The survey was conducted between November 22nd 2016 to January 16th, 2017, recruiting 215 valid respondents. Slow recruitment due to frequent social networking services (SNS) scamming in Japan (11), in which users are often messaged by fake accounts attempting to steal personal information, and subsequent potential recruitment bias in which many respondents would not reply, led to a change in recruitment strategy. Because an advertisement must be screened by app companies prior to its promotion in-app, this was deemed more trustworthy to potentially recruit more participants. A splash screen poster (a full-screen advertisement that appears when the user opens the app) encouraging application users to respond to the linked survey was placed on 9Monster, the most popular Japanese gay mobile app (12), for one week from January 16th to January 23rd, 2017 to supplement response numbers. This methodology was used previously with success in the US (13,14). The advertisement was displayed only to users of the app in Greater Tokyo. It was shown in rotation whenever the application was opened, and could be seen in the 'advertising' section in Greater Tokyo. The advertising splash screen was created by a professional artist (Figure 13). The characters and text were edited multiple times according to pilot survey MSM and University of the Ryukyus sociologists in order to create a survey with the widest net and least bias of appeal for Japanese MSM respondents. It recruited a further 1442 participants for a total of 1657 valid respondents. All survey participants were notified they could win prizes of up to 80 USD by random lottery, as well as receive a survey results report. In total, 1335 (80.6%) of participants applied for the lottery incentive and 964 (58.2%) applied for the survey results.

Translation:

Lifestyle and Sexual Lifestyle Survey

Prizes awarded by lottery!

Figure 13: Splash screen advertisement on 9Monster: Lifestyle and sexual lifestyle survey

3.7 Data collection and measurement

The survey was a self-administered online questionnaire (Appendix 1). The primary survey was an anonymous multiple choice online survey consisting of 37 questions, with 22 individual indicator questions regarding social capital. In brief, social capital questions ask respondents to list whether or not they can gain access to particular resources or services within one week's time, based on a form of social capital measurement known as the 'Resource Generator' (15,16). The survey took between 15 – 30 minutes to complete according to piloting. Respondents were not entered into the lottery and did not receive compensation if they did not finish the social capital questions in the survey, as informed in the plain language statement. The survey was translated into Japanese and back-translated into English by an independent Japanese native

translator to ensure that meanings were equivalent, and that questions and scales were appropriate.

The questionnaire had four main sections:

a) Socio-demographic characteristics

b) Social capital

c) HIV knowledge and behaviors

d) Mental health

a. Socio-demographic characteristics

Socio-demographic characteristics of participants were determined by 14 questions related to birthplace, current place of residence, age, sexual orientation, sex, length of habitation in Tokyo, health, occupation, working hours, education, marital status. These 14 questions were previously used effectively in Japan in the Fukuoka Laborer Social Capital survey (17) and an Okinawa MSM social capital survey (10). These socio-demographic characteristics have been found to have large effects on social capital results and should be controlled for in order to not overestimate social capital effects (18–20).

b. Social Capital

Social capital was measured using The Resource Generator (15), a validated instrument (21) to assess individual social capital, conceptualized as valued resources that individuals can access through their social networks (16). It contains 18 culturally adapted questions assessing participants' ability to access both physical and mental support resources embedded in social networks through MSM or heterosexual alters, for example, 'Do you have access to an MSM

or heterosexual who you trust very much?' Participants could choose one of the following four responses: 'heterosexual', 'MSM', 'both', 'neither' for all social capital questions. According to these results, participants were grouped into three levels of social capital (high, medium, and low). High SC participants were defined as 1.0 standard deviation (SD) above the overall mean, low SC participants as one SD below the overall mean, and medium SC participants in-between; thus 20% to 30% of participants were grouped into the high and low SC categories respectively. There was high reliability for the MSM social capital scale (Cronbach's alpha = 0.91) and heterosexual social capital scales (Cronbach's alpha = 0.91).

This research uses multiple measures of social capital in order to grasp all aspects of social capital as conceptualized in a multilevel framework. The 'resource generator' is an instrument to assess individual social capital, conceptualized as valued resources that individuals can access through their social networks (15,16). Because it is a directly comparable framework, it is used in the hope that future research in Japan on the MSM community regarding social capital will utilize this methodology so that results can be compared nationwide. A variety of theoretically grounded social capital sub-dimensions were measured and included in this chapter.

Group exclusion, restriction of freedom, excess time burden, and downward leveling norms were considered as potential negative social capital outcomes (22) and measured as a negative social capital sub-dimension. However, there was low reliability for the subscale (MSM social capital Cronbach's alpha = 0.54; Heterosexual social capital Cronbach's alpha = 0.45), and it was therefore split into four individual questions, for example 'Do you know an MSM or heterosexual who makes you feel excluded from a group?' or 'Do you know an MSM or heterosexual who restricts your freedom?'

Social capital was conceptualized into the following four sub-dimensions and social cohesion (18,19): Social Support (social capital that members can draw upon to cope with daily

problems.); Social leverage (social capital assists members to access information and limit socio-economic hardship.); Informal social control (keeps people in order with health and safety promotion); Community Organization Participation (residents formally organized for collective activity for addressing community issues.); and Social cohesion (level of relational trust and shared values in community.)

Emotional support was based on a five-item scale. Respondents were asked if they know someone they can talk to about personal matters, someone they trust very much, shares the same norms, shares the same values, and someone who shares the same opinions. There was high reliability for the emotional support scale (Cronbach's alpha = 0.85 for both MSM and heterosexual emotional support cumulative scales).

Practical support was based on a five-item scale. Respondents were asked if they knew someone who could lend them a car, lend them 30,000 yen, help them move, do their shopping when they're ill, or find them a job. Cronbach's alpha = 0.79 for MSM and heterosexual practical support cumulative scales.

c. HIV knowledge and behaviors

Risk behavior in the survey was measured by HIV knowledge, condomless anal sex, self-stigma and self-efficacy. Drug and alcohol use are also factors that research indicates leads to HIV risk. Previous research (Hidaka, 2008), shows that drug use in Japan is minimal, with on average two drug-related HIV infections per year. An alcohol and related condom self-efficacy question has therefore been included, but a drug measure was not. With the recent advent of Pre-exposure prophylaxis (PrEP), condomless anal sex can no longer be defined as completely unprotected sex. A social capital researcher (23), therefore uses the term 'completely unprotected sex'. However, 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 individual. Neither Truvada (emtricitabine/tenofovir disoproxil fumarate) (FTC/TDF) nor generic versions of FTC/TDF are approved for prevention in Japan, and although CLAI therefore does not include PrEP, without knowing the HIV status or UVL status, we still cannot know the risk of engaging in CLAI. I therefore measure CLAI as risky behavior, but not as 'completely unprotected sex'.

HIV stigma questions were taken from a multicomponent AIDS phobia scale developed by Harell and Wright (1998) that was used successfully in Korea (24) and graded on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Respondents were asked three questions regarding HIV testing: ever having had an HIV test, having had an HIV test in the previous six months, and intention to get tested in the future (all with 'yes' or 'no' response options). 'Recent testing' was defined as testing within the previous six months.

d. Mental health

The suicidal ideation question utilized item 9 on the Australian patient health questionnaire-9 (PQH-9), and was previously used successfully with aboriginal men in Australia (25). It asked respondents 'In the past two weeks, how often have you been bothered by thoughts you would be better off dead or of hurting yourself in some way' with four possible responses, 1 (not at all), 2 (several days), 3 (more than half the days), 4 (nearly every day). It was later recorded as a dichotomous variable (1 = suicide ideation; 0 = no suicide ideation).

The subjective happiness scale (26) was used in which four questions measure subjective happiness on a scale of 1 (Very unhappy) to 7 (very happy). It was previously translated into Japanese and used successfully (27), and the researchers kindly gave us permission to use their Japanese translation.

3.8 Data Management

This research primarily utilises quantitative data from two anonymous multiple choice online survey over 1600 valid MSM respondents. Qualitative data was also gained from in-depth comments and life stories by survey participants. The survey contained a description of the purpose of the survey, an assurance of privacy, a request for only MSM with full consent and understanding to respond, and consent for data re-use in future research. The privacy of all respondents is protected, with raw data only viewed by myself. Any responses under 8 minutes were considered invalid, and payment and data was cancelled. Intellectual property is under ownership of RHD Student Adam Hill Rolander.

All survey data was imported into SPSS version 24. All analysis is done in IBM SPSS 24. Final results are exported to MS Excel and stored as MS Excel spreadsheets. As these formats could become unsupported in the future, they will be made available as ASCII files with syntax files as well. Because the data is of high public interest, of significant interest to other researchers, and would be costly to reproduce, data files will be catalogued in a single database, with metadata (filename, author, geographic coverage, response rate etc.) using Data Documentation Initiative standards and stored indefinitely. I am the sole owner and intellectual property holder of the data.

Datasets will be publicly released and archived 18 months after completion of publications. All survey responses are anonymous, voluntary, confidential, and unidentifiable. All results will be released as only aggregate statistics. All identifiers will be removed from datasets prior to depositing them in public archives. The data and documentation will remain at The University of Melbourne, Faculty of Arts, School of Social and Political Sciences with Professor Leah Ruppanner. Negotiated access to anonymous data may be considered at the University of Melbourne, and outside the university of Melbourne depending upon request.

3.9 Statistical analyses

SPSS version 24 was used to analyze data. It provides a comprehensive framework for working with data, including tools for sample and population estimations, testing, confidence intervals and sensitivity analysis, the visualization of recruitment chains and regression modelling.

General Process

Results were cleaned and translated from Japanese into English in MS Excel 2016. They were then imported into SPSS version 24. All analysis was done in SPSS, final results exported to MS Excel 2016 and MS Word 2016. All frequencies, means, medians, proportions and ranges were checked in all variables.

Primary dependent outcome variables measuring HIV risk utilized for examining associations with independent variables were: condom use with a regular male anal sex partner, condom use with a non-regular male anal sex partner, condom use with a female partner, recent and lifetime HIV testing, and HIV testing intent.

Primary independent variables that were being investigated for association with decreased HIV risk were MSM and heterosexual social capital (made up of 18 separate questions based on the resource generator (Van der Gaag, 2005), as well as social capital subscales consisting of MSM and heterosexual bonding, bridging, alternative, social support, social leverage, social control, community participation, and social cohesion. Respondents were split into three groups of social capital (high, medium, and low), with cut-points of 1.0 standard deviations above and 1.0 standard deviations below the mean labeled the high and low groups, and those in between labeled the medium group.

Condom use with a regular anal sex partner was re-coded as a dichotomous outcome measure, (0 = never or rarely; 1 = most of the time and always). Respondents reporting no anal

intercourse with a regular male sex partner were removed. Condom use with a non-regular anal sex partner was as a dichotomous outcome measure, (0 = never or rarely; 1 = most of the time and always.) Respondents reporting no anal intercourse with a non-regular male sex partner were removed. Condom use with a female intercourse partner was re-coded as a dichotomous outcome measure, (0 = never or rarely; 1 = most of the time and always.) Respondents reporting no intercourse with a female sex partner were removed.

Lifetime HIV testing, recent HIV testing, and future testing intent were coded as dichotomous outcome measures, (0 = No; 1 = Yes.)

HIV Knowledge questions were coded as a dichotomous outcomes, with a score of 1 if the HIV knowledge questions were answered correctly, and 0 if any were answered incorrectly.

The HIV related self-efficacy score was created from seven questions ("I can say no to sex when a partner wants sex and I don't", "It's difficult to talk about condom use with partners", "I feel confident in my ability to use condoms when my partner doesn't want to use them", "I am able to avoid behavior that may put me at risk of HIV infection", "I find it difficult to have safer sex when drunk", "I encourage my friends to practice safer sex", "I am afraid of using a condom because if I do sex partners will think I have HIV"), each of which were ranked on a five-point Likert scale from 1(strongly disagree) to 5 (strongly agree). Negatively phrased questions were reverse coded in SPSS, and the scores for each respondent were added together for a total score from all seven questions.

Poor health was re-coded as a binary variable, with 0 = Very poor/Poor/Fair and 1 = Healthy/Very healthy

Subjective Happiness score was created from four questions according to the subjective happiness scale. It was a linear score from a minimum of 4 to a maximum of 28 points.

Age, Education, Residence, and Employment were coded as categorical variables.

Place of birth, Marital status, Intercourse partner-sex, and Health were coded as binary variables.

Out-status and gay-community identification usage were coded as binary variables.

Gay bar attendance and gay community volunteering usage were coded as binary variables.

Use of gay mobile apps for sex, use of gay mobile apps to find friends, use of gay mobile apps to avoid being identified as gay, and use of gay mobile apps to find a serious relationship coded as binary variables.

Relationships between the primary dependent outcome variables and covariates were investigated initially in means comparison and univariate analyses, and were later controlled for in the multivariate analyses when investigating the relationship of the independent variable social capital on the primary dependent outcome variables.

Variables are outlined in Table 2 below, and a more detailed Excel spreadsheet including all variables, questions, and response coding can be accessed via Figshare at the following DOI 10.26188/5c35dd5707faf.

Table 2: Variables of survey questions

Variable	**Question**
Age: 18 - 25 Age: 26 - 35 Age: 36 - 45 Age: 46+	*What is your age?*
Married	*Are you currently married?*
Education: highschool or less Education: Two-year university Education: University Education: Graduate degree	*What is the highest level of education you have completed?*

Full-time work Part-time work Student Self-employed Unemployed	*What is your current occupation or field of employment?*
Out to family	*Are you out about your sexuality to your family?*
Out to close friends	*Are you out about your sexuality to your close friends?*
Out to colleagues and classmates	*Are you out about your sexuality to your colleagues and classmates?*
Identify as a member of the gay community	*I identify as a member if the gay community*
Health	*How would you rate your overall health?*
Use gay mobile apps to find sex	*To what extent agree with the following statement: I use gay mobile apps to find sex*
Use gay mobile apps to find friends	*To what extent agree with the following statement: I use gay mobile apps to find friends*
Use gay mobile apps to avoid being identified as gay	*To what extent agree with the following statement: I use gay mobile apps to avoid being identified as gay*
Use gay mobile apps to find a serious relationship	*To what extent agree with the following statement: I use gay mobile apps to find a serious relationship*
Hattenba attendance	*How often do you go to Hattenba?*
Length of gay bar attendance	*How long (if ever) have you been attending gay bars?*
Recent organized gay group activity	*In the past 6 months have you participated in any organized gay group activities (political/social etc.) or gay community events or any volunteer work for any gay organizations?*
HIV knowledge: "Having other STIs does not increase the chance of HIV infection"	*Is the following true or false: Having other STIs does not increase the chance of HIV infection*

Ever tested for HIV	*Have you ever been tested for HIV?*
Tested for HIV in past six-months	*Have you been tested for HIV in the last six months?*
Intend to undertake testing for HIV in future	*Are you planning on getting tested for HIV in the future?*
condom frequency regular male sex partner	*How often do you use a condom with a regular (penetrative and receptive anal sex) male partner?*
condom frequency casual male sex partner	*How often do you use a condom with casual (penetrative and receptive anal sex) male partners?*
condom frequency female sex partner	*How often do you use a condom with female (penetrative and anal sex) partners?*
HIV information from School education	*HIV information from School education*
HIV information from Hospital pamphlet	*HIV information from Hospital pamphlet*
HIV information from Gay Internet Resource	*HIV information from Gay Internet Resource*
HIV information from Government Internet Resource	*HIV information from Government Internet Resource*
HIV information from Friend	*HIV information from Friend*

HIV information from Gay Bar	*HIV information from Gay Bar*
HIV information from Television/Newspaper	*HIV information from Television/Newspaper*
HIV information from Gay Magazine	*HIV information from Gay Magazine*
HIV information from Family	*HIV information from Family*
HIV information from Sex partner	*HIV information from Sex partner*
Advice about practicing safe sex likely to follow	*Who's advice about practicing safe sex would you be most likely to follow?*

Approach for investigating associations

Univariate analyses, in which only one independent variable and one dependent variable are included in the model was carried out in order to find significant associations between independent variables and the primary dependent variable outcome, HIV risk-taking behaviors and suicidal ideation. Associations with a p-value of 0.010 or less were included in the multivariate analyses. Multivariate analyses were then performed on the primary dependent variables for HIV risk-taking behaviors, consisting of inconsistent condom use with regular and casual male partners and female partners, lifetime and recent HIV testing, and future HIV testing intent as well as suicidal ideation. Adjusted odds ratios and 95% Confidence Intervals were reported.

Social Capital as the dependent variable

Social capital was examined as a dependent variable in order to investigate the distribution of resource access among MSM and heterosexual social networks. Univariate analyses, in which only one independent variable and one dependent variable are included in the model was carried out in order to find significant associations between independent variables and the dependent variable outcomes, MSM and heterosexual social capital, and the unadjusted odds ratios and 95% Confidence Intervals reported. Significant associations, defined as a P-value of under 0.10, were included in the multivariate analyses.

3.10 Ethical considerations

a. Plain Language Statement (PLS) and informed consent (Appendices 2 and 3): A PLS was on the first page of the online survey. Participants then chose to give consent when they elected to continue with the survey.
b. Anonymity and confidentiality: data was de-identified, no names or other identifying information was collected.
c. Voluntary participation: participation was voluntary and there were no consequences for electing not to participate. A small token payment was provided to participants who entered and won the lottery to acknowledge the time taken to complete the survey.
d. Risk to participants: I acknowledged the minor risk of psychological distress as a result of participating in the survey. Information about local MSM helplines and information centers, as well as suicide lines was given at the beginning of the survey.

3.11 Summary

This chapter has given an in depth explanation of this study's research design and methodological approach. It reviewed the stages involved in the collection and analysis of data. It shows how data was explored in multiple ways to bring together themes from the literature in the investigation of connections between social capital and sexual as well as mental health. The following chapters provide analysis of how MSM accessed social capital and how this impacted HIV risk taking behaviors.

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4. Results: Gay Mobile App Use and Gay Community Participation Characteristics of MSM in Greater Tokyo

Abstract

Background: Geo-social-networking mobile applications are frequently used by men-who-have-sex-with-men (MSM) to meet anonymous sex partners, and previous studies have failed to reach the large sexually active MSM population not socially active in the Greater Tokyo gay community. This research addressed this research gap by examining the feasibility of using two different methods for recruiting MSM via Geo-social-networking mobile applications and sought to create exploratory profile of geo-social-networking application use, gay community participation, and mental and physical well-being of MSM in the Greater Tokyo Area.

Methods: Respondents were recruited from popular gay mobile apps among MSM in Japan using a modified time-location sampling technique, and a splash screen advertisement for one week directing respondents to a web-based survey.

Results: Participants were young (mean age = 35), single, educated, and mainly employed fulltime. There was high homosexual (85.1%) and bisexual (14.1%) identification, and only 8.9% had both male and female sex partners. Over half (53.4%) resided in the 23 wards of central Tokyo, and almost all (96.3%) of respondents were born in Japan. Over half of respondents (59%) were out about their sexuality to only close friends, but few were out to colleagues, classmates, or family. Respondents used gay mobile apps very frequently, with 89.7% using them more than twice a week, mainly in order to find sex and make friends. There was low gay community attachment, and just over half had ever attended a gay bar (56.8%), and 47.6% had attended a bathhouse. Gay group activity participation was very low at just 13.2% in the past six months. Although respondents were very healthy, I found a high prevalence (30.9%) of suicidal thoughts indicating a high degree of psychological distress in the past two weeks.

Conclusions: These results imply that there is a large non-gay-community attached MSM population in Greater Tokyo frequently using gay mobile apps. Utilization of popular gay mobile apps to promote HIV testing and mental health interventions may be an effective policy.

4.1 Introduction

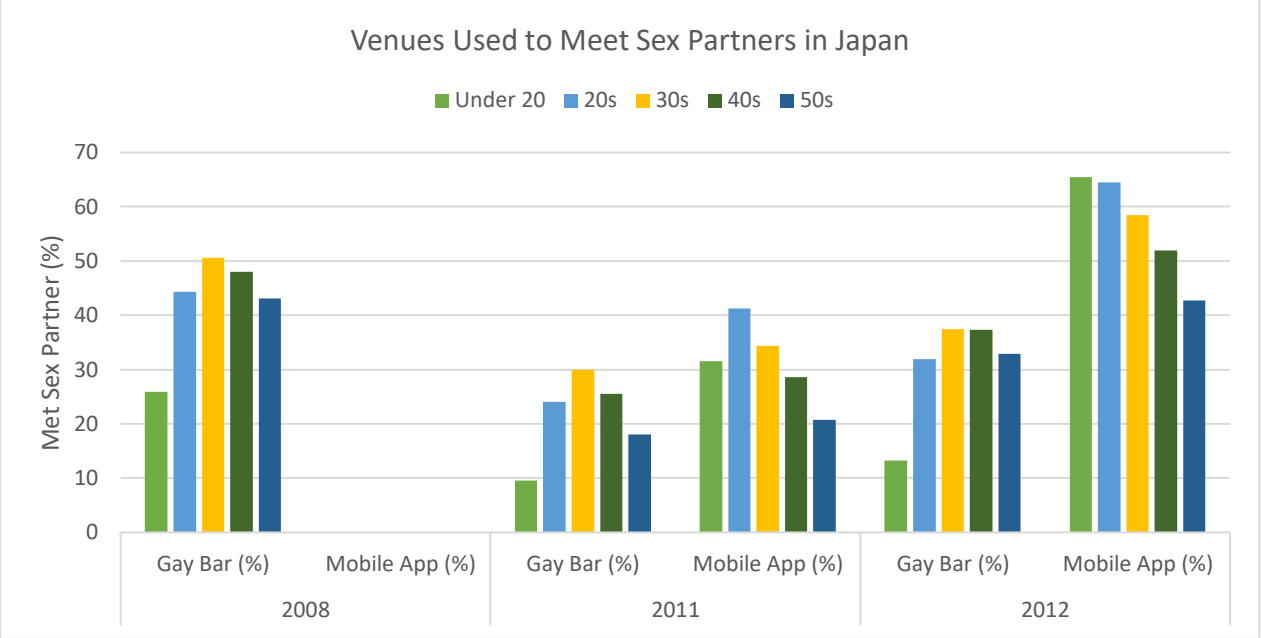
MSM are estimated to make up 4.6% of the male population in Japan, but are disproportionately burdened by HIV (1), accounting for the majority (78%) of new Japanese male HIV cases (2). Greater Tokyo has reported the highest levels of new HIV and AIDS cases in Japan every year since surveillance began in 1985. MSM also have an increased risk of various mental health disorders, including major depression in adolescence and adulthood, bipolar disorder, generalized anxiety disorder (3), and higher suicidal ideation than the general population (4). These psychosocial factors that disproportionately affect MSM have been found to be associated with sexual risk-taking behaviors (5).

However, there has been a lack of research on Japanese MSM. An estimated 65.4% (982,300) MSM are not attached to the gay community (1), and previous studies have focused on the gay community attached MSM population using traditional venue-based sampling techniques that have failed to reach this largely untapped population. Because gay geo-social networking applications, henceforth referred to as gay mobile apps, have users who're both attached and non-community-attached MSM, they have been found to potentially provide access to MSM not traditionally accessible through venue-based surveys (6–8). Japanese app rates are rising steadily, with over 70% of Japanese under 40 using a smart phone to access the internet (9). Gay mobile apps have very quickly become one of the most popular venues to access sex among MSM in the world (10) and Japan (Figure 14), (11). Although Grindr is currently the most popular gay geo-social application in the world with almost 12 million active users in 2017 (12), Japanese application use varies significantly from the West. In 2017, the most used application was 9Monster (commonly known as 9Mon), with 300,000 users as of

April 2017 in Japan, and 400,000 in December 2018 (13). 9Mon and other Geo-social applications enable users to use global positioning systems (GPS) in mobile phones to search through a grid of nearby users based on their proximity, and to contact and meet nearby users, enabling MSM to encounter each other quickly and easily. 9Mon is popular with a broad spectrum of MSM, and has some unique features that have made it popular in Japan, including a *tamagochi*-esque feature where users breed monsters and level up attributes depending on how many other users breed, message, and like you, encouraging socialization with many users. It also has a 'howl' feature where users can draw attention to themselves and request anything from an immediate lunch date to CLAI. However, at the time this survey was undertaken, very little is known about MSM who specifically use gay geo-social networking applications in Japan.

Previous research has shown MSM gay mobile app users to be younger, better educated, and have higher numbers of sexual partners (14,15), more lifetime diagnoses of sexually transmitted infections not including HIV (10,14), and higher rates of HIV testing (15–17) than non-app using MSM.

At the time of this survey to my knowledge, there was no previous research regarding gay mobile app users in Greater Tokyo, and this research therefore utilizes a geo-social networking application based cross-sectional convenience sample survey in order to create the first exploratory population profile of Japanese MSM gay mobile app users. Investigating the socio-demographics, gay mobile app use patterns, and mental and physical well-being of this hard-to-reach population helps our understanding of different MSM subgroups, and in doing so enables us to better profile the Japanese MSM population and potentially tailor prevention strategies.



Source: Reach Online 2012 (11).

Figure 14: Percent (%) of Sex Partners Met at Gay Bars and on Mobile Apps

For comparison, in Melbourne Australia, over one-third (38.5%) of 2339 MSM participants in Melbourne reported meeting a male sex partner in the past six months on a mobile app compared to 28.1% at a gay bar in 2013; in 2016, when this survey was conducted, almost half (48.2%) of 2886 MSM participants reported meeting a male sex partner in the past six months on a mobile app compared to 28.6% at a gay bar (18).

4.2 Objectives

Considering the limited research into the Japanese gay mobile app using MSM population, this chapter aims to answer the following questions:

1. What are the socio-demographic characteristics of MSM who use gay geo-social networking applications in Greater Tokyo?
2. Among MSM in Greater Tokyo who use gay mobile apps, how frequently do they use gay mobile apps relative to their broader participation in the gay community?

3. What are the levels of self-reported physical and mental health?

4.3 Results

4.3.1 Respondent Characteristics

The socio-demographic characteristics displayed in Table 3 profile a sample of 1653 MSM in Greater Tokyo. The mean age was 35.31 years old (SD = 9.81), with a range from 18 – 69 years of age. Respondents were concentrated in the central 23 wards of Tokyo, and over three-times the number of respondents resided in the 23 wards of central Tokyo than Greater Tokyo proportional to their respective populations. Almost all (96.3%) of the respondents were born in Japan. The vast majority were unmarried (95.6%) and educated, with 96.7% completing high school, and 58.1% completing university or a postgraduate degree. Nearly three quarters of respondents (73.9%) were employed fulltime, with low unemployment (4.2%), and long work hours. The majority of respondents identified as homosexual (85.1%) or bisexual (14.1%), and 8.9% had both male and female sex partners. Few respondents were open about their sexuality to family (27.3%) or colleagues and classmates (22.5%), although over half were out to close friends (59.0%).

Table 3: Socio-demographic characteristics of respondents

		n	%
Current residence	Tokyo	883	53.4
	Kanagawa	248	15
	Chiba	141	8.5
	Saitama	164	9.9
	Another prefecture	209	12.6
	Another country	8	0.5
	Total	1653	100
Birthplace	Japan	1593	96.3
	China	18	1.1

	Taiwan	9	0.5
	Korea	5	0.3
	Brazil	6	0.4
	Philippines	4	0.2
	Other	20	1.2
	Total	1655	100
Age	18 to 25	319	19.4
	26 to 35	550	33.4
	36 to 40	507	30.8
	Over 46	270	16.4
	Total	1646	100
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
Length of residence in Greater Tokyo	Never lived in Greater Tokyo	145	8.8
	Less than one year	80	4.8
	Between one and two years	135	8.2
	Between three and ten years	314	19
	More than ten years	978	59.2
	Total	1652	100
Occupation	Full-time	1133	68.5
	Part-time	185	11.2
	Student	168	10.2
	Self-employed	73	4.4
	Freelance	16	1
	Unemployed	69	4.2
	Other	9	0.5
	Total	1653	100

Weekly work hours	0	120	7.3
	1 to 19	135	8.2
	20 to 39	174	10.6
	40 to 49	663	40.2
	50 to 59	335	20.3
	60 +	222	13.5
	Total	1649	100
Education	Elementary school	1	0.1
	Junior high school	53	3.2
	High school	367	22.2
	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 sex	Men	1488	90.7
	Both	146	9.3
	Total	1645	100
Sexuality	Homosexual	1408	85.1
	Bisexual	233	14.1
	Other	14	0.8
	Total	1655	100
Out to Family	No	1181	72.7
	Yes	443	27.3
	Total	1624	100
Out to All Friends	No	1464	91.2
	Yes	141	8.8
	Total	1605	100
Out to Close Friends	No	669	41
	Yes	964	59

	Total	1633	100
Out to Colleagues/Classmates	No	1242	77.5
	Yes	360	22.5
	Total	1602	100

4.3.2 Gay Mobile app Use

Table 4 shows participant gay mobile app use. On average, respondents used 9Monster the most (83%) followed by jack'd (10.3%). Application use was relatively recent, and very few respondents had used geo-social networking applications for over 10 years (9.6%) and only half had been using them for between 3 - 10 years (52.0%). As Grindr and gay mobile apps only emerged in 2009, it is likely the case that these respondents were using web-based dating apps (*deai-kei saito*) or bulletin board systems as opposed to mobile apps. Most respondents used applications almost every day (69.6%), and nine-tenths (89.7%) used them more than twice a week. Over three-quarters (75.5%) of participants reported using gay mobile apps to meet friends, and the second most common reason was to meet other men for sex (61.4%), while over half of respondents (53.2%) reported using gay mobile apps for a serious relationship, and very few (8.2%) reported using them to not be seen as gay.

Table 4: Gay Mobile Apps Usage characteristics

		n	%
Most used gay mobile app	None	26	1.6
	9Monster	1369	83.0
	jack'd	170	10.3
	Grindr	51	3.1
	Tinder	19	1.2
	Other	15	0.9
	Total	1650	100.0
Length of gay mobile app use	Less than one year	205	12.4
	Between one and two years	427	25.8

	Between three and ten years	861	52.1
	More than ten years	159	9.6
	Total	1652	100.0
Gay mobile app use frequency	Once a month or less	67	4.1
	Around once a week or less	101	6.1
	Between two and five times a week	331	20.1
	Almost everyday	1145	69.6
	Total	1644	100.0
Use gay mobile apps to find sex	Strongly disagree	80	4.9
	Disagree	162	9.8
	Neutral	394	23.9
	Agree	732	44.5
	Strongly agree	278	16.9
	Total	1646	100.0
Use gay mobile apps to find friends	Strongly disagree	55	3.4
	Disagree	103	6.3
	Neutral	243	14.8
	Agree	944	57.6
	Strongly agree	293	17.9
	Total	1638	100.0
Use gay mobile apps to avoid being identified as gay	Strongly disagree	966	59.3
	Disagree	338	20.7
	Neutral	192	11.8
	Agree	97	6.0
	Strongly agree	36	2.2
	Total	1629	100.0
Use gay mobile apps to find a serious relationship	Strongly disagree	205	12.5
	Disagree	180	11.0
	Neutral	380	23.2

	Agree	579	35.4
	Strongly agree	291	17.8
	Total	1635	100.0

4.3.3 Gay-Community Participation

Table 5 shows gay venue attendance. A little over half of the sample (56.8%) had ever attended gay bars or events. Of those who had, almost half (42.6%) attended for over ten years, and participation was infrequent, with only 21.8% participating once a week or more. Only a quarter of respondents attended gay bars or events in order to find sex partners (24.1%), a third in order to find a serious relationship (31.3%), and half attended to make friends (52.2%). Gay venue attendance was low among participants: 56.8% of participants had ever attended a gay bar, 47.6% had ever attended a bathhouse, and while most respondents identified as a member of the LGBT community (83.1%), very few had participated or volunteered in gay group activities in the past six-months (13.2%). Among participants who attended gay bars, two-thirds (61.3%) attended once every month or more; Among participants who attended bathhouses, 52.7% attended once a month or more

Table 5: Physical gay community participation characteristics

		n	%
Length of gay bar/event participation	Never	712	43.2
	Less than one year	142	8.6
	Between one and two years	131	7.9
	Between three and ten years	266	16.1
	More than ten years	399	24.2
	Total	1650	100.0
Gay bar & event frequency	Once every six months	368	38.8
	Once a month	375	39.5
	Once a week	159	16.8
	More than once a week	47	5.0

	Total	949	100.0
Gay bar & event: to find sex	Strongly disagree	560	35.5
	Disagree	312	19.8
	Neutral	380	24.1
	Agree	265	16.8
	Strongly agree	61	3.9
	Total	1578	100.0
Gay bar & event: to find friends	Strongly disagree	309	19.6
	Disagree	121	7.7
	Neutral	325	20.6
	Agree	661	41.9
	Strongly agree	162	10.3
	Total	1578	100.0
Gay bar & event: to find a serious relationship	Strongly disagree	433	27.5
	Disagree	239	15.2
	Neutral	412	26.1
	Agree	356	22.6
	Strongly agree	137	8.7
	Total	1577	100.0
Hattenba frequency	Never	864	52.4
	Around once every six months	371	22.5
	Around once a month	303	18.4
	Around once a week	102	6.2
	Twice a week or more	10	0.6
	Total	1650	100.0
Participated in organized gay group activity in past 6 months	No	1433	86.8
	Yes	218	13.2
	Total	1651	100.0
Identify as a member of the LGBT community	Strongly disagree	45	2.7
	Disagree	52	3.2

Neutral	180	11.0
Agree	546	33.3
Strongly agree	817	49.8
Total	1640	100.0

4.3.4 HIV knowledge Characteristics

Table 6 shows the HIV knowledge characteristics. Around nine-tenths (87.3%) of respondents correctly understood that HIV cannot be transmitted by kissing, and that having other STIs increases the chance of HIV infection (92%), although only two-thirds (67.8%) of respondents correctly understood that showering before and after sex does not decrease the chances of HIV infection.

Table 6: HIV knowledge characteristics

		n	%
HIV can be transmitted by kissing	Correct	1432	87.3
	Incorrect	209	12.7
	Total	1641	100.0
Having other STI's does not increase the chance of HIV infection	Correct	1510	92.0
	Incorrect	131	8.0
	Total	1641	100.0
Showering before and after sex reduces chances of HIV transmission	Correct	1114	67.8
	Incorrect	530	32.2
	Total	1644	100.0

4.3.5 HIV Stigma Characteristics

Table 7 shows HIV/AIDS stigma characteristics. Very few respondents felt agreed or strongly agreed that when they felt an ache/pain they assumed it was due to HIV (5.6%), or that they avoided watching TV programs or reading information about HIV/AIDS (2.5%).

However, about one third (34.5%) agreed or strongly agreed that they frequently checked their bodies for signs of HIV/AIDS.

Table 7: HIV/AIDS stigma characteristics

		n	%
When I feel an ache or pain, I assume it is due to HIV/AIDS	Strongly disagree	536	32.5
	Disagree	541	32.8
	Neutral	479	29.1
	Agree	81	4.9
	Strongly agree	11	0.7
	Total	1648	100.0
I avoid watching TV programs and reading information about HIV/AIDS	Strongly disagree	726	44.1
	Disagree	618	37.5
	Neutral	261	15.9
	Agree	35	2.1
	Strongly agree	6	0.4
	Total	1646	100.0
I frequently check my body for signs of HIV/AIDS	Strongly disagree	208	12.6
	Disagree	347	21.1
	Neutral	524	31.8
	Agree	458	27.8
	Strongly agree	111	6.7
	Total	1648	100.0

4.3.6 Self-efficacy for safer sex

Table 8 shows self-efficacy for safer sex. Condom use self-efficacy levels were relatively high. Most respondents (59%) felt confident in their ability to refuse sex despite a partner wanting it when they don't, and although over nine-tenths (91.7%) didn't feel they have difficulty discussing condom use with partners, only two-fifths (40.8%) of respondents felt confident in their ability to use condoms when a partner doesn't want to. Just over half (53.9%)

of respondents felt they could avoid behavior putting them at risk of HIV infection. Almost half (43.6%) of respondents felt that they had trouble having safe sex when drunk, and about a third (31.1%) of respondents encouraged friends to practice safer sex.

Table 8: Self-efficacy for Safer Sex

		n	%
I can say no to sex when a partner wants sex and I don't	Strongly disagree	55	3.3
	Disagree	145	8.8
	Neutral	476	28.9
	Agree	733	44.5
	Strongly agree	238	14.5
	Total	1647	100.0
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	100.0
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	100.0
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	100.0

I find it difficult to have safer sex when drunk	Strongly disagree	202	12.3
	Disagree	274	16.7
	Neutral	451	27.5
	Agree	556	33.9
	Strongly agree	159	9.7
	Total	1642	100.0
I encourage my friends to practice safer sex	Strongly disagree	271	16.5
	Disagree	329	20.1
	Neutral	530	32.3
	Agree	380	23.2
	Strongly agree	129	7.9
	Total	1639	100.0
I am afraid of using a condom because if I do sex partners will think I have HIV	Strongly disagree	862	52.5
	Disagree	481	29.3
	Neutral	228	13.9
	Agree	53	3.2
	Strongly agree	18	1.1
	Total	1642	100.0

4.3.7 Well-being and Suicidal Ideation Characteristics

Table 9 show the participant characteristics for wellbeing and suicidal ideation. The majority of respondents (63.8%) were healthy, and had a mean subjective happiness score of 4.4/7. Almost one-third (30.9%) of participants reported suicidal ideation in the past two weeks.

Table 9: Health and wellbeing characteristics

		n	%
How would you rate your overall 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
Two-week prevalence of suicidal thoughts	Yes	1141	30.9
	No	510	69.1
In general, I consider myself	1 (Very Unhappy)	39	2.4
	2	96	5.8
	3	249	15.1
	4	399	24.2
	5	471	28.5
	6	226	13.7
	7 (Very Happy)	170	10.3
	Total	1650	100.0
Compared with most of my peers, I consider myself	1 (Very Unhappy)	56	3.4
	2	141	8.6
	3	266	16.2
	4	460	27.9
	5	369	22.4
	6	200	12.1
	7 (Very Happy)	155	9.4
	Total	1647	100.0
Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?	1 (Very Unhappy)	96	5.8
	2	141	8.6
	3	296	18.0
	4	435	26.4
	5	378	22.9
	6	155	9.4
	7 (Very Happy)	147	8.9
	Total	1648	100.0

Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterization describe you?	1 (Very Unhappy)	235	14.3
	2	343	20.9
	3	316	19.2
	4	365	22.2
	5	233	14.2
	6	80	4.9
	7 (Very Happy)	71	4.3
	Total	1643	100.0

4.4 Population Profile Results Discussion

4.4.1Recruitment

This study examined the feasibility of using two different methods for recruiting MSM via gay mobile apps in Greater Tokyo. It showed that purchasing splash screens on gay mobile apps can be used to recruit large numbers of MSM in a relatively short period of time, and that popular mobile app companies such as 9Monster are willing to discount advertising for MSM related prevention research in Japan. It also showed that while the online time-space-sampling methodology similar to those used previously on Grindr (17,19) was not entirely successful, it would be possible to attain a proper sample with more resources. The initial survey had an efficiency of 3.8 respondents per day, comparable to previous research using this methodology, which ranged from 0.3 – 3.2 respondents per day (17,19–21). The methodology limited self-selection but had a low response rate of only 3.8%, on the lower end of previous studies' recruitment ratios of 2% - 12% (17,19,22). Low response rates increase risk of study invalidity (23), and at these levels may face self-selection bias similar to that of advertising with splash screens or banner advertising. Splash screen advertising efficiency was 238.1 respondents per day, comparable to previous research which ranged from 43.3 respondents per day to 675 respondents per day. Because MSM-related HIV prevention suffers from lack of sustainable financing and few researchers specializing in HIV among MSM (24), advertising may be more practical than an adapted time-space-sampling methodology, particularly as advertising could

be placed throughout Japan and results could be compared for different districts. A potential future area of interest would be to compare respondent socio-demographics and sexual behaviors from respondents recruited via both methodologies.

4.4.2 Demographic Characteristics

This was one of the first studies examining the socio-demographic and mental health of gay mobile app users in Japan. Gay mobile app users in Japan were young, single, highly educated, healthy, and concentrated in central Tokyo. The mean age of this study was 35.3 years old (SD = 9.8), with a range from 18 – 69 years (two respondents aged 16 and 17 were removed), comparable to a study of 4572 venue attending MSM in Japan who had a mean respondent age of 35.5 (SD 10.4), and a range of 16 – 74 (25). Venue based research had an older skewing population range, as older MSM are more likely to attend physical gay venues in the literature (11). Previous gay mobile app research also found users to be younger with mean ages from studies ranging from 24.8 to 30.7, (7,14,20,21), likely due to a high proportion of youth using smartphones (9), and being more technologically proficient (26).

Respondents were educated, and over half of the sample (58.1%) held university degrees, higher than gay venue attending MSM (25), although more of the gay venue attending sample came from outside central Tokyo where university attendance was found to be higher than other prefectures (e.g. almost two-thirds (63.1%) of respondents residing in central Tokyo had graduated university, compared to less than half (48.3%) of respondents residing in other prefectures). Previous research has shown internet using MSM to be highly educated in Southeast Asia (27), and in a meta-analysis (26) of 8 studies of MSM using gay mobile apps (10,15,16,19–22,28), university graduates ranged from 68-89% of respondents, with an unweighted average of 84.5%. The studies were recorded in the US and China (16), both of which have lower university graduation rates than Japan. One of the reasons cited for the link between education and gay mobile app use is that smartphones are expensive and because education levels are associated with higher incomes, users tend to be more educated. In Japan,

as phone contracts included free smartphones (including apple *iphones*), it is possible that smartphone use is more diverse and less impacted by socio-economic status than in the West and China. The results of this study are also more recent than comparative research, which ranges from 2012 – 2015, and smartphone use has been growing exponentially, reaching more MSM in 2016 than just 'early adopters' (20). Although further studies are needed, particularly utilizing the geo-location features to attain a probability sample, it is possible that Japanese gay mobile app users have more diverse socio-economic backgrounds, and potentially a larger variety and proportion of Japanese MSM use gay mobile apps than in the West. Although there is no comparative health data for gay mobile app using MSM, the population was very healthy, with less than one tenth (7.9%) rating their health as poor compared to 14.2% in the general male population in 2010 (Japanese General Social Survey, 2010). Higher education and youth are strongly correlated with self-rated health (29), and because survey respondents were young and well educated, this may have influenced the results.

As with prior studies in Southeast Asia and Japan (8,30,31), levels of coming out were low, with almost two thirds of respondents (59.0%) out to close friends, and only a quarter out to family (27.3%) and classmates or colleagues (22.5%), and less than a tenth (8.8%) out to all friends. Results were comparable and slightly higher than the gay mobile app data from Okinawa, perhaps due to higher gay community attachment rates in Tokyo and gay identification. Results were also higher than a 2005 internet survey (30), in which only 12% had come out to parents, and 51% to a friend. Coming out in Japan possibly remains low due to invisibility (32), as only 5% of the general population knew a colleague or friend who was LGBT, homophobia, with 37.2% of MSM having experienced being called 'homo' or 'faggot' in school (30), and fear of shaming one's family as a result of coming out (33).

4.4.3 Motivations for Gay Mobile App Use

Although gay apps such as 9Monster are assumed to be 'sex apps', over three-quarters of respondents used it in order to make new friends compared to two-thirds who used it to find sex. Previous research on Grindr similarly found that less than 30% of respondents listed 'hooking up' as their main reason for using gay mobile apps, but rather used it for facilitating new MSM connections in their surroundings. Furthermore, YMSM Grindr users used dating sites more for finding sex, Grindr for finding new MSM connections, and Facebook for maintaining connections (28). Although previous research has shown that MSM who use gay mobile apps and conceal their sexuality from the general population more commonly use gay mobile apps and avoid gay venues (34) , less than one-tenth of MSM used gay mobile apps to hide their sexuality. This was possibly related to the high level of homosexual identity (85.1%), much higher than a previous online study of Japanese MSM (30) in which one-third of respondents identified as bisexual or unsure/unknown. Furthermore, as with previous research (11), because almost twice as many respondents used gay mobile apps (61.4%) rather than gay venues in order to find sex partners (24.1%), it is clear that prevention efforts on mobile apps are increasingly important in order to reach MSM engaging in sexual behaviors.

4.4.4 Mental Health

Suicidal ideation has been found to lead to suicide attempts (35–37). Suicide is a significant issue in Japan, the fifth largest cause of death for the general population, and the leading cause of death among Japanese aged 15 – 24 (38). Suicide among MSM in Japan is an under researched topic (4,30), and MSM in Asia have been estimated to have 2.9 times the risk for suicidal ideation than the general population (39). Furthermore, suicidal ideation was observed associated to HIV risk-taking among MSM (40), and PLWHA were observed with high levels of suicidal ideation in China (41).

Almost one third (31%) of survey participants reported experiencing suicidal ideation in the past two weeks, answers of which were associated with a 75%, 115%, and 185% increased risk of suicide in the US (42). Although there is no direct comparison possible due to limited data in Japan, an internet study of MSM in Japan found that 15% had attempted suicide (4,30,43). In a 2017 meta-analysis of lifetime suicide ideation among MSM conducted by Lou et. al, the reported prevalence ranged from 13.2 to 55.8%, and pooled lifetime prevalence was 34.97% (95% CI: 28.35%–41.90%). Subgroup analyses showed that the lifetime prevalence of suicidal ideation among MSM differed significantly by geographic area, sample source and HIV status. Future research could examine if suicidal ideation varies with sample source (e.g. gay mobile app using MSM vary from venue based MSM or internet using MSM), as well as measure lifetime suicidal ideation so as to create a comparable measure with other countries worldwide, as well as recent suicidal ideation. Further mental health research among MSM in Japan is warranted, particularly in rural areas.

4.5 Results Implications

Internet based interventions have been found to engage non-community attached MSM who may not attend gay venues, but who continue to engage in high-risk sexual activities (44). Two-thirds of the Japanese MSM population are estimated to not attend gay venues (1) and almost half of gay mobile app users in this survey had never even attended a gay bar. As this research shows, MSM gay mobile app users are young, and MSM between 20 – 40 years-old are most at risk for acquiring HIV in Japan (2). Previous research has shown significantly higher HIV testing levels after HIV testing promotion than before using mobile app HIV testing promotions (45) and HIV testing SMS reminders (46). Almost one-third (31%) of respondents reported suicidal ideation in the past two weeks. Mental distress has been linked to HIV risk behaviors (47), and implies the need for not only HIV prevention campaigns, but also mental health campaigns for MSM on gay mobile apps. Mobile apps could also add a

'mental health' category where hotlines and mental health information is displayed. Moreover, Japanese school education does not adequately approach sex-education or LGBT education, and both could be taught in public schools in order to counter stigma and increase testing among self-identifying MSM youth who have been found to have particularly high suicide ideation in Japan (11). Finally, the large install base and frequency with which respondents use gay mobile apps may make them more effective for promoting HIV testing and mental health material than creating new apps which MSM may not download or use.

4.6 Future research

Future research could investigate gay mobile app use in other regions of Japan. Being able to compare population profiles and app use in different regions could enable prevention strategies to be tailored to specific populations. For example, if it became apparent through future research that in Hokkaido there was much higher *hattenba* attendance among MSM, resources could be intensified in those locations. Future research could also be undertaken at gay venues, enabling population and sexual risk behavior and HIV testing comparisons between Japanese gay mobile app users and non-users. Previous research has found different gay mobile apps to have different user-bases, and future research could compare sexual risk behaviors and user attributes from different mobile apps. If certain apps were found to be associated with lower HIV testing or CLAI, advertising could be tailored appropriately for each app base, advertising designed to appeal to individual app demographics. High levels of suicidal ideation could be researched more fully, and compared with the general population. If findings are corroborated, mental health counseling and suicide hotlines could be advertised on gay mobile apps. Little is known about the one-tenth (8.9%) of MSM who have sex with both men and women. This population is particularly important for predicting HIV levels among women in the future as it acts as a bridge to the heterosexual population (48). This population has been found to have lower lifetime HIV testing in previous research

(49). Future research could focus on CLAI and HIV testing among MSM with both male and female partners as a key to understanding HIV risks for the female heterosexual population in Japan.

4.7 Limitations

The findings of this research were subject to a variety of limitations that must be taken into account when assessing the results. 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 app users in Greater Tokyo as a whole from this data as it is not a representative sample. Furthermore, the behaviors and attitudes reported were self-rated and may have been subject to social desirability bias where participants may downplay certain behaviors they believe to be undesirable (Kelly 2013). However, because the survey was anonymous and online this effect was minimized.

This was also a cross-sectional study of Greater Tokyo and user app behaviors and even user base may vary depending on the season (for example, April brings more tourists into Tokyo than other months). To overcome this issue, future longitudinal studies, and use of an online-respondent-driven survey method (ORDS) is recommended in order to create a statistically significant population profile. Due to limited resources, this research only used specific gay mobile applications. Other gay mobile apps have been found to be associated with different MSM populations, and may contain different MSM populations worthy of future research.

4.8 Conclusion

This research showed that although it was not successful with limited resources to attempt a probability sample through an online adapted time-space-sampling survey methodology to examine gay mobile apps in Japan, it was possible to attract a wide demographic of MSM gay mobile app users in Greater Tokyo relatively quickly and easily using convenience sampling through gay mobile app splash screen advertising. Similar to previous findings, respondent socio-demographic characteristics were young, single, and well-educated. Furthermore, more users utilize gay mobile apps in order to make friends than sex partners, showing that similar to Grindr in the US (19) gay mobile apps are not simply 'hook-up' apps in Japan. Although respondents had high self-rated health, the study found a high prevalence of suicidal thoughts, indicating a high degree of psychological distress that needs to be attended to for this population. 9Monster and other Japanese MSM application providers have shown willingness to give discounted advertising prices and work together with MSM research. Previous research has shown significantly higher HIV testing levels after using mobile app HIV testing promotions (Rhodes, 2016). Given the large Japanese MSM user-base, limited funding available to MSM HIV prevention in Japan, and the ineffectiveness of gay community venue-based prevention strategies considering the large non-venue attending population, utilizing these applications to promote HIV testing and mental health counseling may be an effective policy to increase MSM testing and counseling uptake.

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Authors	Adam O Hill, Benjamin R Bavinton, Gregory Armstrong
Student's contribution (%)	85%
Journal or book name	PLOS ONE
Volume/page numbers	14
Status	☐ Accepted and In-press ■ Published ☐ In progress — Date accepted/published: 23/01/19

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5. Prevalence and correlates of lifetime and recent HIV testing among men who have sex with men (MSM) who use mobile geo-social networking applications in Greater Tokyo

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Short title: HIV testing among men who have sex with men mobile app users in Tokyo

Key words: men who have sex with men, HIV testing, gay mobile apps, HIV Prevention, Japan

Abstract

Men who have sex with men (MSM) are disproportionately burdened by the human immunodeficiency virus (HIV), accounting for 78% of all Japanese male HIV cases in 2016. Over 30% of newly identified HIV infections in Japan are diagnosed as AIDS annually, suggesting a large proportion of people living with HIV were unaware of their own infection status. An estimated two-thirds of Japanese men who have sex with men (MSM) are not attached to the gay community, and previous studies have largely sampled gay venues, thus, previous studies have likely failed to reach many men in this population. This study therefore examined HIV testing prevalence and correlates among MSM in Greater Tokyo who use gay mobile geo-social networking applications (gay mobile apps), which have been found to increase access to MSM not traditionally accessible through venue-based surveys. Among a sample of 1657 MSM recruited through advertisements on gay mobile apps, the prevalence of lifetime and six-monthly HIV testing was 72.8% and 29.7% respectively. In multiple regression analysis, higher lifetime HIV testing was associated with older age, education, HIV knowledge, anal intercourse with regular and casual male partners, and gay venue attendance. Testing was negatively associated with regular male partner condom use, marriage, residing outside central Tokyo and having both male and female partners. These results indicated that MSM who use gay mobile apps in Greater Tokyo do not meet the CDC yearly testing recommendations for high risk populations. Considering limited HIV prevention funding in Japan for MSM, moderate lifetime and recent testing, and the large number of gay mobile app users, utilization of popular gay mobile apps to promote nearby HIV testing facilities may be an effective prevention policy to target non-community attached MSM, particularly at-risk youth and individuals at risk of sudden-onset AIDS.

5.1 Introduction

HIV testing is an essential component of HIV prevention. HIV testing has positive effects for both HIV prevention and care, and it is well documented that people who learn they are HIV-positive take preventive action to reduce the risk of transmission to others (1), and testing is associated with a 68% efficacy for lowering condomless anal intercourse (CLAI) in meta-analysis (2). Testing is central to the UNAIDS 90-90-90 Targets, with the first of the goals being to diagnose 90% of all HIV-positive individuals by 2020 (3). Moreover, testing is an essential prerequisite for effective treatment as prevention (TasP) strategies, in which all HIV-positive people are treated with anti-retroviral therapy (ART) to stop onward infection to future sexual partners (4,5), and has been found highly effective at preventing HIV transmission in serodiscordant couples in both heterosexual (4) and more recently, homosexual couples (6,7). Frequent testing also reduces the likelihood of late diagnosis and the number of acquired immunodeficiency virus (AIDS) diagnoses.

Men who have sex with men (MSM) are estimated to make up between 4.0 to 4.6% of the male population (8,9) in Japan, but are disproportionately burdened by the human immunodeficiency virus (HIV) (10), accounting for 78% of all Japanese male HIV cases, though this is likely to be higher due to underreporting of MSM transmission (11). Although AIDS has become infrequent among MSM in Western developed nations such the UK (12), it remains a substantial health burden for MSM in Japan where over 30% of newly diagnosed HIV cases were reported as AIDS in 2016 (1,011 HIV and 437 AIDS) (13). Moreover, this figure is likely to be underreported as some small healthcare centers, where approximately 40% of Japanese HIV tests take place, do not differentiate between HIV and AIDS and report all cases as HIV (14). Furthermore, the volume of HIV tests in Japan has reduced by 35% from their peak of 177,000 in 2008 to 118,000 in 2016 due to fewer advertising campaigns and redirection of resources from HIV prevention to AIDS care, and the subsequent closure of free

testing centres (15). Considering the network of health services providing free testing and access to treatment in Greater Tokyo, HIV testing is still infrequent compared to other countries with similar services. From 2011 to 2014, one third (32%) of patients newly diagnosed with HIV went for voluntary testing; over half (53%) were reported due to presence of other diseases, unchanged from 2000 to 2004 (16).

Previous studies among Japanese MSM have focused on the gay community-attached MSM population using traditional venue-based sampling techniques. However, an estimated two-thirds of Japanese MSM are not attached to the gay community (17), thus, previous studies have likely failed to reach many men in this population. Because gay geo-social networking applications, henceforth referred to as gay mobile apps, have users who are both attached and non-community-attached, they have been found to increase access to MSM not traditionally accessible through venue-based surveys (18–22). Gay mobile apps enable users to use global positioning systems (GPS) in mobile phones to search through a grid of nearby users based on their proximity, and to contact and meet nearby users, enabling MSM to encounter each other more quickly and easily (22,23). Gay mobile apps have very quickly become one of the most popular ways to arrange sex among MSM globally (24) and in Japan (25). Although Grindr is currently the most popular gay mobile application in the world with almost 3 million active daily users (26), Japanese application use varies significantly from the West. In 2017, the most used application was 9Monster, with 300,000 Japanese users as of April 2017 (27). While gay internet use has been extensively researched (28), there is a distinct lack of research about MSM who use gay mobile apps outside the US, Australia, and China (29). Existing research has shown gay mobile app users to have higher numbers of sexual partners (18,30), and higher rates of HIV testing (18,29) than non-app using MSM.

This research therefore utilizes a gay mobile app based cross-sectional survey to investigate the frequency and psychosocial correlates of lifetime and recent HIV testing and

future testing intention among gay mobile app using MSM. Understanding testing rates and testing intention among this hard-to-reach population of gay mobile app using MSM improves our understanding of different MSM subgroups, and in doing so enables us to better profile the Japanese HIV epidemic and potentially tailor prevention strategies for different MSM populations.

5.2 Materials and methods

5.2.1 Recruitment

Subjects were recruited using the geo-location feature of gay mobile apps, similar to methods previously used to recruit Grindr users in the US (22,31). Popular gay mobile apps were used (e.g. jack'd, Hornet, Grindr, 9Monster) that were used in a previous similar study recruiting MSM in Japan (32), and were recommended during piloting in order to gain access to the most MSM. Gay mobile apps use geo-location to sort users by proximity, with the users closest to the researcher displayed at the top of a grid of photos with 3-4 photos per row. The researcher was positioned in Tokyo centrally, launched the most popular in Japan and randomly selected one user from each row until 50 previously uncontacted users were messaged with a link to the survey each day. Recruitment messages consisting of a greeting and short message regarding the purpose of the survey and link were sent to gay mobile app users. Messages were logged by the app chat functions, hence previously messaged users were recorded and not messaged again. The survey was conducted between November 22nd 2015 to January 16^{th,} 2016, recruiting 215 valid respondents. Slow recruitment due to frequent social networking services (SNS) scamming in Japan (33), in which users are often messaged by fake accounts attempting to steal personal information, and subsequent potential recruitment bias in which many respondents would not reply, led to a change in recruitment strategy. Because an advertisement must be screened by app companies prior to its promotion in-app, this was deemed more

trustworthy to potentially recruit more participants. A splash screen poster (a full-screen advertisement that appears when the user opens the app) encouraging application users to respond to the linked survey was placed on 9Monster, the most popular Japanese gay mobile app (27), for one week from January 17th to January 23rd, 2017 to supplement response numbers. This methodology was used previously with success in the US (19,21). 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. All survey participants were notified they could win prizes of up to 80 USD by random lottery, as well as receive a survey results report. In total, 1335 (80.6%) of participants applied for the lottery incentive and 964 (58.2%) applied for the survey results.

Only respondents of 18 years or older, who self-reported as MSM (defined as identifying as 'gay' or 'bisexual', or having sexual experience with other men), and who provided online consent to participate in the survey were included in results. Ethics approval was granted by the University of Melbourne Human Research Ethics Committee, ID: 1646197. This research project was reviewed and approved by the Ministry of Foreign Affairs and the University of the Ryukyus in Japan to obtain the necessary visa approvals in order to undertake this study as a foreign researcher. The survey was an anonymous self-administered online questionnaire. Duplicate IP addresses were checked, and responses that did not sufficiently complete the questionnaire were removed. Participation was voluntary and there were no consequences for electing not to participate. All participants were provided with the details for local MSM helplines at the conclusion of the survey. The survey was translated into Japanese and back-translated into English by an independent Japanese native translator.

5.2.2 Study measures

Socio-demographic characteristics of participants was determined by 12 items previously used in Japan (34), including age, gender, sexual orientation, marital status, birthplace, current residence, length of residence in Greater Tokyo, self-rated health, education, occupation, work hours, and intercourse partner sex. 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'. 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 (defined as participation in a gay political or social meeting, community event such as a parade, party, fair, or volunteer activity), and identity as a gay community member. Respondents were asked three questions regarding HIV testing: ever having had an HIV test, having had an HIV test in the previous six months, and intention to get tested in the future (all with 'yes' or 'no' response options). 'Recent testing' was defined as testing within the previous six months. Respondents were asked frequency of lifetime condom use during penetrative or receptive anal intercourse with regular partners (defined as a boyfriend or committed romantic relationship), casual male partners (defined as a sex friend, 'fuck buddy', or any self-defined non-committed sexual relationship with a male partner), and sex with female partners. Lifetime condom use frequency was recorded as 'never', 'rarely', 'most of the time', and 'always'. Following previous studies, low condom use was defined as 'never use condoms' or 'rarely use condoms', while high condom use was defined as 'always use condoms' and 'use condoms most of the time' (35). Lifetime condom use analyses excluded those who did not have intercourse with each respective partner type.

5.2.3 Statistical analysis

Data were analyzed using SPSS version 24. Descriptive statistics were used to describe all variables. We used multivariate binary regression analysis to examine the correlates of lifetime

and recent HIV testing as well as future HIV testing intentions. The enter method was used and variables with unadjusted odds ratios yielding p-values of 0.05 or less were considered eligible for the multivariate model. Unadjusted and adjusted odds ratios with their respective 95% confidence intervals and p-values are reported in the tables.

5.3 Results

5.3.1 Socio-demographic characteristics

The socio-demographic characteristics of the sample are displayed in Table 10. Over half (53.4%) resided in the 23 wards of central Tokyo, and almost all (96.3%) respondents were born in Japan. The mean age was 35 and the vast majority were single (95.6%). They were well educated, with 58.1% completing university or a postgraduate degree. Nearly three-quarters (73.9%) were employed fulltime, and 4.2% were unemployed. There was high gay (85.1%) and bisexual (14.1%) identification, while 8.9% had both male and female sex partners. Just over half of participants had ever attended a gay bar (56.8%), just under half (47.6%) had ever attended a *hattenba* (gay bathhouse), and one-tenth (13.2%) participated in a gay group activity in the past six months.

Table 10: Socio-demographic characteristics

		n	%
Current residence	Tokyo	883	53.4
	Greater Tokyo	553	33.4
	Another prefecture	209	12.6
	Another country	8	0.5
	Total	1653	100.0
Birthplace	Japan	1593	96.3
	Other	62	3.7
	Total	1655	100.0
Age	18 - 25	319	19.4

	26 - 35	550	33.4
	36 - 45	507	30.8
	46+	270	16.4
	Total	1646	100.0
Gender	Male	1641	99.2
	Other	14	0.8
	Total	1655	100.0
Marital status	No	1582	95.6
	Yes	72	4.4
	Total	1654	100.0
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	100.0
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	100.0
Intercourse partner sex	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	Healthy	1056	63.9
	Fair or poor health	598	36.1
	Total	1654	100

5.3.2 HIV prevention characteristics

Table 11 shows levels of HIV testing, lifetime condom use, and information sources. Almost three-quarters of respondents (72.8%) ever tested for HIV. Less than one-third (29.7%) had been tested in the past six months. However, the vast majority of the sample (88.2%) reported that they intended to obtain a test in the future. About one-third of those engaging in lifetime condomless anal intercourse (CLAI) with regular (31.5%) and casual (30.7%) male partners, and one-quarter engaging in condomless sex with female partners (23.6%), had been tested within the past six months. Among participants who had been tested for HIV in their lifetimes, over two-thirds (69.4%) engaged in CLAI with regular male partners, 54.1% engaged in CLAI with casual male partners, and 42.9% had condomless sex with female partners. Similarly, MSM who had never been tested for HIV engaged in risk-taking sexual behaviors: among participants who had never been tested, almost two-thirds (65.5%) engaged in CLAI with regular male partners, over half (54.8%) engaged in CLAI with casual male partners, and 44.4% had condomless sex with female partners. One-fifth (20%) of those never tested had no intention of undertaking future HIV testing. MSM aged 18-25 years had the lowest lifetime HIV testing (50%) and lowest rate of HIV testing in the past six-months (24.7%).

Table 11: HIV prevention characteristics

		n	%
Have you ever been tested for HIV?	No	448	27.2
	Yes	1199	72.8
	Total	1647	100

Have you been tested for HIV in the last six months?	No	1148	70.3
	Yes	484	29.7
	Total	1632	100
Are you planning on getting tested for HIV in the future?	No	194	11.8
	Yes	1447	88.2
	Total	1641	100
How often do you use a condom with a regular (penetrative and receptive anal sex) male partner?[a]	No anal sex with regular male partner	246	14.9
	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 with casual (penetrative and receptive anal sex) male partners?[b]	No anal sex with casual male partner	318	19.3
	Never	35	2.6
	Rarely	197	14.8
	Most of the time	490	36.8
	Always	609	45.8
	Total	1331	100
How often do you use a condom with female (penetrative and anal sex) partners?[c]	No sex with female partner	1358	82.6
	Never	29	10.1
	Rarely	28	9.8
	Most of the time	68	23.8
	Always	161	56.3
	Total	286	100
Whose advice about practicing safe sex would you be most likely to follow?	Doctor	630	38.3
	Regular sex partner	159	9.7
	Non-regular sex partner	20	1.2
	Internet resource	273	16.6
	Government agency	136	8.3
	LGBT Community Centre	418	25.4

	Friend	9	0.5
	Other	2	0.1
	Total	1647	100
HIV /AIDS information sources	School education	370	22.3
	Hospital pamphlet	329	19.9
	Gay internet resource	1441	87.0
	Government internet resource	255	15.4
	Friend	435	26.3
	Gay bar	316	19.1
	Television/newspaper	366	22.1
	Gay magazine	570	34.4
	Family	13	0.8
	Sex Partner	118	7.1
	Total	1656	100

[a] analysis based on a subsample of 1404 people who have anal sex with a regular partner

[b] analysis based on a subsample of 1331 people who have anal sex with a casual partner

[c] analysis based on a subsample of 286 people who have sex with women

Gay internet resources were by far the leading source of HIV information, providing 87% of respondents with HIV/AIDS information. School education provided less than a quarter (22.3%) of respondents with HIV/AIDS information. Younger respondents were more likely to have been provided HIV/AIDS information at school, and half of respondents (49.5%) under 25, were provided with HIV/AIDS information in their school education compared to around a quarter (28.5%) of respondents aged 26 – 35, and less than 10% of respondents aged over 36. Despite gay internet resources providing the most HIV/AIDS information, respondents were most likely to follow a doctors' advice about practicing safe sex (38.3%), followed by LGBT community centers (25.4%), compared to16.6% for gay internet resources. There was low trust in government agencies; less than one-tenth (8.3%) of respondents would follow a Japanese government agency's advice about safe sex.

5.3.3 Correlates of lifetime HIV testing

The prevalence of lifetime HIV testing and binary logistic regression models examining the correlates of lifetime HIV testing are presented in Table 12. There were 17 variables in the univariate regression with significant p-values of under 0.05. The final multivariate logistic regression model showed that the odds of having ever been tested for HIV were higher among MSM who were older, educated, HIV knowledgeable, out to close friends, who had ever attended a gay bar or event, *hattenba,* or participated in gay community activities in the past six-months, and had sex with regular or casual male partners. Lifetime HIV testing odds were lower among participants who: were students; were self-employed; were married; were residing outside of Greater Tokyo; were using gay mobile apps in order to avoid being identified as gay; also had female sex partners; and, who reported high condom use with regular male partners.

Table 12: Multivariate logistic regression for lifetime HIV testing

	Number of respondents (n)	% Reporting Lifetime HIV Testing	Unadjusted Odds Ratio (95% C.I.)	p-Value	Adjusted Odds Ratio (95% C.I.)	p-Value
Age (years)						
18 – 25	316	52.2	REF			
26 – 35	550	74.0	1.60 (1.39 - 1.85)	0.000	1.37 (1.14 - 1.64)	0.001
36 – 45	506	80.4	1.55 (1.40 - 1.72)	0.000	1.43 (1.25 - 1.64)	0.000
46+	266	80.5	1.39 (1.26 - 1.52)	0.000	1.36 (1.21 - 1.54)	0.000
Place of Birth						
Japan	1584	72.8	0.99 (0.56 - 0.17)	0.969		
Other	62	72.6	REF			
Education						
High School or less	416	64.7	REF			
2 year university	272	72.8	1.10 (1.01 - 1.20)	0.026	1.02 (0.93 - 1.12)	0.724
University	799	75.3	1.67 (1.29 - 2.16)	0.000	1.44 (1.06 - 1.95)	0.020
Graduate degree	160	81.3	2.37 (1.52 - 3.7)	0.000	2.00 (1.20 - 3.33)	0.008

Employment						
Full-time work	1131	76.7	REF			
Part-time work	183	68.3	0.66 (0.47 - 0.92)	0.015	0.76 (0.51 - 1.13)	0.178
Student	167	50.3	0.31 (0.22 - 0.43)	0.000	0.63 (0.40 - 1.00)	0.048
Self-employed	96	69.8	0.70 (0.44 - 1.11)	0.129	0.52 (0.32 - 0.86)	0.010
Unemployed	68	79.4	1.17 (0.64 - 2.14)	0.607	1.29 (0.65 - 2.56)	0.468
Current marital status						
Single	1574	73.3	REF			
Married	72	61.1	0.57 (0.35 - 0.93)	0.024	0.51 (0.29 - 0.92)	0.025
Current residence						
Central Tokyo	880	76.9	REF			
Greater Tokyo	549	69.0	0.67 (0.52 - 0.85)	0.001	0.87 (0.67 - 1.14)	0.323
Other prefecture	207	63.8	0.53 (0.38 - 0.73)	0.000	0.67 (0.47 - 0.97)	0.034
Intercourse partners						
Only men	1480	75.1	REF			
Both men and women	146	56.2	0.43 (0.30 - 0.61)	0.000	0.90 (0.54 - 1.49)	0.688
Health						
Healthy	1052	72.1	0.89 (0.71 - 1.12)	0.311		
Fair/poor health	593	74.4	REF			
Out to close friends						
No	667	66.6	REF			
Yes	961	77.1	1.69 (1.36 - 2.11)	0.000	1.57 (1.21 - 2.03)	0.001
Identify as a member of the gay community						
No	1360	74.3	REF			
Yes	276	65.2	1.54 (1.17 - 2.03)	0.002	1.14 (0.83 - 1.56)	0.419
Use gay mobile apps for sex						
No	634	68.9	REF			
Yes	1006	75.3	1.38 (1.11 - 1.72)	0.004	1.05 (0.8 - 1.37)	0.729
Use gay mobile apps to find friends						
No	400	74.0	REF			
Yes	1232	72.6	0.93 (0.72 - 1.21)	0.596		
Use gay mobile apps to avoid being identified as gay						
No	1493	73.7	REF			

Yes	131	60.3	0.54 (0.37 - 0.78)	0.001	0.65 (0.43 - 1.00)	0.048
Use gay mobile apps to find a serious relationship						
No	763	74.8	REF			
Yes	866	71.1	0.83 (0.67 - 1.03)	0.094		
Ever attended A gay bar						
No	710	61.3	REF			
Yes	931	81.8	2.85 (2.28 - 3.57)	0.000	1.58 (1.21 - 2.05)	0.001
Recent participation in gay group/community or volunteer activities						
No	1425	70.9	REF			
Yes	218	85.3	2.38 (1.61 - 3.52)	0.000	1.59 (1.02 - 2.47)	0.040
Hattenba attendance						
No	858	64.9	REF			
Yes	783	81.5	2.38 (1.89 - 2.99)	0.000	1.53 (1.17 - 1.99)	0.002
HIV Knowledge: Having other STIs doesn't increase chance of infection						
Correct	1505	74.0	REF			
Incorrect	130	58.5	2.02 (1.40 - 2.92)	0.000	1.60 (1.04 - 2.45)	0.033
Anal sex with regular male partners						
No	244	57.4	REF			
Yes	1399	75.6	2.31 (1.74 - 3.05)	0.000	2.00 (1.39 - 2.86)	0.000
Anal sex with casual male partners						
No	317	57.0	REF			
Yes	1325	76.5	2.37 (1.84 - 3.06)	0.000	1.51 (1.08 - 2.13)	0.016
Sex with female partners						
No	1352	75.7	REF			
Yes	285	58.9	0.46 (0.35 - 0.60)	0.000	0.66 (0.45 - 0.99)	0.042
Condom use with regular male partners[a]						
Low	516	79.3	REF			
High	883	73.4	0.72 (0.56 - 0.94)	0.014	0.72 (0.54 - 0.96)	0.026
Condom use with casual male partners[b]						
Low	231	75.8	REF			
High	1094	76.6	1.05 (0.75 - 1.46)			
Condom use with female partners[c]						

Low	56	55.4	REF
High	229	59.8	1.20 (0.67 - 2.17)

[a]analysis based on a subsample of 1404 respondents who have anal sex with a regular partner

[b]analysis based on a subsample of 1331 respondents who have anal sex with a casual partner

[c]analysis based on a subsample of 286 respondents who have sex with women

[abc]Low condom use = never/rarely use a condom; High condom use = most of the time/always use a condom

5.3.4 Correlates of recent HIV testing

The prevalence and univariate and multivariate logistic regression models examining the correlates of HIV testing in the past six-months are presented in Table 13. The final multivariate logistic regression model showed recent HIV testing odds were higher among MSM who attended *hattenba* (AOR, 1.30; 95% CI, 1.03 - 1.65), and who have a regular male partner (AOR, 1.85; 95% CI, 1.25 - 2.72).

Table 13: Multivariate logistic regression for recent HIV testing

	Number of respondents (n)	% Reporting Recent HIV Testing	Unadjusted Odds Ratio (95% C.I.)	p-Value	Adjusted Odds Ratio (95% C.I.)	p-Value
Age (years)						
18 – 25	316	24.7	REF			
26 – 35	545	33.0	1.24 (1.06 - 1.45)	0.007	1.15 (0.96 - 1.39)	0.137
36 – 45	498	30.9	1.12 (1.01 - 1.24)	0.040	1.07 (0.94 - 1.22)	0.296
46+	264	26.9	1.04 (0.94 - 1.14)	0.474	1.00 (0.89 - 1.12)	0.979
Place of Birth						
Japan	1570	29.3	0.66 (0.39 - 1.11)	0.114		
Other	61	39.3	REF			
Education						
High School or less	415	26.7	REF			
2 year university	269	25.3	0.98 (0.90 - 1.07)	0.670	0.96 (0.87 - 1.05)	0.340
University	790	31.4	1.25 (0.96 - 1.63)	0.094	1.13 (0.85 - 1.51)	0.395
Graduate degree	158	36.1	1.55 (1.05 - 2.29)	0.029	1.40 (0.92 - 2.12)	0.120
Employment						
Full-time work	1115	31.3	REF			
Part-time work	182	28.0	0.85 (0.60 - 1.20)	0.358	0.87 (0.60 - 1.28)	0.484
Student	168	24.4	0.71 (0.49 - 1.02)	0.066	0.91 (0.57 - 1.45)	0.700

Self-employed	97	21.6	0.60 (0.37 - 0.99)	0.047	0.61 (0.36 - 1.02)	0.059
Unemployed	68	29.4	0.91 (0.53 - 1.56)	0.728	1.02 (0.58 - 1.79)	0.943
Current marital status						
Single	1560	29.7	REF			
Married	71	29.6	1.00 (0.59 - 1.68)	0.985		
Current residence						
Central Tokyo	871	32.5	REF			
Greater Tokyo	544	27.8	0.80 (0.63 - 1.01)	0.060	0.94 (0.73 - 1.20)	0.605
Other prefecture	206	22.3	0.60 (0.42 - 0.85)	0.005	0.69 (0.48 - 1.01)	0.056
Intercourse partners						
Only men	1468	31.0	REF			
Both men and women	143	19.6	0.55 (0.36 - 0.84)	0.005	0.68 (0.39 - 1.17)	0.165
Health						
Healthy	1045	29.8	1.01 (0.81 - 1.26)	0.936		
Fair/poor health	585	29.6	REF			
Out to close friends						
No	662	25.8	REF			
Yes	951	32.2	1.36 (1.09 - 1.70)	0.006	1.21 (0.95 - 1.53)	0.119
Identify as a member of the gay community						
No	274	25.9	REF			
Yes	1347	30.3	1.24 (0.93 - 1.67)	0.148		
Use gay apps for sex						
No	627	25.8	REF			
Yes	998	32.2	1.36 (1.09 - 1.70)	0.007	1.18 (0.92 - 1.50)	0.188
Use gay apps to find friends						
No	398	27.9	REF			
Yes	1219	30.3	1.12 (0.87 - 1.44)	0.367		
Use gay apps to avoid being identified as gay						
No	1497	30.1	REF			
Yes	130	26.2	0.82 (0.55 - 1.24)	0.348		
Use gay apps to find a serious relationship						
No	760	28.7	REF			
Yes	854	30.7	1.10 (0.89 - 1.36)	0.382		

Ever attended A gay bar						
No	704	24.6	REF			
Yes	922	33.6	1.56 (1.25 - 1.94)	0.000	1.19 (0.93 - 1.52)	0.174
Recent participation in gay group/community or volunteer activities						
No	1412	28.4	REF			
Yes	216	37.5	1.51 (1.12 - 2.04)	0.007	1.25 (0.90 - 1.72)	0.179
Hattenba attendance						
No	852	25.5	REF			
Yes	774	34.2	1.52 (1.23 - 1.89)	0.000	1.30 (1.03 - 1.65)	0.030
HIV Knowledge: Having other STIs doesn't increase chance of infection						
Correct	1493	30.2	REF			
Incorrect	128	23.4	1.41 (0.93 - 2.16)	0.109		
Anal sex with regular male partners						
No	242	17.8	REF			
Yes	1387	31.7	2.12 (1.50 - 3.00)	0.000	1.85 (1.25 - 2.72)	0.002
Anal sex with casual male partners						
No	313	21.4	REF			
Yes	1315	31.6	1.69 (1.27 - 2.27)	0.000	1.02 (0.72 - 1.45)	0.890
Vaginal sex with female partners						
No	1341	30.9	REF			
Yes	281	23.1	0.70 (0.50 - 0.90)	0.009	0.90 (0.60 - 1.33)	0.583
Condom use with regular male partners[a]						
Low	514	31.1	REF			
High	873	32.1	1.05 (0.83 - 1.32)	0.715		
Condom use with casual male partners[b]						
Low	227	30.8	REF			
High	1088	31.8	1.05 (0.77 - 1.43)	0.776		
Condom use with female partners[c]						
Low	56	21.4	REF			
High	225	23.6	1.13 (0.56 - 2.30)	0.736		

[a]analysis based on a subsample of 1387 respondents who have anal sex with a regular partner

[b]analysis based on a subsample of 1315 respondents who have anal sex with a casual partner

[c]analysis based on a subsample of 281 respondents who have sex with women

[abc]Low condom use = never/rarely use a condom; High condom use = most of the time/always use a condom

5.3.5 Correlates of future HIV testing intent

The prevalence and univariate and multivariate logistic regression models examining the correlates of future HIV testing intent are presented in Table 14. The final multivariate logistic regression model showed future HIV testing intention odds were higher among MSM who attend gay bars (AOR, 1.47; 95% CI, 1.06 – 2.05), use gay mobile apps to find friends (AOR 1.58; 95% CI, 1.12 – 2.22), are healthy (AOR 1.46; 95% CI, 1.06 – 2.03), have a regular sex partner (AOR, 2.01; 95% CI, 1.31 – 3.10), and who engage in high condom use with casual male partners (AOR, 2.09; 95% CI, 1.38 – 3.18). Lower odds of intention of future HIV testing was associated with respondents who were married (AOR, 0.45; 95% CI, 0.24 – 0.85), and attended hattenba (AOR, 0.64; 95% CI, 0.46 – 0.90).

Table 14: Multivariate logistic regression for future HIV testing intent

	Number of respondents (n)	% Reporting Future HIV Testing Intent	Unadjusted Odds Ratio (95% C.I.)	p-Value	Adjusted Odds Ratio (95% C.I.)	p-Value
Age (years)						
18 – 25	318	90.6	REF			
26 – 35	546	90.1	0.98 (0.77 - 1.23)	0.843	1.06 (0.80 - 1.40)	0.682
36 – 45	503	87.3	0.90 (0.77 - 1.04)	0.153	0.97 (0.81 - 1.17)	0.770
46+	265	83.0	0.85 (0.75 - 0.96)	0.007	0.93 (0.80 - 1.08)	0.327
Place of Birth						
Japan	1579	88.0	0.65 (0.256 - 1.63)	0.354		
Other	61	91.8	REF			
Education						
High School or less	418	86.1	REF			
2 year university	270	87.4	1.03 (0.92 - 1.15)	0.629	1.04 (0.92 - 1.18)	0.495
University	793	88.5	1.24 (0.87 - 1.77)	0.227	1.21 (0.82 - 1.79)	0.341
Graduate degree	160	93.1	2.18 (1.11 - 4.27)	0.023	2.01 (1.00 - 4.07)	0.051
Employment						

Full-time work	1122	88.1	REF			
Part-time work	185	85.4	0.79 (0.50 - 1.23)	0.289	0.94 (0.57 - 1.55)	0.797
Student	167	94.0	2.11 (1.08 - 4.10)	0.028	1.78 (0.81 - 3.92)	0.152
Self-employed	97	84.5	0.73 (0.41 - 1.31)	0.295	0.77 (0.42 - 1.41)	0.393
Unemployed	68	86.8	0.88 (0.43 - 1.82)	0.729	1.14 (0.53 - 2.45)	0.746
Current marital status						
Single	1568	88.8	REF			
Married	72	73.6	0.35 (0.20 - 0.60)	0.000	0.45 (0.24 - 0.85)	0.013
Current residence						
Central Tokyo	877	87.5	REF			
Greater Tokyo	547	90.1	1.30 (0.92 - 1.84)	0.131		
Other prefecture	206	85.4	0.84 (0.54 - 1.23)	0.427		
Intercourse partners						
Only men	1475	88.7	REF			
Both men and women	146	89.7	1.13 (0.65 - 2.00)	0.677		
Health						
Healthy	1048	90.0	1.57 (1.16 - 2.13)	0.003	1.46 (1.06 - 2.03)	0.022
Fair/poor health	591	85.1	REF			
Out to close friends						
No	661	87.6	REF			
Yes	961	88.6	1.10 (0.81 - 1.49)	0.557		
Identify as a member of the gay community						
No	272	88.6	REF			
Yes	1358	88.1	0.95 (0.63 - 1.43)	0.804		
Use gay apps for sex						
No	553	87.6	REF			
Yes	889	88.6	1.10 (0.81 - 1.50)	0.543		
Use gay apps to find friends						
No	398	83.9	REF			
Yes	1228	89.7	1.68 (1.21 - 2.32)	0.002	1.58 (1.12 - 2.22)	0.009
Use gay apps to avoid being identified as gay						
No	1487	88.2	REF			
Yes	131	88.5	1.04 (0.59 - 1.82)	0.896		

Use gay apps to find a serious relationship						
No	763	86.2	REF			
Yes	860	90.1	1.46 (1.07 - 1.97)	0.016	1.15 (0.83 - 1.59)	0.402
Ever attended A gay bar						
No	704	86.1	REF			
Yes	931	89.8	1.42 (1.05 - 1.92)	0.022	1.47 (1.06 - 2.05)	0.022
Recent participation in gay group/community or volunteer activities						
No	1420	88.0	REF			
Yes	217	88.9	1.09 (0.70 - 1.72)	0.699		
Hattenba attendance						
No	885	90.2	REF			
Yes	780	86.0	0.67 (0.50 - 0.91)	0.010	0.64 (0.46 - 0.90)	0.011
HIV Knowledge: Having other STIs doesn't increase chance of infection						
Correct	1500	88.1	REF			
Incorrect	129	89.9	0.83 (0.46 - 1.51)	0.545		
Anal sex with regular male partners						
No	243	79.0	REF			
Yes	1395	89.7	2.29 (1.61 - 3.26)	0.000	2.01 (1.31 - 3.10)	0.001
Anal sex with casual male partners						
No	315	83.5	REF			
Yes	1322	89.3	1.62 (1.15 - 2.28)	0.006	1.32 (0.85 - 2.06)	0.211
Vaginal sex with female partners						
No	1347	88.4	REF			
Yes	285	86.7	0.85 (0.58 - 1.24)	0.385		
Condom use with regular male partners[a]						
Low	516	90.1	REF			
High	879	89.5	0.94 (0.65 - 1.35)	0.729		
Condom use with casual male partners[b]						
Low	230	80.4	REF			
High	1092	91.1	2.50 (1.70 - 3.67)	0.000	2.09 (1.38 - 3.18)	0.001
Condom use with female partners[c]						
Low	57	80.7	REF			
High	228	88.2	1.78 (0.82 - 3.85)	0.143		

[a]analysis based on a subsample of 1395 respondents who have anal sex with a regular partner

[b]analysis based on a subsample of 1322 respondents who have anal sex with a casual partner

[c]analysis based on a subsample of 285 respondents who have sex with women

[abc]Low condom use = never/rarely use a condom; High condom use = most of the time/always use a condom

5.4 Discussion

This survey shows that gay mobile app users in Greater Tokyo are unlikely to reach the first of the 90-90-90 aims set by UNAIDS, having 90% of people living with HIV (PLHIV) diagnosed by 2020, with 72.8% of MSM respondents ever tested for HIV. Two-fifths (40.4%) of MSM who had undergone lifetime HIV testing underwent testing at least once every six months, meeting CDC MSM yearly HIV-testing recommendations (36). Comparisons with existing Japanese data show lifetime testing was similar to previous MSM lifetime testing reports. For example, a 2013 survey of 491 MSM in Greater Tokyo found almost three quarters (72.9%) to have been tested for HIV in their lifetime, over a third (35.0%) in the past year, and almost nine-tenths (86.2%) had considered getting an HIV test (10). Lifetime testing was higher than previous data collected by MSM internet surveys in Asia, including Korea (37), China (60.5% (18); 58.3% (38)) and Vietnam (23.5%; (39)), possibly due to higher availability in Japan of free HIV testing, counselling, antiretroviral therapy, and lower stigma, associated with HIV testing uptake. Respondents had higher lifetime testing in this research than gay bar attending MSM in Japan with a similar age profile to this study (61.0%; Shiono (9)), supported by previous findings where gay mobile app users were also found to have higher lifetime testing than non-users in China (18) and meta-analysis (29).

Socio-demographic factors significantly associated with lifetime testing (age, education, residence) were similar to previous findings among both gay mobile app using and non-using MSM in Japan and abroad. Higher education was associated with higher lifetime testing among respondents similar to previous findings among venue-attending MSM in Japan (9), and abroad (38,40,41), and rural residency was significantly associated with lower lifetime

HIV testing among MSM, possibly due to lower HIV information access and lower tolerance for sexual minorities (42), and lower HIV knowledge (43). Lifetime HIV testing was significantly lower among MSM youth, and only half (52.2%) of respondents aged 18 – 25 had been tested for HIV, and one-quarter (24.7%) in the past 6-months. Youth have been found to have lower HIV testing among MSM who use gay mobile apps (21), internet (44) and attend gay venues (40). Youth may have lower lifetime HIV testing because they are younger, and therefore have had fewer partners, thus perceive their risk as lower, and have had fewer years to be tested (45). However, studies have shown that compared to older MSM, young MSM (YMSM) are more likely to engage in CLAI concurrently with both their primary partner and with someone outside the relationship (46), and are thus at higher risk for HIV (47). Only half of respondents aged 18 – 25 had learned about HIV in schools, indicating the pressing need for good quality sex education in Japanese high schools.

Respondents who engaged in anal sex with regular partners were twice as likely to have been tested in their lifetime, and more likely to have been tested recently. Although due to the cross-sectional nature of this study causation cannot be determined, two explanations are possible for the association between anal intercourse with male partners and lifetime and recent HIV testing. First, perceived risky sexual behaviors may lead to HIV testing. Thus, MSM who have engaged in risky sexual behaviors with regular and casual male partners may perceive this risk and get tested. A second potential explanation is that respondents are engaging in negotiated safety, where regular partners agree not to have CLAI with outside partners after being tested with regular partners (48). HIV negative seroconcordant relationships (e.g. where both partners are HIV negative), are associated with low HIV incidence (49). However, respondents not discussing or complying with negotiated safety is a risk factor for HIV transmission as MSM often continue to use gay mobile apps throughout relationships (23), and over half were found to have both regular and casual partners concurrently (50). Condom use

may become increasingly inconsistent as casual MSM relationships continue (51), posing significant risk of infection to regular partners with whom they have a higher number of sex acts, more frequent receptive roles, and lower condom use; subsequently, regular partners accounted for 68% of MSM HIV transmissions in the US (52), but only one-tenth in Australia where negotiated safety has been promoted more among MSM (53).

Although respondents who engaged in CLAI with regular male partners were more likely to have undergone testing in their lifetime, participants who engaged in CLAI with casual male partners or condomless sex with female partners were not more likely to have undergone lifetime or recent testing. Without knowing an individual's Pre-exposure prophylaxis (PrEP) status and viral load, it is difficult to ascertain the risk posed by CLAI. However, PrEP is not currently approved for HIV prevention in Japan (54), and MSM engaging in CLAI with casual male partners may therefore be at higher risk of HIV but are not following CDC testing guidelines for high-risk individuals to undergo testing more regularly (36).

Unlike anal intercourse with male partners, sex with female partners was significantly associated with lower lifetime HIV testing. Previous research has found lower regular and lifetime HIV testing associated with both bisexual behavior (40) and bisexual identity (9,45,55) among MSM. Increased internalized homo-negativity, associated with lower HIV testing (56), and lower gay community attachment may potentially explain the association between MSM who have intercourse with both male and female partners and lower lifetime HIV testing. All forms of gay community attachment and participation (gay bar attendance, gay community activity participation, *hattenba* attendance, as well as coming out to close friends) were associated with higher lifetime testing. Lower gay community attachment was associated with less access to HIV testing information, and lower emotional support for a positive HIV result without which the fear of a positive result may make MSM reticent of being tested (45). More explicitly, in Japan, free HIV testing facilities and HIV prevention information is almost

exclusively advertised through gay NGOs at gay venues. Survey respondents with both male and female sex partners participated less in the gay community, and therefore had less information regarding access to HIV testing facilities.

5.4.1 Increasing access to HIV testing

In order to increase testing numbers, both HIV testing promotion and additional testing strategies such as expansion of rapid voluntary counselling and testing (VCT), which is associated with a threefold increase in HIV testing uptake and a twofold increase in receipt of results (57), and approval of self-testing kits such as rapid, oral, fluid HIV home tests, a cost-efficient and effective prevention method for networks with high-risk sexual practices (58) should be examined. Utilizing the ubiquity of vending machines in Japan in order to sell self-testing kits together with other items such as in China (59), particularly outside of urban areas such as Tokyo where access to testing is poor, may lead to an increase in testing if promoted effectively. Research into the kinds of testing services Japanese MSM, particularly non-community attached MSM, would be likely to utilize may also give useful feedback for appropriate resource allocation for HIV testing among high-risk populations. Previous research has shown significantly higher HIV testing levels after HIV testing promotions using mobile app HIV testing advertising (60). Increasing HIV testing rates for non-gay community MSM, specifically bisexual and young MSM may help stop HIV bridging into the Japanese heterosexual population, which has been previously identified as possible but low risk (61). Gay mobile app users are largely willing to receive HIV prevention materials via mobile apps (20), and the majority of respondents requested results from this study, showing an interest in prevention and MSM community behaviors. Because respondents use gay mobile apps frequently, and Japanese gay mobile apps have shown willingness to provide price discounts for MSM surveillance and prevention research, utilization of popular gay mobile apps to promote HIV testing facilities may prove to be a cost-effective prevention policy for targeting

non-community attached MSM youth who are particularly at-risk for HIV infection and increasingly use gay mobile apps instead of attending traditional gay venues to meet sex partners in Japan (25). In order to facilitate testing, increasing the amount of free testing facilities, extending testing hours in order to fit around busy Japanese work schedules, adding free optional HIV testing to the annual health check-ups available to all residents of Japan (with proper privacy protection), and providing cultural competency training for interviewers and health providers at testing centers should be implemented.

5.4.2 Limitations

The research was subject to a variety of limitations that must be taken into account. Respondents were recruited through an advertisement, and may not be representative of all Japanese MSM. Furthermore, the behaviors and attitudes reported were self-rated and may have been subject to social desirability bias where male participants may downplay certain behaviors they believe to be undesirable (62). However, because the survey was anonymous and online this effect was likely minimized. Due to limited resources, this research only used specific gay mobile applications. HIV-positive individuals were not excluded from this study. Recent HIV testing, and future HIV testing intention may not be representative of the reality of the situation in Japan. However, the levels of recent HIV testing and future HIV testing intention reported in this study were similar to previous findings in Japan. Other mobile SNS applications are specifically used by particular MSM populations (such as “Mister” for older men), and may contain different MSM populations worthy of future research. All of these apps function similarly, and this study method would likely be appropriate for future comparative and inclusive research in Japan.

5.5 Conclusion

These results show that MSM who use gay mobile apps in Greater Tokyo do not meet the CDC yearly testing recommendations for high risk populations. Although higher than neighbouring nations, HIV testing was still infrequent compared to other countries providing similar levels of care. Considering limited HIV prevention funding in Japan for MSM, moderate lifetime and recent testing, and the large number of gay mobile app users, utilization of popular gay mobile apps to promote nearby HIV testing facilities may be an effective prevention policy to target non-community attached MSM, particularly at-risk youth and individuals at risk for sudden-onset AIDS.

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A. PUBLICATION DETAILS *(to be completed by the student)*

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A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	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	
Authors	Adam O Hill, Benjamin R Bavinton, Gregory Armstrong	
Student's contribution (%)	85%	
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A. PUBLICATION DETAILS *(to be completed by the student)*

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B. STUDENT'S DECLARATION

I declare that the publication above meets the requirements to be included in the thesis

Student's name	Student's signature	Date *(dd/mm/yy)*
Adam Hill Rolander		22/02/19

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- All of the co-authors of the publication have reviewed the above information and have agreed to its veracity
- 'Co-Author Authorisation' forms for each co-author are attached.

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Leah Ruppanner		22/02/19

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6. 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 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

6.1 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 and AIDS cases between 2011–2015 (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).

6.2 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, 9Monster, for one week from January 17th to January 23rd 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).

6.3 Results

6.3.1 Socio-Demographic Characteristics

The socio-demographic characteristics of the 1657 MSM using gay mobile apps in Greater Tokyo are displayed in Table 15. 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.

Table 15: Socio-demographic characteristics

		n	**%**
Current residence	Tokyo	883	53.4
	Greater Tokyo	553	33.4
	Another prefecture	209	12.6
	Another country	8	0.5
	Total	1653	100
Birthplace	Japan	1593	96.3
	Other	62	3.7
	Total	1655	100
Age	18–25	319	19.4
	26–35	550	33.4
	36–45	507	30.8
	46+	270	16.4
	Total	1646	100
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

6.3.2 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 16). 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.

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.

Table 16: Frequency of condom use and self-efficacy for practicing safer sex

		n	%
How often do you use a condom with a regular (penetrative and receptive anal sex) male partner? [a]	No anal sex with regular male partner	246	14.9
	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 with casual (penetrative and receptive anal sex) male partners? [b]	No anal sex with casual male partner	318	19.3
	Never	35	2.6
	Rarely	197	14.8
	Most of the time	490	36.8
	Always	609	45.8
	Total	1331	100
How often do you use a condom with female (penetrative and anal sex) partners? [c]	No sex with female partner	1358	82.6
	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

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

6.3.3 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 17) 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 BA, 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 17: 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% C.I.)	*p*-Value	Adjusted Odds Ratio (95% C.I.)	*p*-Value
Age (years)						
18-25	271	31.4	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			
Japan	1345	37.4	1.61 (0.90–2.88)	0.112		
Education						
High School or less	360	43.3	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	
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)	0.612
Current marital status						
Single	1340	36.2	REF		REF	
Married	63	54.0	2.07 (1.24–3.43)	0.005	2.03 (1.10–3.76)	0.024
Current residence						
Central Tokyo	765	37.9	REF			
Greater Tokyo	446	36.1	0.93 (0.73–1.18)	0.534		
Other prefecture	182	35.7	0.91 (0.65–1.28)	0.586		
Intercourse partners						
Only men	1280	38.0	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			
Healthy	904	35.4	0.83 (0.66–1.04)	0.106		
Out to close friends						
No	549	36.6	REF			
Yes	838	37.2	1.03 (0.82–1.28)	0.815		
Identify as a member of the gay community						
No	236	32.6	REF		REF	
Yes	1155	37.7	1.25 (0.93–1.68)	0.144	1.50 (1.07–2.10)	0.020

Use gay apps for sex						
No	511	31.9	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						
No	339	41.9	REF		REF	
Yes	1053	35.3	0.76 (0.59–0.97)	0.030	0.73 (0.54–0.97)	0.028
Use gay apps to avoid being identified as gay						
No	1268	36.8	REF			
Yes	115	40.0	1.15 (0.78–1.70)	0.490		
Use gay apps to find a serious relationship						
No	631	40.4	REF		REF	
Yes	756	34.0	0.76 (0.61–0.95)	0.014	0.85 (0.66–1.10)	0.218
Ever attended a gay bar						
No	583	37.2	REF			
Yes	817	36.8	0.98 (0.79–1.23)	0.885		
Participation in gay group/community or volunteer activities						
No	1207	38.9	REF		REF	
Yes	194	25.3	0.53 (0.38–0.75)	0.000	0.51 (0.34–0.75)	0.001
Hattenba attendance						
No	716	34.9	REF			
Yes	684	39.0	1.19 (0.96–1.48)	0.111		
Confident in ability to use condoms when partner doesn't want to						
No	839	49.8	REF		REF	
Yes	558	17.6	0.22 (0.17–0.28)	0.000	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		REF	
Yes	736	24.0	0.30 (0.24–0.38)	0.000	0.54 (0.41–0.71)	0.000
Difficult to talk about condoms with partners						
No	1280	35.0	0.32 (0.22–0.48)	0.000	0.45 (0.29–0.71)	0.001
Yes	112	62.5	REF		REF	
Difficult to have safe sex when drunk						
No	785	32.1	REF		REF	
Yes	609	43.7	0.61 (0.49–0.76)	0.000	0.77 (0.60–0.99)	0.043
Attend regular drinking parties						
No	314	37.9	REF			
Yes	1079	36.7	0.95 (0.73–1.23)	0.699		

6.3.4 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 18), 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 18: 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% C.I.)**	***p*-Value**	**Adjusted Odds Ratio (95% C.I.)**	***p*-Value**
Age (years)						
18–25	245	14.3	REF		REF	
26–35	453	15.2	1.06 (0.85–1.32)	0.630	0.97 (0.72–1.30)	0.828
36–45	424	19.3	1.14 (0.99–1.32)	0.071	1.04 (0.85–1.26)	0.717
46+	202	22.8	1.16 (1.03–1.31)	0.015	1.10 (0.93–1.30)	0.252
Place of Birth						
Japan	1273	17.8	REF		REF	
Other	57	8.8	2.30 (0.91–5.82)	0.079	0.76 (0.25–2.27)	0.625
Education						
High School or less	323	29.1	REF		REF	
Two-year university	224	15.6	0.82 (0.74–0.91)	0.000	0.80 (0.70–0.91)	0.001
University	652	14.1	0.40 (0.29–0.55)	0.000	0.35 (0.23–0.52)	0.000
Graduate degree	132	8.3	0.22 (0.11–0.43)	0.000	0.32 (0.15–0.67)	0.002
Employment						
Full-time work	919	16.9	REF		REF	
Part-time work	146	24.0	1.56 (1.03–2.37)	0.037	1.05 (0.62–1.77)	0.856
Student	135	10.4	0.57 (0.32–1.02)	0.059	0.80 (0.36–1.74)	0.565

Self-employed	76	14.5	0.84 (0.43–1.62)	0.597	0.80 (0.37–1.75)	0.582
Unemployed	53	32.1	2.33 (1.28–4.26)	0.006	1.83 (0.86–3.89)	0.118
Current marital status						
Single	1264	17.4	REF			
Married	66	18.2	1.05 (0.56–2.00)	0.871		
Current residence						
Central Tokyo	732	19.7	REF		REF	
Greater Tokyo	430	15.3	0.74 (0.54–1.02)	0.062	0.62 (0.43–0.90)	0.011
Other prefecture	158	13.3	0.62 (0.38–1.02)	0.061	0.57 (0.31–1.03)	0.064
Intercourse partners						
Only men	1212	17.8	REF			
Both men and women	118	13.6	0.72 (0.42–1.26)	0.246		
Health						
Fair/poor health	472	15.1	REF		REF	
Healthy	857	21.6	0.64 (0.48–0.86)	0.003	0.89 (0.63–1.25)	0.491
Out to close friends						
No	519	17.7	REF			
Yes	794	17.6	0.99 (0.74–1.33)	0.965		
Identify as a member of the gay community						
No	217	18.4	REF			
Yes	1101	17.3	0.92 (0.63–1.35)	0.677		
Use gay apps for sex						
No	414	10.6	REF		REF	
Yes	911	20.5	2.17 (1.53–3.09)	0.000	2.01 (1.33–3.03)	0.001
Use gay apps to find friends						
No	340	21.8	REF		REF	
Yes	980	16.0	0.69 (0.50–0.93)	0.017	0.63 (0.44–0.91)	0.013
Use gay apps to avoid being identified as gay						
No	1202	17.6	REF			
Yes	108	18.5	1.07 (0.64–1.77)	0.801		
Use gay apps to find a serious relationship						
No	587	19.5	REF		REF	
Yes	498	15.7	0.76 (0.58–1.02)	0.064	0.95 (0.67–1.34)	0.756
Ever attended a gay bar						
No	530	17.5	REF			
Yes	797	17.3	0.98 (0.74–1.31)	0.913		
Participation in gay group/community or volunteer activities						
No	1139	18.3	REF		REF	
Yes	190	12.1	0.62 (0.39–0.98)	0.040	0.65 (0.37–1.12)	0.117
Hattenba attendance						

No	619	13.6	REF		REF	
Yes	707	20.7	1.66 (1.24–2.22)	0.001	1.10 (0.77–1.58)	0.588
Confident in ability to use condoms when my partner doesn't want to						
No	817	24.8	REF		REF	
Yes	506	5.1	0.16 (0.11–0.25)	0.000	0.38 (0.23–0.61)	0.000
Able to avoid behavior that puts me at risk of HIV infection						
No	643	31.3	REF		REF	
Yes	673	4.3	.010 (0.07–0.15)	0.000	0.18 (0.11–0.28)	0.000
Difficult to talk about condoms with partners						
Yes	110	33.6	REF		REF	
No	1207	16.1	0.38 (0.25–0.58)	0.000	0.54 (0.33–0.88)	0.014
Difficult to have safe sex when drunk						
No	744	13.0	REF		REF	
Yes	577	23.2	0.50 (0.37 - 0.66)	0.000	0.74 (0.53–1.05)	0.091
Attend regular drinking parties						
No	296	20.9	REF		REF	
Yes	1024	16.5	0.75 (0.54–1.03)	0.077	1.05 (0.71–1.56)	0.814

6.3.5 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 19), and were higher among MSM who were married (AOR, 2.70; 95% CI, 1.09–6.69).

Table 19: 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% C.I.)**	***p*-Value**	**Adjusted Odds Ratio (95% C.I.)**	***p*-Value**
Age (years)						
18–25	73	13.7	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		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	15.6	0.45 (0.15–1.31)	0.141	0.73 (0.20–2.63)	0.633
Employment						
Full-time work	214	22.0	REF		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	20.0	0.89 (0.24–3.28)	0.859	1.57 (0.37–6.61)	0.540
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			
Greater Tokyo	116	15.5	0.68 (0.35–1.30)	0.240		
Other prefecture	39	28.2	1.45 (0.64–3.26)	0.375		
Health						
Healthy	195	21.0	1.23 (0.65–2.34)	0.524		
Fair/Poor health	90	17.8	REF			
Out to close friends						
No	155	17.4	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			
Yes	210	19.5	0.91 (0.48–1.74)	0.775		
Use gay apps for sex						
No	119	20.2	REF			
Yes	165	19.4	0.95 (0.53–1.72)	0.871		
Use gay apps to find friends						
No	77	28.6	REF		REF	
Yes	204	16.7	0.50 (0.27–0.93)	0.028	0.68 (0.33–1.37)	0.276
Use gay apps to avoid being identified as gay						
No	239	20.5	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			

Yes	119	16.0	0.65 (0.35–1.19)	0.163		
Ever attended a gay bar						
No	179	17.9	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			
Yes	20	20.0	1.02 (0.33–3.19)	0.967		
Hattenba attendance						
No	169	15.4	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						
Yes	19	31.6	REF			
No	265	19.2	0.52 (0.19–1.42)	0.202		
Difficult to have safe sex when drunk						
No	174	19.0	REF			
Yes	111	21.6	0.85 (0.47–1.53)	0.585		
Attend regular drinking parties						
No	60	25.0	REF			
Yes	224	18.8	0.69 (0.35–1.36)	0.285		

6.4 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) (TDF/FTC) nor generic versions of TDF/FTC 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.

6.4.1 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.

6.5 Conclusions

This research shows that 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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7. How are MSM and Heterosexual Social Capital Access Distributed Among MSM in Greater Tokyo

Abstract

Significant health disparities exist between men who have sex with men (MSM) and the general population in Japan. Social capital has been observed as an important component of positive health outcomes among MSM. However, there is limited research investigating how alter sexuality (possessors of actual resources embedded in social capital networks) mitigates distribution of access to resources embedded in social capital networks. Using cross-sectional data from an online MSM survey of 1564 participants in Greater Tokyo, I investigated whether social capital access distribution varies with MSM and heterosexual alters, independent of socioeconomic status.

To measure social capital, the study used eighteen questions assessing the respondents' ability to access both physical and mental-support resources embedded in social networks. There was high reliability for the MSM social capital scale (Cronbach's alpha = 0.91) and heterosexual social capital scales (Cronbach's alpha = 0.91).

The final regression model revealed that heterosexual social capital access was positively associated with youth, educational attainment (e.g. University; B=0.77, 95%CI=0.15 - 1.38), fulltime employment, health (B=0.70, 95%CI=0.16 - 1.23), being out to close friends (B=1.41, 95%CI=0.89 - 1.93), and bisexual behavior (B=2.54, 95%CI=1.66 - 3.42). MSM social capital access was positively associated with being out to close friends (B=1.41, 95%CI=0.89 - 1.93), identifying as a member of the gay community (B=0.70, 95%CI=0.07 - 1.32), and ever attending a gay bar or event (B=2.17, 95%CI=1.67 - 2.68). MSM social capital access was negatively associated with being a student (B=-1.06, 95%CI=-1.99 - -0.12), living outside of central Tokyo (B=-1.53, 95%CI=-2.26 - -0.81), bisexual behavior (B=-2.18, 95%CI=-3.11 - -

1.25), and using gay mobile apps for sex (B=-0.68, 95%CI=-1.16 - -0.20) or for a serious relationship (B=-0.87, 95%CI=-1.34 - -0.39).

The separation of alter sexual identity reveals differences in prevalence and correlates of access to resources embedded in MSM and heterosexual social capital among MSM in Greater Tokyo. In order to help close the health gap for greater Tokyo MSM, policy interventions focusing on MSM social capital deprived groups, such as non-gay venue attending MSM, those living outside central Tokyo, and who identify as bisexual may be beneficial.

7.1 Introduction

Significant health disparities exist between men who have sex with men (MSM) and general populations globally, including higher rates of mental illness, suicidal ideation and attempts (1)(2), increased risk of acquiring HIV and STIs (3), and elevated rates of health-adverse behaviors such as recreational drug use (4). In Japan, MSM are burdened with a concentrated HIV epidemic, and although MSM are estimated to make up between 2.6% – 4.1% of the male population (5), they accounted for 78% of reported Japanese male HIV cases in 2016 (6). Furthermore, Japanese MSM face discrimination from Japanese politicians (7) and media (8), verbal harassment due to homophobic bias (9), bullying in schools (10), frequent sexual victimization and forced sex (11), and subsequent high levels of suicidal ideation (12).

There is extensive variation in definitions of social capital (13). In this study, social capital refers to resources potentially accessed by individuals through their social networks (14), and consists of an ego (the individual accessing resources through their social networks), alters (possessors of the actual resources provided to the ego), and the resources themselves (ranging from emotional support to a small cash loan). As opposed to community definitions of social capital which regard social capital as equally distributed, an individual social capital definition considers the distribution of social capital in society as unequal (15), enabling the identification

of correlates of individual social capital resource access. Social capital resources are commonly disaggregated into structural and cognitive resources (16). Structural resources consist of community participation (16), while cognitive resources are psychosocial resources such as friendship and emotional support (17,18). Although cognitive resources are more frequently associated with positive health and life satisfaction outcomes, cognitive and structural resources often support each other, and both active participation and social supports are necessary to maintain physical and mental health. Social capital has been observed as an important component of positive health outcomes, ranging from reductions in suicidal ideation (19) and self-stigma (20) to increased HIV testing and HIV risk-reducing behaviors (20–23).

Two theoretical mechanisms are proposed to contribute to social capital access inequality: homophily, and network diversity (24). Homophily, the process in which individuals associate with others similar to themselves, leads to individual network members with mostly network ties to resource possessors (alters) similar to themselves (in gender, age, and education) (25)(24,26). This results in segregated personal networks and restricted interactions with others who are not alike. Access to the same resource through multiple sources leads to redundancy, as access to a resource through one channel is generally sufficient (27). Network diversity therefore provides access to variety of useful resources; whereas a lack of network diversity leads to an excess of similar resources and redundancy (17). Prior studies examining correlates of access to resources embedded in social capital networks have largely supported homophily and network diversity theories (25) (24) (28).

Considering the abundance of literature regarding the important benefits provided by social capital, there is a surprising dearth of studies examining its distribution (24). MSM have unique lived experiences, social discrimination, an HIV epidemic, a limited population, and a variety of other factors that may lead to MSM social capital network access distribution being unique compared to that of heterosexual networks. Despite the burden of this epidemic and

health disparities disproportionately held by MSM, there is a severe paucity of research addressing health gaps within the Japanese MSM population itself, and the majority of prior studies fail to describe which individual MSM have access to these health-beneficial resources, and through which social capital networks. I addressed this research gap by identifying social capital access inequality and exploring how specific sub-dimensions of social capital are accessed differently through MSM and heterosexual social capital networks among MSM in Greater Tokyo. Examining how social capital is distributed among MSM is important for understanding a variety of health disparities (29), and may help provide effective interventions addressing health and well-being inequalities among this burdened population.

7.2 Methods

I undertook a cross-sectional survey among MSM who use gay mobile apps in Greater Tokyo using an anonymous, self-administered structured questionnaire. Ethics approval was provided by the Human Research Ethics Committee at the University of Melbourne (HREC 1646197), and local study approval was provided by the University of the Ryukyus and Japanese Ministry of Health and Welfare.

7.2.1 Participants

Participants were aged 18 years or older, self-identified as MSM (defined as identifying as homosexual or identifying as ‘gay’ or ‘bisexual’, or having sexual experience with other men), and had provided online consent to participate in the survey. Participation was voluntary and there were no consequences for electing not to participate. The questionnaire was translated from English into Japanese by a native translator and back-translated into English by an independent translator. Duplicate IP addresses, email 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.

7.2.2 Recruitment

Recruitment is described in detail in previous publications (30). In brief, participants were recruited using the geo-location feature of gay mobile apps, similar to methods previously used to recruit Grindr users in the US (31,32). Initially, the mobile apps were opened on a mobile phone and one online user was selected from each row until 50 previously uncontacted users were messaged with a link to the survey. The study recruited 215 participants using this approach between November 22nd 2016 and January 16th 2017. Between January 17th 2017 and January 23rd 2017 a splash screen advertisement poster (a full screen advertisement showed to users when opening the app) was placed on gay mobile apps with a link to the survey. This methodology had previously been used with success in the US (33,34). It was shown in rotation whenever the application was opened by users in the Greater Tokyo area, recruiting a further 1442 participants resulting in 1564 valid participants who answered all social capital questions and were included in this study.

7.2.3 Measures

Questions regarding the socio-demographic were adapted from previous research in Japan (35), including age, gender, sexual identification, marital status (marriage is only legal between men and women in Japan), birthplace, current residence, self-rated health status, highest level of education, employment status, and whether or not they had sexual relationships with men only or both men and women. Gay community participation was measured by frequency of gay bar and gay event attendance, frequency of bathhouse (*hattenba*) attendance, gay group activity participation in the past six-months, and gay community identification.

Social capital was measured using The Resource Generator (18), a validated instrument (36) to assess individual social capital, conceptualized as valued resources that individuals can access through their social networks (37). It contained 18 culturally adapted questions assessing participants' ability to access both physical and mental support resources embedded in social networks through MSM or heterosexual alters, for example, 'Do you have access to someone who you trust very much?' Participants could choose one of the following four responses: 'heterosexual', 'MSM', 'both', 'neither'. There was high reliability for the MSM social capital scale (Cronbach's alpha = 0.91) and heterosexual social capital scales (Cronbach's alpha = 0.91). The cognitive social capital sub-scale was based on a five-item scale consistent with previous examples (16). Respondents were asked if they know someone they can talk to about personal matters, someone they trust very much, shares the same norms, shares the same values, and someone who shares the same opinions. There was high reliability for the cognitive social capital (Cronbach's alpha = 0.85 for MSM social capital and 0.85 for heterosexual social capital).Similarly, the structural social capital sub-scale was based on a five-item scale consistent with previous examples (16). Respondents were asked if they knew someone who could lend them a car, lend them 30,000 yen, help them move, do their shopping when they are ill, or find them a job. The scale was reliable (Cronbach's alpha = 0.79 for MSM social capital and 0.79 for heterosexual social capital)

7.2.4 Statistical Analysis

Data were analyzed using SPSS version 24. I used multivariate linear logistic regression analysis to examine the correlates of social capital among participants. The enter method was used and variables with unadjusted odds ratios yielding p-values of 0.10 or less were considered eligible for the multivariate model. Unadjusted and adjusted odds ratios with their respective 95% confidence intervals and p-values are reported in the tables.

7.3 Results

7.3.1 Socio-demographics

Over half (53.6%) of the 1564 participants resided in central Tokyo, and almost all (96.3%) respondents were born in Japan (Table 20). The median age was 35, two-thirds (68.2%) were employed fulltime, over half (59.0%) had a university education, and a small minority (4.1%) were married to women. Most participants (91.2%) had only male sexual partners, and 8.8% reported having both male and female sex partners.

Table 20: Socio-demographic characteristics (n=1564)

		n	%	Mean MSM Social Capital	Mean Heterosexual Social Capital
Current residence	Central Tokyo	833	53.6	11.5	9.1
	Greater Tokyo	524	33.7	9.5	8.5
	Other prefecture	196	12.6	8.8	8.4
Birthplace	Japan	1506	96.3	10.4	8.7
	Other	58	3.7	13.0	10.8
Age	18 - 25	302	19.4	9.6	10.0
	26 - 35	523	33.6	10.8	9.5
	36 - 40	478	30.7	10.6	8.0
	46+	254	16.3	10.7	7.6
Marital status	Single	1499	95.9	10.6	8.8
	Married	64	4.1	8.4	9.0
Employment	Full-time work	1065	68.2	10.7	8.8
	Part-time work	180	11.5	9.4	7.2
	Student	155	9.9	9.4	11.1
	Self-employed	95	6.1	12.1	9.8
	Unemployed	67	4.3	10.5	6.6
Education	High School or less	394	25.2	9.8	7.9
	2-year university	263	16.8	10.0	8.0
	University	756	48.3	10.9	9.3

	Graduate degree	151	9.7	10.8	10.3
Intercourse partner sex	Men	1408	91.2	10.7	8.6
	Men and women	136	8.8	8.5	11.1
Health	Healthy	990	63.4	10.9	9.6
	Fair or poor health	572	36.6	9.7	7.4

7.3.2 Gay community participation and identification

Over three-quarters (75.5%) of participants reported using gay mobile apps to meet friends, almost two-thirds (61.9%) reported using them for sex, over half of participants (53.6%) reported using gay mobile apps for a serious relationship, and less than one-tenth (8.0%) reported using them to avoid being identified as gay (as an alternative to attending a gay bar or public event). Over half of participants (56.7%) had ever attended a gay bar or gay event, and less than half (48.0%) had ever attended a gay bathhouse, and a small minority (13.4%) had participated or volunteered in organized gay group activities in the past six-months.

Table 21: Gay community participation and identification (n=1564)

		n	**%**	**Mean MSM Social Capital**	**Mean Heterosexual Social Capital**
Use gay mobile apps to find sex	Neutral/disagree	594	38.1	10.8	8.9
	Agree	964	61.9	10.3	8.8
Use gay mobile apps to find friends	Neutral/disagree	379	24.5	10.3	8.8
	Agree	1171	75.5	10.6	8.8
Use gay mobile apps to avoid being identified as gay	Neutral/disagree	1421	92.0	10.6	8.8
	Agree	123	8.0	9.2	9.2
Use gay mobile apps to find a serious relationship	Neutral/disagree	719	46.4	10.8	8.5
	Agree	829	53.6	10.3	9.1
Ever attended gay bar or event	No	674	43.3	8.5	8.5
	Yes	884	56.7	12.0	9.1

Ever attended gay bathhouse	No	810	52.0	10.2	9.2
	Yes	748	48.0	10.8	8.4
Participated in gay group activity in past 6 months	No	1351	86.6	10.2	8.7
	Yes	209	13.4	12.5	9.9
Identify as a member of the gay community	Neutral/disagree	270	17.4	9.2	8.0
	Agree	1286	82.6	10.8	9.0
Out to close friends	No	653	39.5	8.7	7.4
	Yes	911	60.5	11.7	9.8

7.3.3 Social Capital

Table 22 shows that social capital resources were more accessible through MSM alters in general than heterosexual alters. Total social capital scores ranged from between 0 to 18, and MSM social capital (mean SC 10.48, SD 5.33) provided access to more resources than heterosexual social capital (mean SC 8.82, SD 5.33). MSM cognitive social capital (mean 3.60, SD 1.92) was significantly more accessible than heterosexual cognitive social capital (mean 2.71, SD 2.05); for example, one third (36.4%) of respondents had access to someone with whom they could discuss intimate matters through an MSM alter compared to one-tenth (9.8%) through a heterosexual alter. MSM structural social capital (mean 1.39; SD 1.15) was similarly accessible through heterosexual networks (heterosexual instrumental resources mean 1.26; SD 1.16).

Table 22: Social capital characteristics (n=1564)

	n	**Mean**
MSM social capital	1564	10.5
Cognitive MSM social capital	1564	3.6
Structural MSM social capital	1564	1.9
Total Combined MSM and heterosexual social capital	1564	12.6

Heterosexual social capital	1564	8.8
Cognitive Heterosexual social capital	1564	2.7
Structural Heterosexual social capital	1564	1.9

7.3.4 Correlates of heterosexual social capital

The multivariate linear regression model (Table 23) showed that participants who had completed university or a graduate degree (e.g. University; B=0.77, 95%CI=0.15 - 1.38) reported higher access to resources embedded in heterosexual social capital networks than those who had lower educational attainment. Whereas participants who were employed part-time reported lower access to heterosexual social capital than those employed fulltime (B=-1.06, 95%CI=-1.85 - -0.27), students reported higher access (B=1.66, 95%CI=0.70 - 2.62). Participants who reported being in good health had higher access to heterosexual social capital than those reporting fair or poor health (B=0.70, 95%CI=0.16 - 1.23). Participants reporting both male and female sex partners had higher access to heterosexual social capital than those who reported only male sex partners (B=2.54, 95%CI=1.66 - 3.42), and participants who were out to close friends had higher access to heterosexual social capital resources than those who were not (B=1.41, 95%CI=0.89 - 1.93). Participants who were over 35 years of age had lower access to heterosexual social capital than those aged 18 – 25 (e.g. 36 – 45 B=-0.33, 95%CI=-0.60 - -0.05).

Table 23: Multivariate linear regression for heterosexual social capital (n=1564)

	Number of respondents (n)	**Mean Heterosexual Social Capital**	**Univariate coefficient (95% C.I.)**	**p-Value**	**Multivariate coefficient (95% C.I.)**	**p-Value**
Age (years)						
18-25	302	10.0	REF			
26 – 35	523	9.5	-0.26 (-0.63 - 0.11)	0.173	-0.03 (-0.42 - 0.36)	0.871
36 – 45	478	8.0	-0.66 (-0.90 - -0.40)	0.000	-0.33 (-0.60 - -0.05)	0.020
46+	254	7.6	-0.59 (-0.81 - -0.37)	0.000	-0.37 (-0.61 - -0.14)	0.002

Place of Birth						
Japan	1506	8.7	REF			
Other	58	10.8	2.01 (0.60 - 3.14)	0.005	-0.34 (-1.63 - 0.95)	0.605
Education						
High School or less	394	7.9	REF			
2-year university	263	8.0	0.036 (-1.70 - 0.24)	0.731	0.02 (-0.16 - 0.21)	0.796
University	756	9.3	1.39 (0.74 - 2.03)	0.000	0.77 (0.15 - 1.38)	0.014
Graduate degree	151	10.3	2.41 (1.42 - 3.40)	0.000	1.40 (0.48 - 2.33)	0.003
Employment						
Full-time work	1065	8.8	REF			
Part-time work	180	7.2	-1.66 (-2.48 - -0.83)	0.000	-1.06 (-1.85 - -0.27)	0.009
Student	155	11.1	2.22 (1.33 - 3.10)	0.000	1.66 (0.70 - 2.62)	0.001
Self-employed	95	9.8	0.99 (-0.11 - 2.09)	0.076	0.92 (-0.08 - 1.92)	0.070
Unemployed	67	6.6	-2.26 (-3.55 - -0.97)	0.001	-1.15 (-2.35 - 0.06)	0.063
Current marital status						
Single	1499	8.8	REF			
Married	64	9.0	1.49 (0.83 - 2.16)	0.000	1.16 (-0.13 - 2.44)	0.078
Current residence						
Central Tokyo	833	9.1	REF			
Greater Tokyo	524	8.5	-0.55 (-1.13 - 0.33)	0.065	0.04 (-0.49 - 0.56)	0.893
Other prefecture	196	8.4	-0.68 (-1.51 - 0.15)	0.107	0.18 (-0.58 - 0.93)	0.644
Intercourse partner sex						
Only men	1408	8.6	REF			
Both men and women	136	11.1	2.54 (1.61 - 3.47)	0.000	2.54 (1.66 - 3.42)	0.000
Health						
Fair/poor health	572	7.4	REF			
Healthy	990	9.6	2.21 (1.67 - 2.75)	0.000	0.70 (0.16 - 1.23)	0.010
Out to close friends						
No	634	7.5	REF			
Yes	911	9.8	2.38 (1.85 - 2.90)	0.000	1.41 (0.89 - 1.93)	0.000
Identify as a member of the gay community						
No	270	8.0	REF			
Yes	1286	9.0	0.99 (0.29 - 1.69)	0.005	0.23 (-0.42 - 0.87)	0.490

Use gay mobile apps for sex						
No	594	8.9	REF			
Yes	964	8.8	-0.80 (-0.63 - 0.47)	0.773		
Use gay mobile apps to find friends						
No	379	8.8	REF			
Yes	1171	8.8	0.05 (-0.57 - 0.67)	0.874		
Use gay mobile apps to avoid being identified as gay						
No	1421	8.8	REF			
Yes	123	9.2	0.36 (-0.62 - 1.34)	0.472		
Use gay mobile apps to find a serious relationship						
No	719	8.5	REF			
Yes	829	9.1	0.62 (0.08 - 1.15)	0.022	0.55 (0.05 - 1.04)	0.029
Ever attended gay bar or event						
No	674	8.5	REF			
Yes	884	9.1	0.63 (0.92 - 1.16)	0.022	-0.29 (-0.83 - 0.25)	0.288
Participation in organized gay group or volunteer activities						
No	1351	8.7	REF			
Yes	209	9.9	1.20 (0.42 - 1.97)	0.002	0.20 (-0.52 - 0.92)	0.592
Gay bathhouse attendance						
No	810	9.2	REF			
Yes	748	8.4	-0.84 (-1.37 -0.32)	0.002	-0.43 (-0.94 - 0.07)	0.092

7.3.5 MSM Social Capital Correlates

The multivariate linear regression model (Table 24) showed that participants who reported being out to close friends (B=1.41, 95%CI=0.89 - 1.93), identifying as a member of the gay community (B=0.70, 95%CI=0.07 - 1.32), and ever attending a gay bar or event (B=2.17, 95%CI=1.67 - 2.68) had higher access to MSM social capital resources than those who did not. Students had lower access to MSM social capital than those employed fulltime (B=-1.06, 95%CI=-1.99 - -0.12), and participants living outside of central Tokyo had lower

access to MSM social capital than those living in Tokyo's central 23 wards (for example a prefecture outside of Greater Tokyo; B=-1.53, 95%CI=-2.26 - -0.81). Participants reporting both male and female sex partners had lower access to MSM social capital than those who reported only male sex partners (B=-2.18, 95%CI=-3.11 - -1.25), and participants reporting using gay mobile apps for sex (B=-0.68, 95%CI=-1.16 - -0.20) or for a serious relationship (B=-0.87, 95%CI=-1.34 - -0.39) had lower access to MSM social capital resources than those who did not.

Table 24:Multivariate linear regression for MSM social capital (n=1564)

	Number of respondents (n)	Mean MSM Social Capital	Univariate coefficient (95% C.I.)	p-Value	Multivariate coefficient (95% C.I.)	p-Value
Age (years)						
18 – 25	302	9.6	REF			
26 – 35	523	10.8	0.56 (0.19-0.93)	0.003	0.12 (-0.26 - 0.49)	0.550
36 – 45	478	10.6	0.31 (0.05-0.56)	0.017	0.16 (-0.10 - 0.43)	0.229
46+	254	10.7	0.26 (0.04-0.48)	0.020	0.16 (-0.06 - 0.39)	0.162
Place of Birth						
Japan	1506	10.4	REF			
Other	58	13.0	2.58 (1.18 - 3.98)	0.000	1.17 (-0.07 - 2.42)	0.065
Education						
High School or less	394	9.8	REF			
2 year university	263	10.0	0.056 (-0.15 - 0.26)	0.597	-0.09 (-0.27 - 0.1)	0.355
University	756	10.9	1.13 (0.49 - 1.781)	0.001	0.13 (-0.47 - 0.72)	0.677
Graduate degree	151	10.8	0.975 (-0.21- 1.97)	0.055	-0.51 (-1.41 - 0.39)	0.264
Employment						
Full-time work	1065	10.7	REF			
Part-time work	180	9.4	-1.23 (-2.07 - -0.40)	0.004	-0.11 (-0.87 - 0.66)	0.782
Student	155	9.4	-1.27 (-2.16 - -0.38)	0.005	-1.06 (-1.99 - -0.12)	0.026
Self-employed	95	12.1	1.38 (0.27 - 2.49)	0.015	0.52 (-0.44 - 1.49)	0.288
Unemployed	67	10.5	-0.163 (-1.47 - 1.15)	0.807	0.67 (-0.50 - 1.83)	0.262
Current marital status						

Single	1499	10.6	REF			
Married	64	8.4	-1.06 (-1.73--0.39)	0.003	-1.07 (-2.31 - 0.17)	0.092
Current residence						
Central Tokyo	833	11.5	REF			
Greater Tokyo	524	9.5	-1.90 (-2.47 - -1.33)	0.000	-0.99 (-1.50 - -0.48)	0.000
Other prefecture	196	8.8	-2.61 (-3.42 - -1.80)	0.000	-1.53 (-2.26 - -0.81)	0.000
Intercourse partner sex						
Only men	1408	10.7	REF			
Both men and women	136	8.5	-2.18 (-3.11 - -1.25)	0.000	-1.62 (-2.48 - -0.76)	0.000
Health						
Fair/poor health	572	9.7	REF			
Healthy	990	10.9	1.19 (0.65 - 1.74)	0.000	-0.02 (-0.54 - 0.49)	0.929
Out to close friends						
No	634	8.7	REF			
Yes	911	11.7	2.99 (2.48 - 3.51)	0.000	1.73 (1.24 - 2.23)	0.000
Identify as a member of the gay community						
No	270	9.2	REF			
Yes	1286	10.8	1.61 (0.91 - 2.30)	0.000	0.70 (0.07 - 1.32)	0.028
Use gay mobile apps for sex						
No	594	10.8	REF			
Yes	964	10.3	-0.54 (-1.08 - 0.01)	0.053	-0.68 (-1.16 - -0.20)	0.005
Use gay mobile apps to find friends						
No	379	10.3	REF			
Yes	1171	10.6	0.32 (-0.30 - 0.93)	0.311		
Use gay mobile apps to avoid being identified as gay						
No	1421	10.6	REF			
Yes	123	9.2	-1.37 (-2.34 - -0.39)	0.006	-0.11 (-0.98 - 0.75)	0.798
Use gay mobile apps to find a serious relationship						
No	719	10.8	REF			
Yes	829	10.3	-0.46 (-0.99 - 0.71)	0.090	-0.87 (-1.34 - -0.39)	0.000
Ever attended gay bar or event						
No	674	8.5	REF			

Yes	884	12.0	3.56 (3.06 - 4.06)	0.000	2.17 (1.67 - 2.68)	0.000
Participation in organized gay group or volunteer activities						
No	1351	10.2	REF			
Yes	209	12.5	2.30 (1.53 – 3.07)	0.000	0.36 (-0.34 - 1.05)	0.313
Gay bathhouse attendance						
No	810	10.2	REF			
Yes	748	10.8	0.59 (0.65 - 1.12)	0.028	0.00 (-0.48 - 0.49)	0.988

7.4 Discussion

The separation of alter sexual identity reveals differences in prevalence and correlates of access to cognitive and structural resources embedded in MSM and heterosexual social capital among MSM in Greater Tokyo. Heterosexual social capital access was positively associated with youth, educational attainment, fulltime employment, health, being out to close friends, and bisexual behavior. MSM social capital access was positively associated with being out to close friends, identifying as a member of the gay community, and ever attending a gay bar or event. MSM social capital access was negatively associated with being a student, living outside of central Tokyo, bisexual behavior, and using gay mobile apps for sex or for a serious relationship.

The positive association between heterosexual social capital access and age, educational attainment and fulltime employment coheres to the theorized effects of homophily, through which network egos and alters have similar socio-demographic traits (24,25), and is consistent with previous studies examining social capital access distribution among general populations. For example, gender, education, age, fulltime-work, and local ethnicity were associated with structural social capital access in the Netherlands (24), and higher education level, work experience, and active membership in volunteer organizations were associated with social capital access in Sweden (28). This study reveals an important difference regarding the

direction of association between age and social capital access; whereas older age was positively associated with social capital access among the general population in the Netherlands (24), it was negatively associated with heterosexual capital access among MSM in this study. One possibility for this inverse association is that the creation of social capital requires a considerable time investment to establish network ties from which resources can be accessed (15), and individuals possess a finite amount of time that must be split accordingly between MSM and heterosexual networks. Among the working-aged general population, social resources from occupational and volunteer contacts accumulates over time as individuals continue to invest time almost exclusively into heterosexual networks, establishing and strengthening heterosexual network ties prior to leveling off with old age (38). However, older MSM have been observed to self-identify as homosexual more than young MSM (YMSM) in Japan, who often identify as bisexual (39). As MSM become increasingly involved in the gay community, they may reduce their time accordingly in heterosexual social networks in order to maintain equilibrium, leading to the negative association between age and heterosexual social capital, and higher mean levels of MSM social capital access among older MSM in this study.

Participants reported higher access to cognitive resources such as emotional support through MSM social capital than through heterosexual social capital, but similar access to structural resources such as a small loan or a job. Heterosexual social capital includes formal network connections for school and work, which may provide access to practical resources such as jobs, or biological parents and siblings, who may also provide resources such as a small loan. Less than one-quarter of participants had revealed their sexuality to their families in this study. Consequently, familial cognitive resources such as emotional support may be limited. Consistent with these findings, a previous study observed that gay men have reduced access to family and spousal social resources, receiving more social support from their ‘family of

choice', comprised more of close friends than birth family (40). Participants also reported access to a greater variety of total resources through MSM than heterosexual social capital networks, likely as a direct result of the network diversity available in MSM social capital networks. Resource homogeneity is generally higher within a group of people than two different groups (27), and MSM social networks tie individual MSM together because of their sexual behaviors, overriding the socio-demographic homophily that form heterosexual social networks such as educational background, age, and occupation. MSM therefore belong to MSM social networks while simultaneously belonging to more homogenous heterosexual social networks. MSM are therefore able to access resources through other MSM in different heterosexual social networks through structural holes, where network ties provide access to resources unavailable in an individual's regular networks (27). Because access to the same resource through multiple sources leads to redundancy, and access to a resource through one network tie is sufficient (27), network diversity provides access to a greater variety of resources, possibly resulting in greater access to more diverse resources among MSM social networks (17).

MSM social capital access was higher among participants reporting central Tokyo residence, only having male partners, and ever having attended a gay bar or event. This is likely because central Tokyo has the highest MSM population and most gay venues in Japan, and because MSM with only male partners inevitably spend more time with other MSM. Although MSM social capital access was positively associated with gay bar and gay event attendance, it was not associated with gay bathhouse attendance. Similarly, Participants who attended bathhouses and used gay mobile apps primarily for sex reported lower MSM social capital network access compared to those who did not, indicating it is not only frequency but also the purpose of gay mobile app use and gay community participation that influences the development of social capital networks.

The findings that MSM social capital access is not associated with socio-demographic or socio-economic variables, but is rather associated with gay community participation and identification, indicate that MSM social capital provides important resource access to socio-economically deprived MSM not available through heterosexual networks. These findings conform to network diversity theory and the informal nature of MSM social networks, and though not causal in nature, some potential reasons can be posed to explain these differences. One possibility is that differences in MSM and heterosexual network structures contribute to a lack of homophily in correlates of MSM social capital network access. Heterosexual social networks consist largely of formal networks such as co-workers, university friends, and biological family. Social ties formed in these environments are largely homogenous and segregated by age, education, and occupation. MSM social networks may contain more variation in age, educational attainment and occupation because similar to social capital access findings among other populations with limited numbers such as prisons (41), the limited number of choices available for networking with other MSM results in MSM social ties being formed more at areas where MSM gather such as gay venues and increasingly on gay mobile apps (9), where occupations and educational backgrounds are much more varied, rather than at workplace or educational establishments. Furthermore, differences between heterosexual and gay mobile apps may further reduce MSM social network homphily. Whereas popular (mainly) heterosexual mobile dating apps such as Tinder place an emphasis on education, age, and occupation, displaying a verified university, workplace, and age prominently by the pictures and profile, popular gay apps in Japan such as 9Monster do not; rather, priorities are placed on sexual position, versatility and proximity. Considering these factors, MSM may have access to a wider variety of alters and social capital resources through informal social capital networks formed online and at gay venues than heterosexual networks formed at educational and occupational institutions.

Participants who are out about their sexuality to close friends reported higher access to both MSM and heterosexual social capital resources perhaps because MSM who come out are more likely to be extroverted than those who are not out. Two further possible explanations are that 1) for a gay or bisexual man (GBM) to come out to a heterosexual friend, they must already have an established strong social bond with the heterosexual individual which is, in itself, a source of social capital; or 2) coming out to a heterosexual establishes trust, increasing the social bonds between them, and potentially enabling access to resources previously unavailable from the relationship.

Findings from this data set yet to be published observed that participants reporting high MSM social capital had almost one-third the levels of recent suicidal ideation as those reporting low MSM social capital. Heterosexual social capital was not associated with suicidal ideation. Future social health interventions targeting MSM mental health and wellbeing in Greater Tokyo could therefore focus on developing MSM social capital among groups reporting low MSM social capital access such as MSM who are students, living outside of central Tokyo, who have male and female partners, and who use gay mobile apps primarily for sex or for a serious relationship. The establishment of gay community centers or monthly community activities in rural areas, LGBTI student groups, and tailoring community center outreach and networking promotions on gay mobile apps to appeal to MSM seeking serious relationships may be effective MSM social capital building tools, and have been associated with health-positive outcomes in prior studies (19,20,22,23).

This study was subject to a variety of limitations. The results presented were collected from gay mobile apps and may not be representative of all MSM in Japan. However, the participant size was comparatively large, and contained a large proportion of non-gay-venue attending MSM, who may have been underrepresented using other methodologies. Responses were self-rated and may have been influenced by social desirability bias, resulting

in participants downplaying behaviors they think are undesirable (42), though being an online anonymous survey this effect was minimalized. The Resource Generator is a validated scale used previously in Japan (35,39), however, there exists no general consensus for measuring social capital, creating difficulties when making comparisons to other studies.

7.5 Conclusion

This study revealed important differences in prevalence and correlates of access to resources embedded in MSM and heterosexual social capital among MSM in Greater Tokyo. MSM social capital access was associated with gay community participation, being out to close friends and gay community identification, only having male partners, using gay mobile apps for a purpose other than finding sex, and residing in central Tokyo. Heterosexual social capital access was associated with educational attainment, occupation, bisexual behavior, health, and being out to close friends. These findings indicate that MSM social capital provides important resource access to socio-economically and health deprived MSM who would otherwise have difficulty accessing these resources through heterosexual social capital networks. More resources were available to participants through MSM social capital networks than heterosexual social capital networks, including over twice the cognitive social capital resources. In order to close the health disparity between MSM and the general population and within the MSM population itself, policy interventions should focus more specifically on developing MSM social networks through LGBTI community centers and gay mobile app promotions while simultaneously working to reduce discrimination and increase acceptance of sexual minorities in order for MSM to be able to increase their heterosexual cognitive social capital and not rely so heavily on MSM social capital for their wellbeing.

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8. HIV Risk-Taking Behaviors Associated with Access to Resources Embedded in Social Capital Networks among Men who have Sex with Men in Japan

Abstract

Social capital (SC) is an important determinant of HIV risk in modern society. Previous studies have suggested that social capital is positively associated with reduced HIV risk, however, few have investigated if associations vary between men who have sex with men (MSM) and heterosexual alters (possessors of actual resources embedded in social capital networks) and HIV risk-taking behaviors. Using cross-sectional data from an online MSM survey of 1564 participants in Greater Tokyo, I investigated whether social capital is associated with consistent condom use with regular and casual male partners, and lifetime HIV-testing, independent of a variety of individual and community level confounders.

To measure social capital I used eighteen questions assessing the respondents' ability to access both physical and mental-support resources embedded in social networks. Respondents were grouped into three levels of social capital. High SC respondents were defined as 1.0 standard deviation (SD) above the overall mean, low SC respondents as one SD below the overall mean, and medium SC respondents in between; thus 20% to 30% of respondents were grouped into the high and low SC categories.

Multivariate models revealed that participants reporting high heterosexual social capital (SC) were twice as likely to report consistent condom use with casual partners as participants reporting low heterosexual SC (AOR=1.97, 95%CI=1.11 - 3.49). Participants who possessed high MSM SC were over twice as likely to have undertaken HIV testing in their lifetimes (AOR=2.44, 95%CI=1.58 - 3.75), and half as likely to use condoms consistently with regular

male partners (High MSM SC, AOR=0.57, 95%CI=0.39-0.84) as participants reporting low MSM SC.

Due to observed mixed associations between SC and HIV risk behaviors, policy interventions aiming to close the HIV-risk gap for Greater Tokyo MSM should not blindly promote MSM social capital without considering potential negative outcomes.

8.1 Introduction

Human immunodeficiency virus (HIV) testing and consistent condom use are essential components of HIV prevention. Condoms are highly effective at preventing the transmission of HIV and STIs when used correctly and consistently (1), and remain an essential barrier to sexual HIV transmission in Japan where bio-medical prevention methods such as Pre-Exposure Prophylaxis (PrEP) are not available (2). HIV testing is a central pillar of HIV prevention and is associated with reduced condomless anal intercourse (CLAI) (3). Furthermore, HIV testing is a prerequisite for effective treatment as prevention (TasP) strategies, in which all HIV-positive people are treated with anti-retroviral therapy (ART) to stop onward infection to future sexual partners (4,5), and a range of condomless behavioral risk reduction strategies (6).

Although men who have sex with men (MSM) are estimated to make up 4.0% of the male population in Japan (7), they are disproportionately at risk of contracting HIV (8), accounting for 78% of all Japanese male HIV cases in 2016 (9). AIDS remains a substantial health burden for MSM in Japan with over 30% of newly diagnosed HIV cases were reported as AIDS in 2016 (9). Despite the importance of regular HIV testing and consistent condom use for effective HIV prevention, the volume of HIV tests in Japan has reduced by 35% from their peak of 177,000 in 2008 to 118,000 in 2016 (10), and condom use has remained inconsistent among MSM in Japan (8,11,12).

Social capital is increasingly recognized as playing an important part of HIV risk reduction strategies (13), and has been observed as a protective factor for direct and indirect HIV risk (14–17). For example, social capital was observed to be a stronger predictor variable for AIDS cases than poverty or income inequality in the US (18), associated with more frequent HIV testing among MSM and consistent condom use among female sex workers (FSW) in Swaziland (19,20), and associated with lower late HIV testing in the US (21,22). Social capital is defined in this study as resources potentially accessed by individuals through their social networks (23), and consists of an ego (the individual accessing resources through their social networks), alters (possessors of the actual resources provided to the ego), and the resources themselves (ranging from emotional support to a small cash loan).

Despite critical consensus arguing the importance of defining and separating the ego and the alter (15,24,25), because social capital research is often conducted on existing studies, social capital indicators have largely been incapable of this (26). Moreover, social capital outcomes are situational. While social capital networks were observed to facilitate the flow of HIV information, access to testing, and to enable the renegotiation of harmful norms (27), they can also lead to strengthening norms and trust among social capital networks associated with increased risk-taking behaviors (28), or exclude individuals, potentially leading to high levels of HIV risk-taking among excluded non-members (29). It is therefore critically important to distinguish between social capital networks that are associated with HIV risk reducing and HIV risk-taking behaviors. An effective method for proposed distinguishing between social capital networks is to stratify analysis across socio-demographic characteristics such as gender, ethnicity, or sexual minority status (21), which has observed marked differences in health and HIV-risk outcomes (21,30). For example, social capital networks accessed through Japanese alters were associated with higher positive health outcomes among foreign laborers in Japan than social capital networks accessed through foreign alters (30), and in Zimbabwe,

involvement in female community groups were more often associated with reduced HIV prevalence, whereas involvement in male community groups were not, perhaps as a result of the negative health impacts of shows of masculinity (13,27). Despite these observations, there is no previous research stratifying social capital network by alter sexual minority status, examining if MSM social capital networks and heterosexual social capital networks are associated with HIV risk-taking behaviors among MSM.

To the best of our knowledge, there are no previous studies addressing whether and how social capital networks accessed through MSM and social capital networks accessed through heterosexual are associated with differing HIV risk-taking behaviors among MSM. This study addresses this research gap and examines if MSM social capital networks and heterosexual social capital networks are associated with differing HIV testing and condom use behaviors among MSM in Japan. These findings help identify protective factors that enable people to engage in HIV risk reducing behaviors and inform the development of social HIV intervention strategies for this hard-to-reach sub-population at the center of the Japanese HIV epidemic.

8.2 Methods

I undertook a cross-sectional survey among MSM who use gay mobile apps in Greater Tokyo using an anonymous, self-administered and structured questionnaire. Ethics approval was provided by the Human Research Ethics Committee at the University of Melbourne (HREC 1646197).

8.2.1 Participants

Participants were aged 18 years or older, self-identified as MSM (defined as identifying as homosexual or identifying as ‘gay’ or ‘bisexual’, or having sexual experience with other

men), and had provided online consent to participate in the survey. Participation was voluntary and there were no consequences for electing not to participate. The questionnaire was translated from English into Japanese by a native translator and back-translated into English by an independent translator. Duplicate IP addresses, email 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.

8.2.2 Recruitment

Recruitment is described in detail in previous publications (11,31). In brief, participants were recruited using the geo-location feature of gay mobile apps, similar to methods previously used to recruit Grindr users in the US (32,33). Initially, the mobile apps were opened on a mobile phone and one online user was selected from each row until 50 previously uncontacted users were messaged with a link to the survey. I recruited 215 participants using this approach between November 22nd 2016 to January 16th 2017. Between January 17th 2017 to January 23rd 2017 I placed a splash screen advertisement poster (a full screen advertisement showed to users when opening the app) on gay mobile apps with a link to the survey. This methodology had previously been used with success in the US (34,35). It was shown in rotation whenever the application was opened by users in the Greater Tokyo area, recruiting a further 1442 participants resulting in 1657 valid participants.

8.2.3 Measures

Questions regarding the socio-demographic confounders were adapted from previous research in Japan (30), including age, gender, sexual identification, marital status (marriage is only legal between men and women in Japan), birthplace, current residence, self-rated health

status, highest level of education, employment status, and whether or not they had sexual relationships with men only or both men and women. In previous studies, education has been found associated with HIV testing (36,37) and condom use (38–40); both bisexual behavior (36), and bisexual identity (12,41) have been observed associated with lower lifetime HIV testing; age has been observed associated with lower condom use (42), but higher rates of HIV testing (41); rural residency has been observed associated with lower lifetime and recent HIV testing among MSM (43,44); and married or cohabiting MSM were found less likely to report condom use at last sex than unmarried and not cohabiting MSM (45).

Respondents were asked three questions regarding frequency of lifetime condom use during penetrative or receptive anal intercourse with regular and casual male partners as well as vaginal intercourse with female partners. Lifetime condom use frequency was recorded as 'never', 'rarely', 'most of the time', and 'always'. 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' (46). Condom use analyses excluded those who did not have intercourse with each respective partner type. Respondents were asked if they had ever had an HIV test, with 'yes' or 'no' response options.

Gay community participation measured years and frequency of gay bar and gay event attendance, frequency of bathhouse (*hattenba*) attendance, gay group activity participation in the past six months, and gay community identification. Social capital was measured using the Resource Generator (24), a validated instrument (47) to assess individual social capital, conceptualized as valued resources that individuals can access through their social networks (26). It contained 18 culturally-adapted questions assessing participants' ability to access both physical and mental support resources embedded in social networks through MSM or heterosexual alters, for example, 'Do you have access to an MSM, a heterosexual, both, or neither who you trust very much?' Participants were grouped into three levels of social capital

(high, medium, and low). High SC participants were defined as 1.0 standard deviation (SD) above the overall mean, low SC participants as one SD below the overall mean, and medium SC participants in-between. There was high reliability for the MSM social capital scale (Cronbach's alpha = 0.91) and heterosexual social capital scales (Cronbach's alpha = 0.91). Downward leveling norms were conceptualized by Alejandro Portes as potential negative social capital outcomes (48) and measured by the question, 'Do you know an MSM or heterosexual who influences you to engage in unsafe sex?'. Participants could choose one of the following four responses: 'heterosexual', 'MSM', 'both', 'neither'.

8.2.4 Statistical Analysis

Data were analyzed using SPSS version 24. I used multivariate binary logistic regression analysis to examine the correlates of condom use and HIV testing. The enter method was used and variables with unadjusted odds ratios yielding p-values of 0.10 or less were considered eligible for the multivariate model. Unadjusted and adjusted odds ratios with their respective 95% confidence intervals and p-values are reported in the tables.

8.3 Results

8.3.1 Socio-demographics and gay community participation

A total of 1564 participants answered all social capital questions and were included in this analysis. Over half (53.6%) of the 1564 participants resided in central Tokyo, and almost all (96.3%) respondents were born in Japan (Table 25). The median age was 35, two-thirds (68.2%) were employed fulltime, over half (59.0%) had a university education, and a small minority (4.1%) were married to women. Most participants (91.2%) had only male sexual partners, and 8.8% reported having both male and female sex partners. Over half of participants (56.7%) had ever attended a gay bar, and less than half (48.0%) had ever attended a gay

bathhouse. A minority had participated in organized gay group activities in the past six-months (13.4%).

Table 25: Socio-demographic, social capital and gay community participation (n=1564)

			Mean		p-Value		
	n	%	MSM Social Capital	Heterosexual Social Capital	Regular male partner consistent condom use[a]	Casual male partner consistent condom use[b]	Lifetime HIV Testing
MSM Social Capital							
Low	325	20.8	2.0	6.4	REF		
Medium	927	59.3	11.4	8.7	0.024	0.089	0.000
High	312	19.9	16.7	11.8	0.085	0.785	0.000
Heterosexual Social Capital							
Low	342	21.9	7.7	1.1	REF		
Medium	956	61.1	10.7	9.6	0.252	0.075	0.142
High	266	17.0	13.2	16.0	0.088	0.000	0.714
Know someone who influences you to engage in unsafe sex					REF		
Heterosexual	58	3.5	10.8	10.5	0.302	0.282	0.018
MSM	370	22.6	12.1	9.4	0.000	0.000	0.000
Current residence							
Central Tokyo	833	53.6	11.5	9.1	REF		
Greater Tokyo	524	33.7	9.5	8.5	0.534	0.062	0.001
Other prefecture	196	12.6	8.8	8.4	0.586	0.061	0.000
Birthplace							
Other	58	3.7	13.0	10.8	REF		
Japan	1506	96.3	10.4	8.7	0.112	0.44	0.969
Age							
18 – 25	302	19.4	9.6	10.0	REF		
26 – 35	523	33.6	10.8	9.5	0.078	0.630	0.000
36 – 40	478	30.7	10.6	8.0	0.059	0.071	0.000
46+	254	16.3	10.7	7.6	0.006	0.015	0.000
Marital status							
Single	1499	95.9	10.6	8.8	REF		
Married	64	4.1	8.4	9.0	0.005	0.871	0.024

Employment							
Full-time work	1065	68.2	10.7	8.8	REF		
Part-time work	180	11.5	9.4	7.2	0.653	0.037	0.015
Student	155	9.9	9.4	11.1	0.001	0.059	0.000
Self-employed	95	6.1	12.1	9.8	0.766	0.597	0.129
Unemployed	67	4.3	10.5	6.6	0.675	0.006	0.607
Education							
High School or less	394	25.2	9.8	7.9	REF		
2 year university	263	16.8	10.0	8.0	0.130	0.000	0.026
University	756	48.3	10.9	9.3	0.009	0.000	0.000
Graduate degree	151	9.7	10.8	10.3	0.005	0.000	0.000
Intercourse partner sex							
Men	1408	91.2	10.7	8.6	REF		
Men and women	136	8.8	8.5	11.1	0.018	0.246	0.000
Health							
Fair or poor health	572	36.6	9.7	9.6	REF		
Healthy	990	63.4	10.9	7.4	0.106	0.003	0.311
Ever attended gay bar or event							
No	674	43.3	8.5	8.5	REF		
Yes	884	56.7	12.0	9.1	0.885	0.913	0.000
Ever attended gay bathhouse							
No	810	52.0	10.2	9.2	REF		
Yes	748	48.0	10.8	8.4	0.111	0.001	0.000
Participated in organized gay group activity in past 6 months							
No	1351	86.6	10.2	8.7	REF		
Yes	209	13.4	12.5	9.9	0.000	0.040	0.000
Identify as a member of the gay community							
Neutral/disagree	270	17.4	9.2	8.0	REF		
Agree	1286	82.6	10.8	9.0	0.144	0.677	0.002

[a] analysis based on a subsample of 1328 respondents who have anal sex with a regular partner

[b] analysis based on a subsample of 1261 respondents who have anal sex with a casual partner

[ab]Consistent condom use = most of the time/always use a condom

8.3.2 Social Capital and HIV Prevention

Almost three-quarters of participants (73.3%) had been tested for HIV (Table 26). Consistent condom use was reported by almost two-thirds (62.7%) of participants with regular male partners, 82.3% with casual male partners.

Table 26: HIV prevention characteristics (n=1564)

		n	%	Mean MSM Social Capital	Mean Heterosexual Social Capital
Have you ever been tested for HIV?	No	416	26.7	8.7	8.6
	Yes	1143	73.3	11.1	8.9
Condom use consistency with regular (penetrative and receptive anal sex) male partners? [a]	Inconsistent	495	37.3	11.0	8.4
	Consistent	833	62.7	10.6	9.2
Condom use consistency with casual (penetrative and receptive anal sex) male partners? [b]	Inconsistent	223	17.7	10.6	7.5
	Consistent	1038	82.3	10.7	9.2

8.3.3 Social capital correlates of HIV testing and consistent condom use

In the final multivariate logistic regression model (Table 27) participants reporting high heterosexual social capital (SC) were twice as likely to report consistent condom use with casual partners than participants reporting low heterosexual SC (AOR=1.97, 95%CI=1.11 - 3.49). Participants who possessed high MSM SC (AOR=2.44, 95%CI=1.58 - 3.75) or medium MSM SC (AOR=1.62, 95%CI=1.21 - 2.17) were twice as likely and 1.5 times more likely respectively to have undertaken HIV testing in their lifetimes, and half as likely to use condoms consistently with regular male partners (High MSM SC, AOR=0.57, 95%CI=0.39-0.84; Medium MSM SC, AOR=0.62, 95%CI=0.46-0.83). Participants reporting medium MSM SC were half as likely to use condoms consistently with casual male partners (Medium MSM SC, AOR=0.64, 95%CI=0.43-0.95) than participants reporting low MSM SC. Participants with

access to MSM who influenced them to practice unsafe sex were less likely to use condoms consistently with regular male partners (AOR=0.54, 95%CI=0.41-0.70) or casual male partners (AOR=0.52, 95%CI=0.38-0.73) but more likely to have undertaken lifetime HIV testing (AOR=1.47, 95%CI=1.07-2.01) than participants reporting no access to MSM who influenced them to practice unsafe sex.

Table 27: Multivariate logistic regression for consistent condom use with regular and casual male partners and lifetime HIV testing (n=1564)

	Consistent regular male partner condom use		Consistent casual male partner condom use		Lifetime HIV testing	
	A.O.R (95% C.I.)	p-Value	A.O.R (95% C.I.)	p-Value	A.O.R (95% C.I.)	p-Value
MSM Social Capital						
Low	REF					
Medium	0.62 (0.46 - 0.83)	0.002	0.64 (0.43 - 0.95)	0.027	1.62 (1.21 - 2.17)	0.001
High	0.57 (0.39 - 0.84)	0.004	0.80 (0.47 - 1.35)	0.398	2.44 (1.58 - 3.75)	0.000
Heterosexual Social Capital						
Low	REF					
Medium	1.23 (0.92 - 1.62)	0.158	1.27 (0.89 - 1.81)	0.191	1.04 (0.77 - 1.40)	0.801
High	1.34 (0.89 - 1.99)	0.157	1.97 (1.11 - 3.49)	0.020	0.97 (0.63 - 1.47)	0.869
Combined Heterosexual and MSM Social Capital						
Low	REF					
Medium	0.60 (0.45 - 0.81)	0.001	0.76 (0.52 - 1.12)	0.171	1.72 (1.30 - 2.30)	0.000
High	0.65 (0.45 - 0.93)	0.020	0.93 (0.57 - 1.54)	0.789	1.80 (1.21 - 2.66)	0.003
Know someone who influences you to engage in unsafe sex						
Heterosexual	1.14 (0.62 - 2.11)	0.672	1.25 (0.52 - 3.00)	0.618	0.63 (0.34 - 1.17)	0.141
MSM	0.54 (0.41 - 0.70)	0.000	0.52 (0.38 - 0.73)	0.000	1.47 (1.07 - 2.01)	0.016
Current residence						
Central Tokyo			REF			
Greater Tokyo			1.42 (1.01 - 1.99)	0.043	0.88 (0.67 - 1.15)	0.345
Other prefecture			1.73 (1.03 - 2.90)	0.038	0.72 (0.50 - 1.04)	0.077
Birthplace						
Other			REF			
Japan			0.64 (0.24 - 1.70)	0.371		

Age						
18 – 25	REF					
26 – 35	0.95 (0.79 - 1.14)	0.596	0.98 (0.75 - 1.27)	0.862	1.35 (1.12 - 1.61)	0.001
36 – 40	1.00 (0.88 - 1.13)	0.950	0.95 (0.80 - 1.13)	0.550	1.41 (1.24 - 1.60)	0.000
46+	0.96 (0.86 - 1.07)	0.451	0.89 (0.77 - 1.03)	0.127	1.29 (1.15 - 1.45)	0.000
Marital status						
Single	REF					
Married	0.38 (0.22 - 0.67)	0.001			0.51 (0.29 - 0.90)	0.019
Employment						
Full-time work	REF					
Part-time work	1.04 (0.72 - 1.50)	0.827	0.85 (0.54 - 1.34)	0.483	0.84 (0.57 - 1.23)	0.366
Student	1.70 (1.04 - 2.77)	0.033	1.28 (0.62 - 2.61)	0.503	0.70 (0.45 - 1.09)	0.118
Self-employed	1.06 (0.65 - 1.72)	0.814	1.23 (0.61 - 2.46)	0.562	0.54 (0.33 - 0.87)	0.013
Unemployed	0.94 (0.52 - 1.68)	0.828	0.55 (0.29 - 1.04)	0.067	1.15 (0.60 - 2.18)	0.672
Education						
High School or less	REF					
2 year university	1.09 (0.99 - 1.18)	0.068	1.26 (1.12 - 1.41)	0.000	1.02 (0.93 - 1.12)	0.728
University	1.53 (1.16 - 2.02)	0.003	2.57 (1.79 - 3.68)	0.000	1.33 (0.99 - 1.80)	0.056
Graduate degree	1.76 (1.12 - 2.78)	0.014	3.96 (1.98 - 7.90)	0.000	1.83 (1.11 - 3.01)	0.017
Intercourse partner sex						
Men	REF					
Men and women	1.76 (1.12 - 2.76)	0.014			0.68 (0.45 - 1.01)	0.056
Health						
Fair or poor health			REF			
Healthy			1.21 (0.89 - 1.66)	0.220		
Ever attended gay bar or event						
No					REF	
Yes					1.60 (1.23 - 2.08)	0.000
Ever attended gay bathhouse						
No			REF			
Yes			0.62 (0.45 - 0.85)	0.003	1.71 (1.33 - 2.20)	0.000
Participated in gay group activity in past 6 months						

No	REF					
Yes	1.97 (1.39 - 2.81)	0.000	1.77 (1.09 - 2.89)	0.022	1.69 (1.10 - 2.60)	0.017
Identify as a member of the gay community						
Neutral/disagree					REF	
Agree					1.23 (0.90 - 1.67)	0.190

[a] analysis based on a subsample of 1328 respondents who have anal sex with a regular partner

[b] analysis based on a subsample of 1261 respondents who have anal sex with a casual partner

[ab]Consistent condom use = most of the time/always use a condom

8.4 Discussion

This exploratory separation of alter sexual identity reveals important differences in HIV testing and condom use associated with MSM and heterosexual social capital. Participants with high heterosexual social capital reported double the odds of consistent condom use with casual partners than participants reporting low heterosexual social capital. Participants reporting high MSM social capital were over twice as likely to have undertaken HIV testing in their lifetimes, but half as likely to use condoms consistently with regular male partners as participants reporting low MSM social capital. Participants with access to MSM who influenced them to practice unsafe sex were less likely to use condoms consistently with regular and casual male partners, but more likely to have undertaken lifetime HIV testing than participants reporting no access to MSM who influenced them to practice unsafe sex.

Participants reporting high MSM social capital access were five-times as likely to report lifetime HIV testing as participants reporting low social capital in univariate regressions. Furthermore, gay venue attendance (defined in this study as gay bar and event, gay bathhouse, and organized recent gay activity participation) was associated with increased HIV testing among Japanese MSM in prior research (12). However, in the final multivariate regression controlling for gay venue attendance, participants reporting high MSM social capital were over twice as likely to report ever having undergone HIV testing as those reporting low social

capital, indicating an association with lifetime HIV testing independent of gay venue attendance. Consistent with these findings, previous studies have observed social capital to be positively associated with higher HIV testing (49) and lower late testing (22) in the US.

Whereas participants with high heterosexual social capital were twice as likely to report consistent condom use with casual male partners, participants with high MSM social capital reported less consistent condom use with regular partners. These finding illustrate the contextual influence social capital exerts as social control (50). Social network members often share similar norms and HIV risk behavior levels (51), and the association between high MSM social capital and inconsistent condom use with regular partners coheres to the theorized effects of downward leveling norms (25,48), consistent with existing literature observing associations between social capital and HIV risk-taking behaviors among MSM. For example, perceived lower approval concerning condom use in social networks was associated with higher HIV risk (52), and MSM possessing networks made up of predominantly other gay men was associated with elevated HIV risk behaviors such as insertive UAI in the US (53). In light of the elevated HIV risk MSM face compared to the general population in Japan (8), it is important to observe behaviors associated with HIV risk among this population. However, assessing HIV risk that participants engaging in CLAI with regular male partners face is problematic without knowing their PrEP status, undetectable viral load (UVL), HIV status, or level of engagement in negotiated safety. Nonetheless, PrEP is not approved or distributed in Japan (2), and negotiated safety has not been promoted strongly, thus participants with high MSM social capital who are twice as likely to engage in CLAI with regular partners are potentially at higher risk for HIV.

When social capital is not stratified by alter sexual identity, forming a ‘combined MSM & heterosexual social capital’ access score, the positive associations between heterosexual social capital and consistent condom use with casual partners, and medium MSM social capital with inconsistent condom use with casual partners become statistically non-significant. These

results demonstrate the benefits of using disaggregating social capital by alter sexual identity to gain a clearer understanding of associations between social capital and HIV risk-taking behaviors, and may help explain non-significant associations between social capital and condom use in previous studies (54,55).

The differences in HIV risk-taking behaviors associated with heterosexual and MSM social capital networks are important when implementing social HIV interventions. Because MSM social capital is associated with inconsistent condom use with regular partners, interventions aiming to simply grow social capital among MSM in Japan may unintentionally spread perceived norms of inconsistent condom use. Interventions promoting consistent condom use with all partner types may therefore be an effective approach to increase condom use among MSM reporting high MSM social capital. However, evidence suggests that MSM are less willing to use condoms in committed relationships with regular partners than with casual partners (56,57), and the inclusion of behavioral risk reduction interventions addressing MSM unwilling to use condoms with regular partners is therefore important, particularly with the unavailability of bio-medical interventions such as PrEP in Japan. Findings regarding condomless HIV risk reduction behaviors among gay men show that MSM engaging in any type of condomless HIV risk reduction behavior were much less likely to contract HIV than those engaging in CLAI without any type of condomless HIV risk reduction behavior (6), a probable reason that only one-tenth (10.6%) of HIV infection ascribed to a committed partner in Australia (58), where condomless behavioral risk reduction has been heavily promoted, compared to 68% in the US where condomless behavioral risk reduction strategies have not been widely disseminated (59). A combination of condom use and condomless behavioral risk reduction promotions via gay mobile apps and at *hattenba* may therefore be the most wide-reaching strategy for reducing HIV transmissions among MSM engaging in CLAI.

Organized gay group activity participation was associated with higher condom use with regular and casual partners and HIV testing, indicating that non-governmental-organization (NGO) and gay community center MSM HIV prevention outreach in Japan effectively strengthens positive social norms among participants. However, only 13.4% of participants had participated in the past six-months, and gay community center funding in Japan is limited (60), requiring more resources in order to successfully spread these HIV-risk lowering norms among social networks, particularly among at-risk MSM with lower educational attainment and YMSM. Interventions seeking to foster these risk-reducing behaviors among other MSM should seek to extend the reach of these organized group activities among a wider array of MSM. However, there is little trust among MSM for government provided information (31), and top-down interventions may reduce the effectiveness of the local Japanese activism central to the spread of these risk-reducing norms (27). Efforts to involve more MSM with sexual minority related community activities and NGOs may therefore be more effective for the spreading and uptake of positive risk-reducing norms among Japanese MSM than simply expanding MSM social capital or governmental risk-reduction messaging.

Considering the paucity of research in this area in Japan, this research advances our understanding of mechanisms such as alter sexual identity and social capital indicator, demonstrating how these mitigate HIV risk-taking behaviors. However, this study was subject to a variety of limitations that must be taken into account when analyzing this research. The results presented were collected from gay mobile apps and may not be representative of all MSM in Japan. However, our sample size was relatively large, and is the first to examine social capital among gay-mobile app users, which include a large proportion of non-gay community attached MSM who may not have been represented in past studies. Furthermore, the behaviors and attitudes reported were self-rated and may have been subject to social desirability bias where participants may downplay certain behaviors they believe are undesirable (61). However,

because the survey was anonymous and online this effect was minimized. The resource generator is a validated and comparable scale that has been used previously in Japan (30,62). Nonetheless, there is no universal consensus on how to correctly measure social capital, and this poses difficulties for direct comparison with other studies. Further work would be beneficial on this subject. International scholars could investigate if these directions of association are replicated in other MSM populations in Asia and the West. Although Japan is still relatively ethnically homogenous, exploration of how sexual identity mitigates social capital and HIV risk behaviors for MSM of different ethnic backgrounds may yield important differences.

8.5 Conclusion

This study observed that whereas heterosexual social capital was associated with higher levels of condom use with causal partners, MSM social capital was associated with higher levels of HIV testing and lower levels of regular partner condom use. Associations between MSM social capital and HIV testing independent of gay venue participation indicate potential for integrating social capital enhancement programs into current HIV interventions. However, HIV risk posed by associations between MSM social capital and inconsistent condom use must be considered, particularly in Japan where PrEP is not approved and condoms are still a primary physical barrier for HIV among MSM. In order to close the HIV-risk gap for greater Tokyo MSM, policy interventions should focus more specifically on deprived socio-demographic groups, such as those who have less educational attainment and exposure to sex-education, and further promote social networks associated with organized gay community activities.

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9 Social Correlates of Recent Suicidal Ideation Among Men Who Have Sex with Men in Greater Tokyo

Abstract

Suicide is a major public health problem in Japan, where rates of occurrence are among the highest in the world. Globally, men who have sex with men (MSM) report elevated rates of suicidal ideation and attempts compared to their heterosexual peers. However, there is a paucity of research on suicidal ideation among MSM in Japan, where MSM continue to experience significant stigma and discrimination, and where resources are limited for MSM-specific mental health support. This study examined the prevalence and correlates of recent suicidal ideation among MSM in Greater Tokyo. We recruited 1,657 MSM for an anonymous, online, cross-sectional survey posted on social mobile applications popular with MSM in Japan (e.g., Grindr, 9Monster). Recent suicidal ideation, measured as suicidal thoughts in the preceding two weeks, was reported by almost one-third (31%) of participants. Participants who reported unemployment or part-time employment (compared to full-time employment) and knowing a heterosexual person who restricted their freedom or excluded them from a group had higher odds of suicidal ideation. Being aged 46 years or older, reporting good health, and having a medium or high level of access to social capital networks with other MSM were associated with reduced odds of suicidal ideation. Our findings indicate that suicide prevention interventions with MSM in Greater Tokyo and similar urban settings in Japan should work to enhance MSM social networks as a protective factor; attend to employment concerns, particularly in younger MSM; and enhance current efforts to address stigma and discrimination in the community.

9.1 Introduction

Suicide is a major public health issue in Japan, where suicide mortality rates are among the highest globally (1). In 2016, the suicide rate was 20.5 per 100,000 in Japan, almost double the global average of 10.5 per 100,000 (2). In 2016, the majority of the 2,045 suicide deaths in Tokyo were male (1,328 male; 717 female), and suicide was the leading cause of death among residents under forty years of age, the second leading cause of death among those in their forties, and fourth among those in their fifties (3).

Suicidal ideation is an important predictor of future suicide (4–6), and is associated with the same risk factors as attempted and completed suicides (7,8). Globally, men who have sex with men (MSM) report elevated rates of suicidal ideation compared to heterosexuals (9)(10). Sexual orientation is independently associated with suicidal ideation (11), and a longitudinal study of adolescent health observed that risk markers for suicidal behavior differ in importance between lesbian, gay, and bisexual (LGB) and non-LGB adolescents in the US (10,12). However, there is a paucity of research on suicidal ideation among MSM in Japan.

Social pressure and distress experienced by MSM in Japan are rooted in several factors. Although homosexual behavior is not illegal, MSM face discrimination from Japanese politicians (13) and media (14), frequent verbal harassment due to homophobic bias (15), bullying in schools (16), and high levels of sexual victimization and forced sex (17). Furthermore, heteronormativity and familial pressures to marry and produce offspring – as well as a low acceptance of homosexuality among family members (14) – lead many MSM to conceal their sexuality, which is associated with poor mental health among MSM elsewhere (18). In a society with increasing yet still few codified protections against sexual-orientation discrimination and limited resources available for MSM mental health support (19) (20), these factors likely contribute to the high levels of suicidal ideation described previously (15,17).

An estimated two-thirds of Japanese MSM are not attached to the gay community (21), and novel sampling approaches are required to reach a broader population of MSM. Gay geo-social networking applications, henceforth gay mobile apps, enable users to use global positioning systems (GPS) in mobile phones to search through a grid of nearby users based on their proximity, and to contact and meet nearby users, enabling MSM to encounter each other more quickly and easily (22,23). Gay mobile apps have very quickly become one of the most popular ways to arrange dates and sex among MSM globally (24) and in Japan (15), and have been found elsewhere to increase research access to MSM not traditionally accessible through venue-based surveys (23,25–28). While gay mobile apps have been used to recruit samples of MSM in the United States, Australia, and China (29)(30), this was a novel recruitment strategy when this study was undertaken in November 2016 in Japan.

There is only one published study regarding MSM mental health this decade in Japan we are aware of (17). Our purpose was therefore to contribute to this area of limited research in Japan by measuring the prevalence of suicidal ideation and identify risk factors for suicidal ideation in order to inform suicide prevention strategies for this hard-to-reach population.

9.2 Methods

We undertook a cross-sectional survey among MSM who use gay mobile apps in Greater Tokyo using an anonymous, self-administered, and structured questionnaire. Ethics approval was provided by the Human Research Ethics Committee at the University of Melbourne (HREC 1646197).

9.2.1 Participants and recruitment

Participants were aged 18 years or older, self-identified as MSM (defined as identifying as homosexual or identifying as ‘gay’ or ‘bisexual’, or having sexual experience with other

men), and had provided online consent to participate in the survey. All participants were provided with information on local MSM helplines at the conclusion of the survey. The questionnaire was translated and back-translated from English into Japanese. All survey participants were notified that they could win prizes of up to 10,000 yen (70 GBP) by random lottery, and opt in to receive a survey results report.

Recruitment is described in detail in previous studies (31). In brief, participants were recruited via gay mobile apps using two methods that have been successfully used by studies in the US (23,32) (19,21). First, participants were recruited using the geo-location feature of gay mobile apps popular with MSM in Japan (Grindr, jack'd, and 9Monster). Second, advertisements were placed on the 9Monster app, directing potential participants to the survey. Recruitment ran from November 2016 to January 2017.

9.2.2 Study Measures

Socio-demographics and mobile app use

Questions regarding the socio-demographic characteristics of participants were adapted from previous research in Japan (33), including age, gender, sexual identification, marital status (NB: marriage is only legal between men and women in Japan), birthplace, current residence, self-rated health status, highest level of education, employment status, and whether or not they had sexual relationships with men only or both men and women. Participants were asked how frequently they used gay mobile apps, and a 5-point Likert scale (strongly disagree to strongly agree) measured whether they were motivated to use these apps 'to find sex', 'to find friends', 'to find a serious relationship', and/or 'to avoid being identified as gay' (i.e., attending a gay bar or public event).

Suicidal ideation

The two-week prevalence of suicidal ideation was measured by using item 9 on the Patient Health Questionnaire-9 (PHQ9) (34,35). PHQ-9 item 9 asks participants 'In the past two weeks, how often have you been bothered by 'thoughts you would be better off dead or of hurting yourself in some way' with four possible responses, 'not at all', 'several days', 'more than half the days', 'nearly every day'. Participants who responded 'several days', 'more than half the days' and 'nearly every day' were collapsed into one category in a dichotomous variable and compared against those who responded 'not at all'. Responses to PHQ-9 item 9 indicating any suicidal ideation were associated with a significantly increased risk of suicide attempt and suicide mortality in two large-sample studies of patients in integrated health systems in the United States (36).

Gay community participation and social capital

Gay community participation was measured as frequency of gay bar and gay event attendance, frequency of gay bathhouse (*hattenba*) attendance, and gay group activity participation in the past six-months. Social capital was measured using The Resource Generator (37), a validated instrument (38) to assess individual social capital, conceptualized as valued resources that individuals can access through their social networks (39). Across populations, social capital has been found to be an important predictor of better physical and mental health (40–43), and was associated with reduced suicidal ideation among heterosexuals in Japan (43). Participants were assigned high social capital if their score on this instrument was at least 1.0 standard deviation (SD) above the overall mean; low social capital if at least one SD below the overall mean, and medium social capital if their score lay between these extremes. Reliability was high for the MSM social capital and heterosexual social capital scales (Cronbach's alpha = 0.91). Group exclusion and restriction of freedom were conceptualized by Alejandro Portes as potential negative social capital outcomes (44) and measured by two questions: 'Do you

know an MSM or heterosexual who makes you feel excluded from a group?' 'Do you know an MSM or heterosexual who restricts your freedom?' Participants could choose one of the following four responses: 'heterosexual', 'MSM', 'both', 'neither'.

9.2.3 Statistical analysis

Data were analyzed using SPSS version 24. We used multivariate logistic regression analysis to examine the correlates of recent suicidal ideation. The enter method was used, and variables with unadjusted odds ratios yielding p-values of 0.10 or less were considered eligible for the multivariate model. Unadjusted and adjusted odds ratios with their respective 95% confidence intervals and p-values are reported in the tables.

9.3 Results

9.3.1 Recent suicidal ideation and socio-demographics

Recent suicidal ideation and socio-demographic characteristics of the sample are displayed in Table 28. Almost one third (30.9%) of participants had experienced suicidal ideation in the preceding two weeks. The mean age of participants was 35.3 years old (SD = 9.8), with a range from 18 – 69 years of age, and almost all (96.3%) were born in Japan. Most respondents were unmarried (95.6%) and educated, with 96.7% completing high school, and 58.1% completing university or a postgraduate degree. Nearly three quarters (73.9%) were employed fulltime by a company or self-employed, 11.2% were employed part-time, and 4.2% were unemployed. Nine-tenths (89.6%) of participants had only male partners and 11.4% had both male and female sex partners.

Table 28: Recent suicidal ideation and socio-demographics (n=1651)

	Number of participants (n)	Proportion of participants (%)	% Reporting Suicide Ideation in Past Two Weeks
Recent Suicidal Ideation			
Yes	510	30.9	100.0
No	1141	69.1	0.0
Age (years)			
18 - 25	319	19.4	34.2
26 - 35	549	33.4	31.9
36 - 45	506	30.8	34.2
46+	268	16.3	19.4
Place of Birth			
Other	62	3.8	17.7
Japan	1588	96.2	31.4
Education			
High School or less	420	25.4	36.9
2-year university	271	16.4	38.4
University	799	48.4	26.0
Postgraduate degree	161	9.8	26.7
Employment			
Full-time work	1129	68.5	26.9
Part-time work	185	11.2	45.4
Student	168	10.2	29.8
Self-employed	98	5.9	31.6
Unemployed	69	4.2	59.4
Current marital status			
Single	1578	95.6	31.6
Married	72	4.4	15.3
Current residence			
Central Tokyo	882	53.8	30.6
Greater Tokyo	550	33.5	32.7
Other prefecture	208	12.7	26.9

Intercourse partners			
Only men	1483	89.6	32.0
Both men and women	146	10.4	20.5
Health			
Fair/poor health	595	36.1	46.9
Healthy	1054	63.9	21.7

9.3.2 Gay community participation and identification

Over half were out to close friends (59.1%), and most participants (91.4%) used gay mobile applications twice a week or more (Table 29). Over three-quarters (75.5%) of participants reported using gay SNS to meet friends, and the second most common reason was to meet sex partners (61.4%), while over half of participants (53.2%) reported using gay mobile SNS for a serious relationship, and very few (8.1%) reported using them to avoid being identified as gay (i.e., as an alternative to attending a gay bar or public event). A little over half of participants (56.9%) had ever attended a gay bar or gay event, and less than half (47.5%) had ever attended a gay bathhouse, and a small minority (13.2%) had participated or volunteered in organized gay group activities in the past six-months.

Table 29: Gay community participation and identification (n=1651)

	Number of participants (n)	Proportion of participants (%)	% Reporting Suicide Ideation in Past Two Weeks
Out to close friends			
No	667	40.9	29.2
Yes	963	59.1	31.9
Gay mobile app use frequency			
Less than twice a week	139	8.6	38.1
Twice a week or more	1472	91.4	30.2

Use gay mobile apps for sex			
No	635	38.7	31.5
Yes	1007	61.3	30.6
Use gay mobile apps to make friends			
No	401	24.5	30.2
Yes	1233	75.5	31.1
Use gay mobile apps to conceal sexuality			
No	1493	91.9	30.6
Yes	132	8.1	34.8
Use gay mobile apps to find a serious relationship			
No	764	46.8	28.9
Yes	867	53.2	32.8
Ever attended a gay bar or event			
No	710	43.1	33.8
Yes	935	56.9	28.7
Recent participation in gay group/community or volunteer activities			
No	1429	86.8	31.8
Yes	218	13.2	24.8
Ever attended a bathhouse			
No	864	52.5	31.3
Yes	781	47.5	30.5

9.3.3 Social capital, social exclusion, and restricted freedoms

Mean MSM social capital was higher (10.5/18) than mean heterosexual social capital (8.8) (Table 30). Double the number of participants knew a heterosexual who restricted their freedoms (16.5%) than knew a homosexual who did so (8.1%), and more participants knew a heterosexual who excluded them from a group (4.5%) than knew a homosexual who did so (2.8%).

Table 30: Social capital, group exclusion and restricted freedom (n=1631)

	Number of participants (n)	Proportion of participants (%)	% Reporting Suicide Ideation in Past Two Weeks
MSM Social Capital			
Low	324	20.7	43.2
Medium	926	59.3	31.0
High	312	20.0	18.9
Heterosexual Social Capital			
Low	342	21.9	40.4
Medium	954	57.7	30.1
High	266	17.0	22.9
MSM restricts your freedom			
No	1311	80.4	30.2
Yes	320	19.6	34.4
Heterosexual restricts your freedom			
No	1174	72.0	29.5
Yes	457	28.0	35.0
MSM makes you feel excluded from a group			
No	1522	93.6	30.0
Yes	104	6.4	46.2
Heterosexual makes you feel excluded from a group			
No	1494	91.9	29.3
Yes	132	8.1	51.5

9.3.4 Correlates of recent suicidal ideation

Multivariate logistic regression models examining the correlates of suicidal ideation are presented in Table 31. The final multivariate logistic regression model showed that participants who were employed part-time (AOR=1.99, 95%CI=1.38 - 2.88) or were unemployed (AOR=3.39, 95%CI=1.94 - 5.91) were at least twice as likely to experience suicidal ideation compared to those who were employed full-time. Participants who knew a heterosexual who

restricted their freedom (AOR=1.43, 95%CI=1.10 - 1.88) or excluded them from a group (AOR=2.29, 95%CI=1.46 - 3.60) were more likely to experience suicidal ideation than those who did not. Participants who were over 46 years of age were less likely to experience recent suicidal ideation than those aged 18 – 25 (AOR=0.79, 95%CI=0.70 - 0.90). Participants who reported being healthy were less than half as likely to report suicidal ideation than those reporting neutral or poor health (AOR=0.37, 95%CI=0.29-0.47). Participants with high (AOR=0.37, 95%CI=0.24-0.57) or medium (AOR=0.60, 95%CI=0.45 - 0.81) access to MSM social capital networks were two-thirds and one-third less likely, respectively, to experience recent suicidal ideation than those with low MSM social capital access.

Table 31: Multivariate logistic regression on suicidal ideation

	% Reporting Suicide Ideation in Past Two Weeks	Adjusted Odds Ratio (95% C.I.)	p-Value
Socio-demographics			
Age (years)			
18 - 25	34.2	REF	
26 - 35	31.9	0.90 (0.74 - 1.09)	0.294
36 - 45	34.2	0.94 (0.83 - 1.08)	0.393
46+	19.4	0.79 (0.70 - 0.90)	0.000
Place of Birth			
Other	17.7	REF	
Japan	31.4	2.28 (1.08 - 4.82)	0.031
Education			
High School or less	36.9	REF	
2-year university	38.4	1.05 (0.96 - 1.15)	0.268
University	26.0	0.88 (0.66 - 1.19)	0.416
Postgraduate degree	26.7	1.07 (0.67 - 1.70)	0.772
Employment			
Full-time work	26.9	REF	
Part-time work	45.4	1.99 (1.38 - 2.88)	0.000

Student	29.8	0.92 (0.57 - 1.48)	0.726
Self-employed	31.6	1.33 (0.81 - 2.19)	0.258
Unemployed	59.4	3.39 (1.94 - 5.91)	0.000
Current marital status			
Single	31.6	REF	
Married	15.3	0.48 (0.22 - 1.01)	0.053
Intercourse partners			
Only men	32.0	REF	
Both men and women	20.5	0.63 (0.39 - 1.01)	0.057
Health			
Fair/poor health	46.9	REF	
Healthy	21.7	0.37 (0.29 - 0.47)	0.000
Gay mobile app use			
Gay mobile app use frequency			
Less than twice a week	38.1	REF	
Twice a week or more	30.2	0.73 (0.48 - 1.11)	0.141
Use gay mobile apps to find a serious relationship			
No	28.9	REF	
Yes	32.8	1.25 (0.98 - 1.59)	0.070
Gay venue participation			
Ever attended a gay bar			
No	33.8	REF	
Yes	28.7	0.98 (0.75 - 1.26)	0.853
Recent participation in gay group/community or volunteer activities			
No	31.8	REF	
Yes	24.8	0.77 (0.53 - 1.12)	0.168
Social Capital			
MSM Social Capital			
Low	43.2	REF	
Medium	31.0	0.60 (0.45 - 0.81)	0.001
High	18.9	0.37 (0.24 - 0.57)	0.000
Heterosexual Social Capital			
Low	40.4	REF	

Medium	30.1	0.88 (0.58 - 1.36)	0.569
High	22.9	0.79 (0.60 - 1.06)	0.115
Group exclusion and restricted freedom			
Heterosexual restricts your freedom			
No	29.5	REF	
Yes	35.0	1.43 (1.10 - 1.88)	0.008
MSM makes you feel excluded from a group			
No	30.0	REF	
Yes	46.2	1.36 (0.82 - 2.26)	0.228
Heterosexual makes you feel excluded from a group			
No	29.3	REF	
Yes	51.5	2.29 (1.46 - 3.60)	0.000

9.4 Discussion

This was the first study using PHQ-9 to investigate prevalence and correlates of recent suicidal ideation among MSM in Greater Tokyo. A total of 1,651 MSM who use gay mobile apps participated in a survey and answered PHQ-9, of which 510 (30.9%) reported recent suicidal ideation. Recent suicidal ideation was more likely to be reported among participants who worked part-time or were unemployed and who knew a heterosexual who they felt restricted their freedom or excluded them from a group. Lower likelihood of recent suicidal ideation was reported among participants over 46 years of age (compared to those aged 18-25 years), who were healthy (compared to fair/poor health), and who had access to high or medium MSM social capital (compared to low MSM social capital).

Lifetime suicidal ideation among MSM ranges from 13.2% to 55.8% globally (9). Although local comparisons are limited, the 30.9% of recent suicidal ideation reported by this study, and observed lifetime attempted suicide rates of 14-15% (16,17) in two previous studies of MSM in Japan were many times higher than the 10.9% lifetime suicidal ideation and 1.9%

attempt prevalence reported among the Japanese general population (45). A previous study in the U.S. that used PHQ-9 found that respondents with any level of suicidal ideation were approximately three times as likely to attempt suicide within the next 30 days, and twice as likely to attempt suicide within the following year (46). Furthermore, in a study of the general populations in 17 countries, including Japan, 60% of transitions from suicidal thoughts to suicide plan and suicide attempt occurred within the first year of onset (45). Our findings of high prevalence of recent suicidal ideation using the PHQ-9 thus underscore serious concerns about suicide risk among MSM in Japan, and support past findings of high levels of lifetime suicidal ideation in MSM in other countries.

There are frequent claims that gay mobile apps and 'online hook-up culture' are associated with mental health problems and suicidal ideation among MSM (47,48). However, we observed that after adjustment for exclusion, restriction, and concealment of sexuality, commonly considered as proxies for stigma and discrimination (49), gay mobile app use itself was not associated with suicidal ideation regardless of whether the purpose be to find friends or sexual partners. This suggests that underlying social factors play a more important role in MSM mental health than the specific use of gay mobile apps.

Previous studies have found social capital to be associated with lower suicidal ideation and better mental health among the general population in Japan (42,43). The current study elaborated on these findings, investigating how MSM and heterosexual social capital networks mitigated MSM suicidal ideation. Our results show that only participants with higher access to MSM social capital networks reported reduced suicidal ideation; no significant effect on suicidal ideation was found for participants with higher access to heterosexual social capital networks, after adjusting for confounding. These results are consistent with previous findings regarding differences in social support between general and gay populations. Effective social support in the general population is primarily provided through close family and spouses rather

than friends, colleagues, or professionals (50). However, gay men have reduced access to such family and spousal social resources, and place more importance on gay community identity and involvement (51). Gay-identifying men therefore receive more social support from their 'family of choice', comprised more of close friends than birth family (51). It is possible that access to social resources from other MSM enabled participants to shield themselves from some of the stigma in their heteronormative society and thus not have to conceal their sexuality as much – which we know from previous research is associated with higher self-acceptance and lower self-directed homophobia (52) and suicidal ideation (18). Furthermore, the finding that participants reporting heterosexual exclusion had double the odds of suicidal ideation was consistent with previous studies in which enacted heterosexual stigma, including exclusion, was associated with elevated suicidal ideation and suicide attempts among MSM (53,54).

The implications of the social capital findings in this study are twofold: first, established HIV prevention programs and infrastructure already exists in Japan linking the medical and MSM communities throughout Japan (55). This infrastructure could be used to promote MSM mental health and social support in both healthcare and gay community spaces. These include MSM friendly healthcare centers, gay bars, events, and community centers, but should be expanded to include gay social networking services (SNS) and mobile apps. Second, existing efforts to reduce societal stigma against sexual minorities in Japan should be scaled up. The implementation of inclusive sexual minority education in schools is an important first step, and support for older MSM, although observed to have lower suicidal ideation than young MSM (YMSM), still require tailored mental health support. A Canadian study found that while the majority of gay and bisexual men who attempted suicide recently engaged with a health care provider in the past year, one-third sought care from an alternative provider to their general practitioner (GP) (49). Partnerships among government departments, clinicians, non-governmental organizations (NGOs), and MSM communities exist and provide much needed

important support for MSM in Japan. However, they remain underdeveloped in Japan compared to counterparts in Western countries (55), and health workers have limited knowledge of specific mental health and care needs for MSM (56). Appropriate mental health training of specific MSM-oriented centers and clinics, and their subsequent promotion in gay mobile apps utilizing GPS, which have been found effective for promoting HIV testing (57) and show promise for the self-management of suicidal ideation and self-harm (58), may be useful considering the limited resources for MSM suicide prevention in Japan.

Given the observed associations between heterosexual exclusion and suicidal ideation in this study, implementing broader legislative changes to reduce societal exclusion in the broader Japanese context is necessary. Examples include legalizing same-sex marriage, introducing sex education inclusive of sexual minorities in schools, legislation to specifically protect sexual minorities from discrimination, and inclusion of sexual minority status in suicide prevention campaigns. Furthermore, corporations could be incentivised to be more supportive and inclusive of same sex partnerships in family leave and social arrangements, in order for MSM to be more comfortable about including their partners in the complex network of social commitments that define many employment contexts in Japan.

9.4.1 Limitations

This research was subject to a variety of limitations. Participants were recruited through an advertisement in a single metropolitan area and may not be representative of all Japanese MSM. However, our sample size was relatively large, and our study the first to examine recent suicidal ideation among gay-mobile app users, which include a large proportion of non-gay community attached MSM who may not have been represented in past studies. The behaviors and attitudes were self-reported and may have been subject to social desirability bias (59). Because the survey was anonymous and online, this effect was likely minimized. This research

used a limited set of gay mobile applications. Other mobile SNS applications used more by specific MSM sub-populations (e.g., MSM living with HIV) could provide additional information in future research. Although PHQ9 Item 9 is a qualified, validated measure, it is limited in that it only asks one question regarding overall frequency of suicidal thoughts. It does not distinguish actual plans to commit suicide, which are on the more severe end of the ideation continuum, but important to detect. Despite this limitation, as the first study reporting on recent suicidal ideation among this understudied and high-risk population, these findings are important, and indicate the importance for further research including the spectrum of suicidal ideation, planning, and attempts. Finally, the survey was conducted in winter, so we could not investigate seasonal changes which could have affected suicidal ideation.

9.5 Conclusion

Consistent with previous studies, we found prevalence of suicidal ideation among Japanese MSM to be much higher than prevalence reported in the general population, with approximately one-third of Greater Tokyo gay mobile app using MSM considering self-harm or suicide in the past two weeks. Results show that participants with higher access to MSM social capital reported lower suicidal ideation, while participants reporting heterosexual exclusion reported elevated suicidal ideation. This data indicates the importance of promoting mental health among this population while simultaneously working to reduce societal stigma against sexual minorities in Japan through the effective use of modern social networking services, and integration of mental health care into MSM-oriented services in Japan.

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10. Conclusion

10.1 Summary of Key Findings

10.1.1 Prevalence and correlates of HIV testing

In **Chapter 5,** this study examined the prevalence and correlates of HIV testing among gay mobile app users in order: 1) to estimate levels of HIV testing among gay mobile app users in Greater Tokyo; and, 2) to identify high-risk groups associated with lower levels of HIV testing.

Regarding levels of HIV testing, gay mobile app users in Greater Tokyo are unlikely to reach the first of the 90-90-90 aims set by UNAIDS, which aims to have 90% of people living with HIV (PLWH) diagnosed, as only 72.8% of respondents have ever been tested for HIV, and 29.7% in the past six-months. These testing levels were similar to prior findings among Japanese MSM. For example, a 2013 survey of 491 MSM in Greater Tokyo observed only three quarters (72.9%) of respondents to have been tested for HIV in their lifetime, one-third (35.0%) in the past year, and this despite nine-tenths (86.2%) having considered getting an HIV test (1). Lifetime testing of the gay mobile app users in Greater Tokyo surveyed in this study was higher than previous studies in neighboring countries in Southeast Asia, including Korea (59.8%; Sohn & Cho, 2012), China (60.5%; Bien et al., 2015; 58.3% Zhang et al., 2013) and Vietnam (23.5%; Garcia, Duong, Mercer, Meyer, & Ward, 2013).

In multiple regression analysis, correlates of a higher likelihood of lifetime HIV testing were older age, education, greater HIV knowledge, central Tokyo residence (compared to living in another prefecture), gay-community attachment, and anal intercourse with regular and casual male partners. Lifetime testing was negatively associated with regular male partner condom use, marriage and having both male and female partners.

10.1.2 Prevalence and Correlates of Inconsistent Condom Use

Chapter 6 examined the prevalence and correlates of inconsistent condom use with regular and casual male partners and female partners among gay mobile app users in order to 1) estimate the extent of inconsistent condom use and HIV risk-taking behaviours among gay mobile app using MSM; 2) provide the first ever findings regarding condom use consistency of MSM who engage in sex with female partners in Japan; and 3) identify potentially high-risk groups associated with engaging in inconsistent condom use.

Condom use is an important determinant of HIV incidence among MSM, particularly in Japan where biomedical interventions such as pre-exposure prophylaxis (PrEP) are not available. Participants reported more consistent condom use with casual male partners (82.6%) and female intercourse partners (80.1%) than regular male partners (63.1%). They reported similar levels of consistency with casual male partners, and more inconsistent condom use with regular male partners than prior venue-based studies reporting on condom use consistency in Greater Tokyo (1). There were low levels of recent testing among those engaging in CLAI; only one-third of participants engaging CLAI with regular (31.5%) and casual (30.7%) male partners, and less than one quarter engaging in condom-less sex with female partners (23.6%) had been tested for HIV within the past six-months. MSM who had never been tested for HIV engaged in a variety of risk-taking sexual behaviors; among participants who had never been tested, almost two-thirds (65.5%) engaged in CLAI with regular male partners, over half (54.8%) engaged in CLAI with casual male partners, and 44.4% had condom-less sex with female partners.

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 had only male partners, and among participants reporting lower self-efficacy for safer sex.

The lack of PrEP and PEP, negotiated safety or U = U (undetectable = untransmissible) messaging at the time of this survey, in combination with a moderately high number of PLWHA who are undiagnosed or untreated, suggest that MSM engaging in inconsistent condom use with both regular and casual partners may be at risk for HIV in Greater Tokyo.

Table 32: Frequency of condom use

		n	**%**
How often do you use a condom with a regular (penetrative and receptive anal sex) male partner? [a]	No anal sex with regular male partner	246	14.9
	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 with casual (penetrative and receptive anal sex) male partners? [b]	No anal sex with casual male partner	318	19.3
	Never	35	2.6
	Rarely	197	14.8
	Most of the time	490	36.8
	Always	609	45.8
	Total	1331	100
How often do you use a condom with female (penetrative and anal sex) partners? [c]	No sex with female partner	1358	82.6
	Never	29	10.1
	Rarely	28	9.8
	Most of the time	68	23.8
	Always	161	56.3
	Total	286	100

10.1.3 Distribution of resource access through heterosexual and MSM social capital networks

Access to resources embedded in social capital networks are associated with a plethora of positive health outcomes. In **Chapter 7,** this study examined the distribution of resource access through MSM and heterosexual social capital networks in order to 1) ascertain if MSM and heterosexual social networks provide access to different kinds and amounts of resources; and 2) examine if factors associated with MSM and heterosexual social capital access differ.

The separation of alter sexual identity reveals differences in prevalence and correlates of access to cognitive and structural resources embedded in MSM and heterosexual social capital among MSM in Greater Tokyo. In the final regression model, heterosexual social capital access was positively associated with youth, educational attainment, fulltime employment, health, being out to close friends, and bisexual behavior. MSM social capital access was positively associated with being out to close friends, identifying as a member of the gay community, and ever attending a gay bar or event. MSM social capital access was negatively associated with being a student, living outside of central Tokyo, bisexual behavior, and using gay mobile apps for sex or for a serious relationship. The positive association between heterosexual social capital access and socio-demographics such as age and education cohere to the theorized effects of homophily, through which network egos (individuals with access to resources) and alters (resource possessors) have similar socio-demographic traits (2,3). It is also consistent with the findings of previous studies examining social capital access distribution among general populations (2) (4). The finding that MSM social capital access is associated with gay community participation and identification rather than socio-economic variables such as heterosexual social capital access indicates that MSM social capital provides important resource access to socio-demographically deprived MSM. Furthermore, more resources were

available to participants through MSM social capital networks than heterosexual social capital networks, including more than twice the cognitive social capital (emotional support) resources.

10.1.4 MSM and Heterosexual Social Capital Associations with HIV-risk taking behaviors and HIV Testing

In **Chapter 8,** this study examined the associations between MSM and heterosexual social capital and HIV testing and condom use in order to 1) Examine if MSM and heterosexual social capital are associated with different levels of HIV testing and condom use; and 2) identify potential social HIV interventions.

A valid criticism of social capital research is that although it has been observed to be associated with a variety of positive health outcomes, its influence is often minor when compared to socio-demographic and other important independent variables (5). The following findings summary responds to this criticism by directly comparing the strength and direction of associations between MSM and heterosexual social capital and condom use and HIV testing with other significant covariates (Figure 15, Figure 16 and Figure 17).

MSM and heterosexual social capital were associated with differences in HIV testing and condom use. When controlling for gay venue attendance, participants reporting high MSM social capital access were over twice as likely to report ever having undergone HIV testing than those reporting low social capital, indicating an association with HIV testing independent of gay venue attendance. However, participants reporting high MSM social capital were half as likely to use condoms consistently with regular or casual male partners than participants reporting low MSM social capital. Participants reporting high heterosexual social capital reported more consistent condom use with casual partners than participants reporting low heterosexual social capital. Participants with access to MSM who influenced them to practice

unsafe sex were less likely to use condoms consistently with regular and casual male partners, but more likely to have undertaken lifetime and recent HIV testing than participants reporting no access to MSM who influenced them to practice unsafe sex.

Associations between MSM social capital and HIV testing independent of gay venue participation indicate potential for integrating social capital enhancement programs into current HIV interventions. However, associations between MSM social capital and inconsistent condom use with regular male partners is alarming in Japan, where PrEP is not approved and condoms are still a primary physical barrier for HIV among MSM.

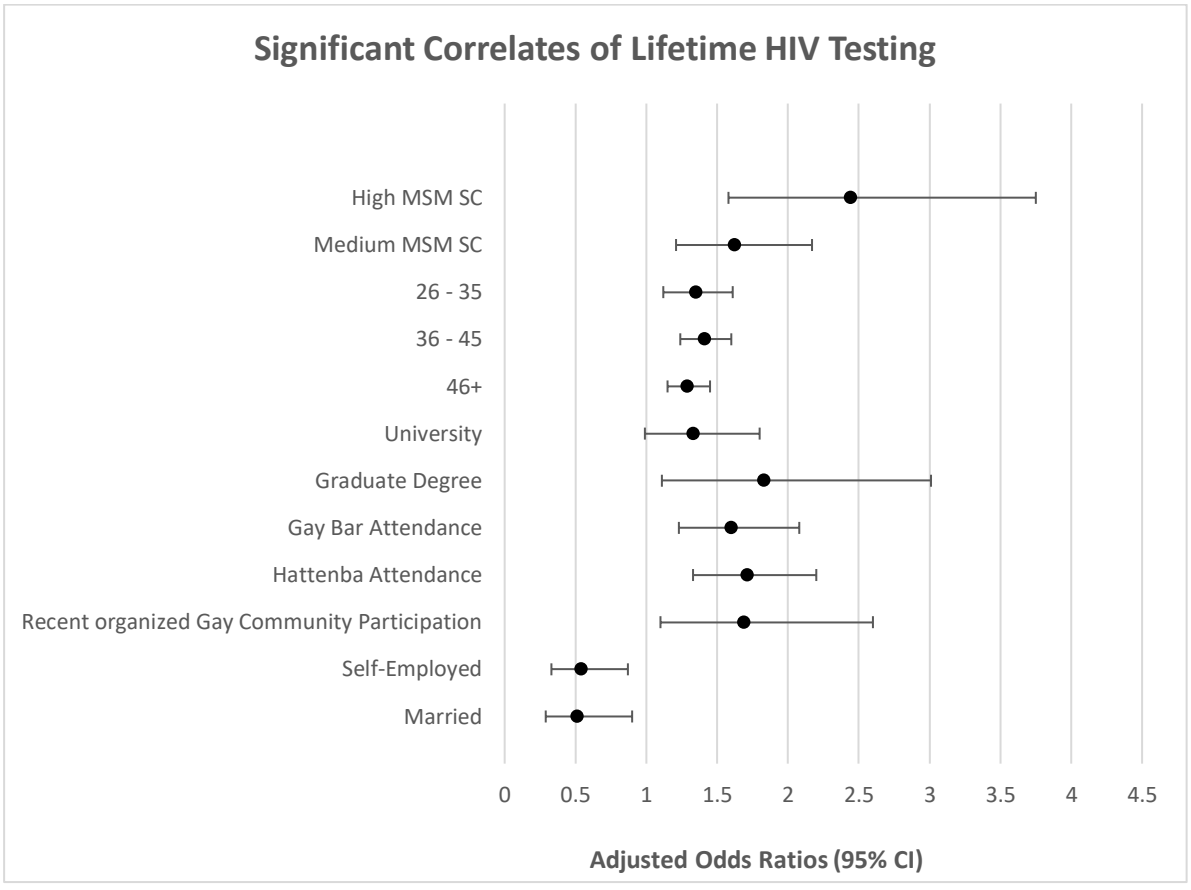

Figure 15: Significant correlates of lifetime testing

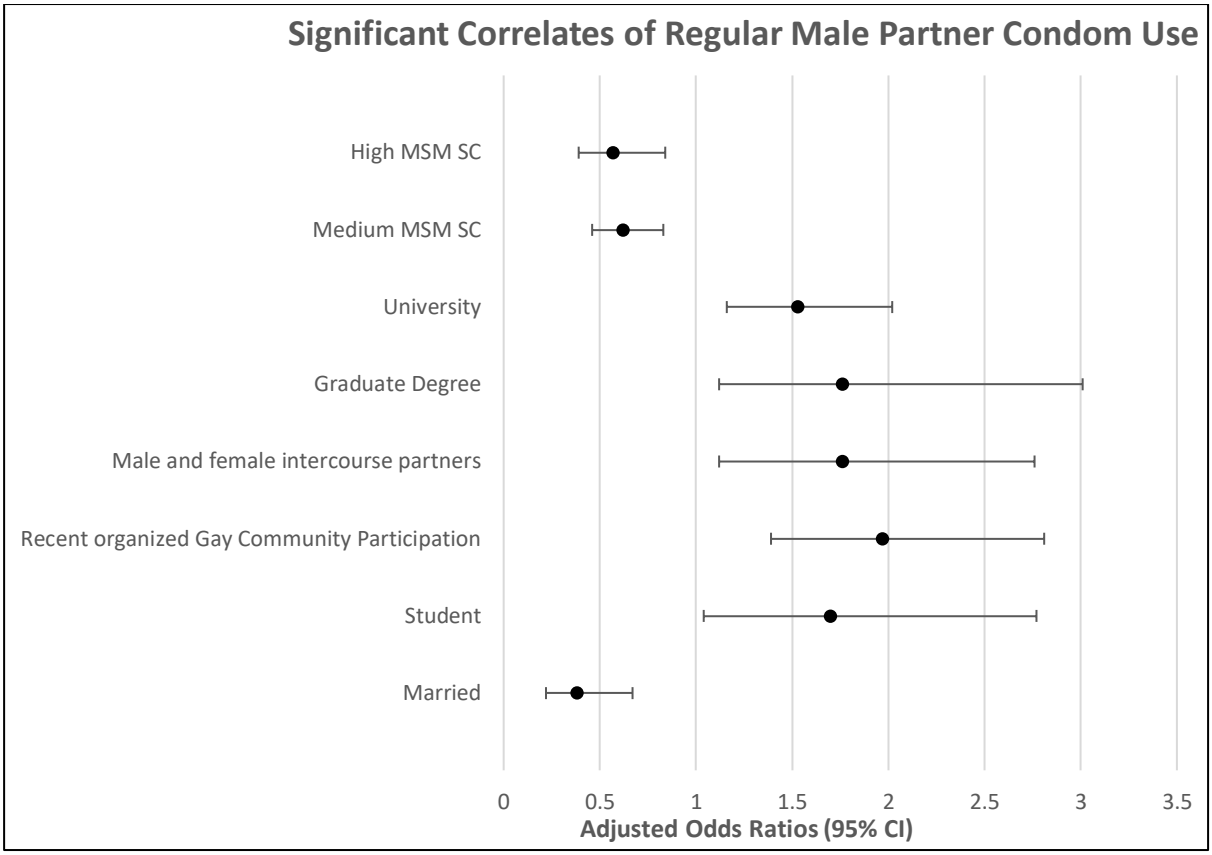

Figure 16: Regular Male Partner Consistent Condom Use Adjusted odds ratios Significant Covariates

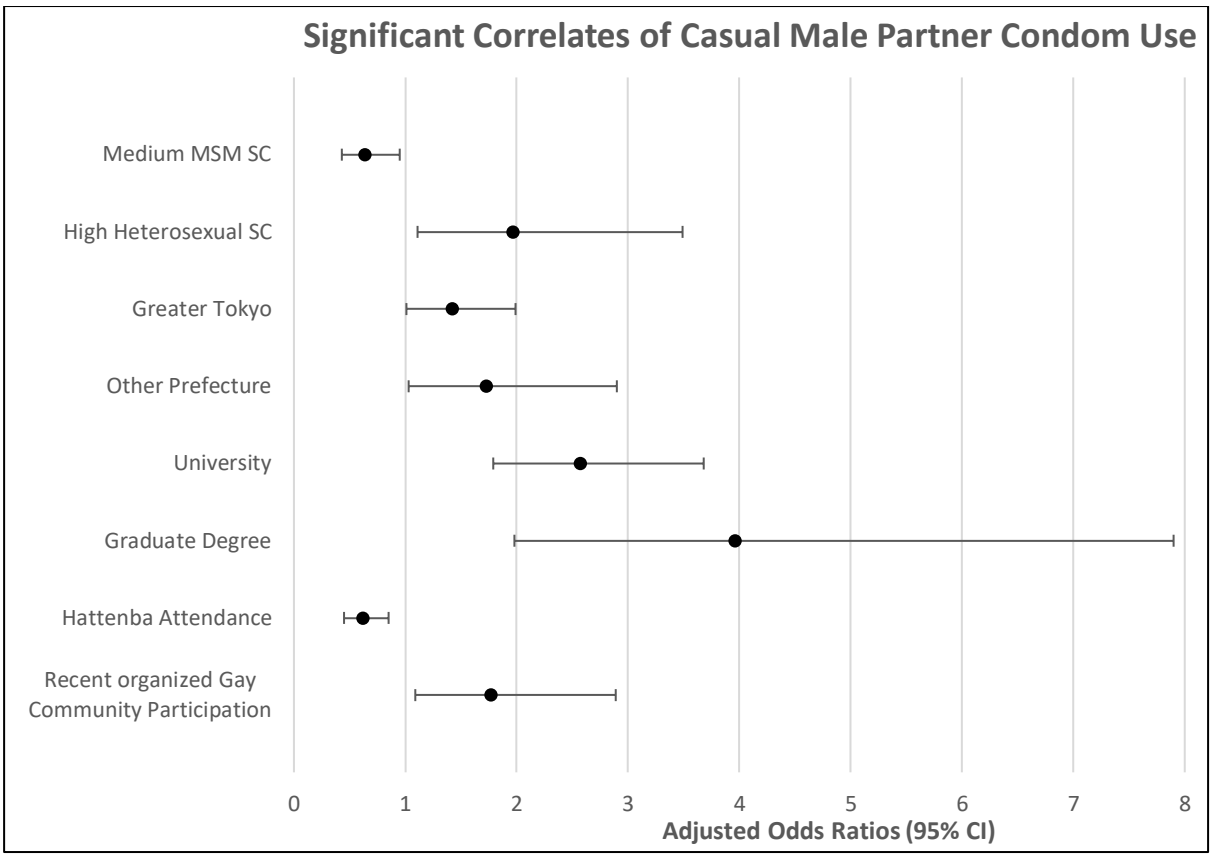

Figure 17: Casual Male Partner Consistent Condom Use Adjusted Odds Ratios Significant Covariates

10.1.5 Prevalence and Social Correlates of Suicidal Ideation

In **Chapter 9,** this study examined the prevalence and social correlates of suicidal ideation in order to 1) Provide the first data regarding prevalence of recent suicidal ideation among gay mobile app using MSM in Greater Tokyo; 2) identify factors associated with suicidal ideation among this population; and 3) identify potential protective social HIV interventions.

Almost one-third (30.9%) of participants reported suicidal ideation in the past two weeks before the survey was taken. Recent suicidal ideation was more likely to be reported among participants who worked part-time or were unemployed and who knew a heterosexual who they felt restricted their freedom or excluded them from a group. Lower likelihood of recent suicidal

ideation was reported among participants over 46 years of age (compared to those aged 18-25 years), who were healthy (compared to fair/poor health), and who had access to high or medium MSM social capital (compared to low MSM social capital). The fact that almost one-third (30.9%) of participants reported recent suicidal ideation in this study, and lifetime attempted suicide rates of 14-15% were observed in two previous studies of MSM in Japan (6,7), it is clear that MSM are more at risk than the general Japanese population, of whom 10.9% reported lifetime suicidal ideation of and 1.9% reported a lifetime suicide attempt (8).

10.2 Implications for HIV Prevention

Findings from this study identify specific groups associated with lower HIV testing and higher HIV risk-taking behaviors. These findings have a variety of implications for HIV prevention strategies and Japan meeting the UNAIDS 90-90-90 targets by 2020. The implications of the main findings for HIV prevention among MSM in Japan are briefly summarized below.

10.2.1 Increasing HIV Testing Among YMSM

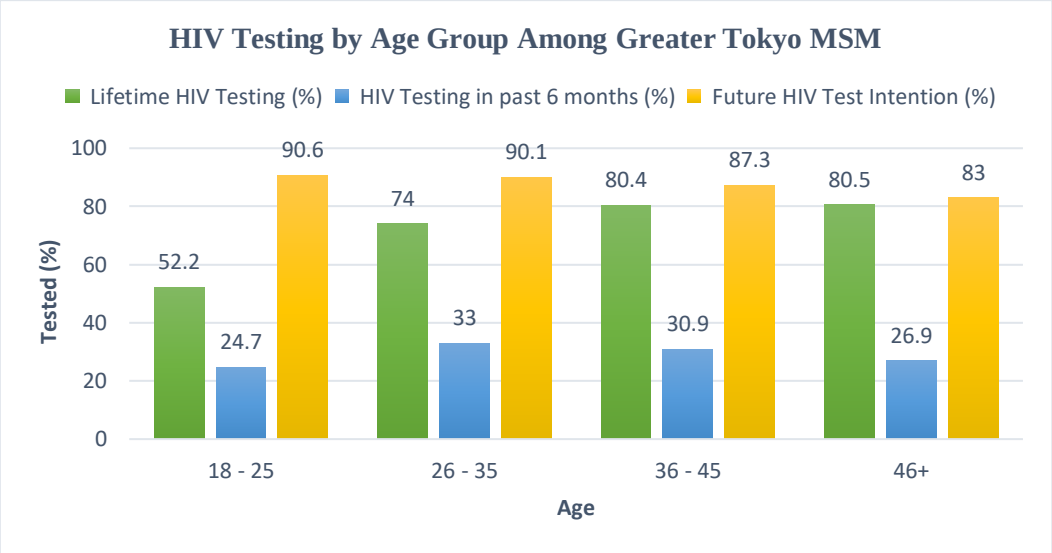

Figure 18: HIV Testing by Age Group among Gay Mobile App Using MSM in Greater Tokyo

As discussed in **Chapter 5**, youth have been observed associated with lower HIV testing among gay mobile SNS using (9), internet using (10) and venue attending (11) MSM. Youth may have lower lifetime HIV testing because they are younger, and therefore have had fewer partners, thus perceive their risk as lower, and have had fewer years to be tested (12). On the other hand, studies have found YMSM to be at higher risk for HIV (13), and less likely to be aware of their infection (14). Japan has very limited sex education in schools, only 2% of participants received any HIV information from family, possibly contributing to the low levels of testing.

Potential options that can be explored in order to address low levels of HIV testing among YMSM in Greater Tokyo are as follows: First, sexual education was found to have positive effects in Japan in previous research (15), and the importance of HIV testing, including among sexual minorities should be taught in public schools. Second, promoting HIV testing on dating apps was associated with higher testing rates post-intervention (16), and promoting HIV testing on gay mobile apps reaches youth who are particularly at-risk for HIV infection, technologically savvy (17) and increasingly use gay mobile apps instead of attending traditional gay venues to meet sex partners in Japan (18). Potential youth friendly advertisements could use GPS and pop-up on gay mobile apps when an individual is near a testing center, showing the testing center location, opening hours, and other information. Third, HIV knowledge could be expanded to youth through community networking on gay mobile apps. Trained peer mentors knowledgeable about the process of testing could appear as in-app community leaders and respond to any queries from YMSM, providing information regarding community anonymous testing and its benefits.

10.2.2 Reaching the UNAIDS 90-90-90 Goals by 2020

As MSM make up the majority of PLWH in Japan, it will be impossible for Japan to successfully achieve the three targets (diagnosing 90% of all HIV positive people, delivering antiretroviral therapy (ART) to 90% of those diagnosed, and achieving viral suppression for 90% on treatment) by 2020 of the 90-90-90 UNAIDS goals without increasing lifetime and regular HIV testing uptake among this hidden population.

HIV testing rates have been steadily decreasing for the past decade. In order to increase HIV testing, particularly among non-community attached MSM, successful HIV testing advertising campaigns that were previously successful (19) should be reinstated. Increasing the ease of access to free testing facilities by extending testing hours in order to fit around busy Japanese work schedules, and adding free HIV testing as an optional extra to annual health checks available to all residents, along with the previously discussed strategies addressing YMSM, could be trialed to see if they increase testing uptake.

In order to increase testing numbers, a combination of increased HIV testing promotion and additional testing strategies such as expansion of rapid voluntary counselling and testing (VCT), associated with a triple levels of HIV testing uptake and double the receipt of results (20), and HIV home tests, which were found effective for high-risk populations (21), should be trialed. Home testing kits could be sold via an official government website, or placed in vending machines near (or inside) *hattenba* and gay districts.

In order to facilitate testing in order to meet the 90-90-90 goals, it is necessary to: 1) increase the amount of free testing centers (particularly in rural areas); 2) expand testing hours in order to fit around busy Japanese work schedules (including weekends and late evenings monthly); 3) provide free optional HIV testing to annual health checkups (with proper privacy protection); 4) begin compulsory cultural competency training for interviewers and health providers at testing centers; and, 5) implement large scale governmental campaigns in

consultation with NGOs to work together to decrease discrimination and stigma against sexual minorities and PLWH in Japan, thus reducing barriers to HIV testing for sexual minorities.

10.2.3 Reducing HIV Transmissions among MSM

This thesis provides some of the groundwork that, combined with the important ongoing surveillance by the Ministry of Health and Welfare HIV Prevention Group and gay community centers, provides a cross-sectional analysis of HIV risk necessary for the effective implementation of a combination of behavioral, bio-medical, and structural interventions among MSM in Greater Tokyo.

In light of the levels of inconsistent condom use among MSM with strong MSM network ties, the approval of bio-medical interventions such as PrEP under similar guidelines to Australia (22), in which it is provided to high-risk MSM provided they are tested for HIV and STIs every three-months, may be an effective tool for preventing the spread of HIV among MSM engaging in high risk behaviors such as inconsistent condom use with casual partners. Other structural interventions, such as the approval of universal test-and-treat policies could also be effective in further reducing new HIV infections among MSM in Japan.

Condom use with regular partner was alarmingly low, and there may be significant risk of infection from regular partners. Future research in Japan should investigate HIV infection pathways to more accurately assess the risk of CLAI with regular and casual partners and adjust subsequent interventions appropriately. Regardless, due to the lack of bio-medical interventions, condoms remain the primary barrier to HIV in Japan among MSM, and the importance of condom use with all partners should be promoted on gay mobile apps and at *hattenba* in particular. Findings regarding condomless HIV risk reduction behaviors among gay men show no increased risk of HIV infection reported among MSM engaging in negotiated

safety and strategic positioning compared to MSM engaging in no CLAI, while serosorting outside negotiated safety was associated with an intermediate rate of HIV infection, and withdrawal with a higher risk than no CLAI (23). While regular partners accounted for 68% of MSM HIV transmissions in the US (24), they only accounted for one-tenth in Australia (25) where condomless behavioral HIV risk reductions strategies have been promoted. The promotion of condomless behavioral HIV risk reduction strategies may therefore be effective at reducing HIV risk in Japan for MSM unwilling to use condoms with regular partners.

Scaling up existing surveillance programs to effectively assess changing risk factors, particularly in regard to the recent intake of foreign workers from South-East Asia and upcoming 2020 Olympics is important. Increasing gay community center and event testing, and further promotion of U=U messaging may help reduce testing barriers and lower HIV stigma.

10.3 Implications for suicide interventions among MSM

The implications of the social capital findings regarding suicide interventions in this study are twofold: first, established HIV prevention programs and infrastructure that already exists in Japan linking the medical and MSM communities throughout Japan (26) could be used to promote MSM mental health and social support in both healthcare and gay community spaces. These include MSM friendly healthcare centers, gay bars, events, and community centers, but should be expanded to include gay social networking services (SNS) and mobile apps. Second, existing efforts to reduce societal stigma against sexual minorities in Japan should be scaled up. Partnerships among government departments, clinicians, non-governmental organizations (NGOs), and MSM communities exist and provide much needed important support for MSM in Japan. However, they remain underdeveloped in Japan compared to counterparts in Western countries (26), and health workers have limited

knowledge of specific mental health and care needs for MSM (27). Appropriate mental health training of specific MSM-oriented centers and clinics, and their subsequent promotion in gay mobile apps utilizing GPS, which show promise for the self-management of suicidal ideation and self-harm (28), may be useful considering the limited resources for MSM suicide prevention in Japan. Lastly, mental health first aid training, examining how family, friends and peers support LGBTI people who may be going through a mental health crisis (29) could be explored in Japan.

10.4 Future Research

A variety of future research should be undertaken in order to reduce future HIV transmissions among MSM in Japan, and to support their physical and mental wellbeing.

1) Surveillance regarding HIV transmission pathways through regular and casual partners is important to inform effective behavioral interventions
2) Trials to test if in-app HIV testing and condom use promotions result in sustained increases in condom use and regular HIV testing among MSM.
3) In order to address the lack of data regarding sexual minorities other than GBM, future studies examining HIV prevalence, health and wellbeing of all LGBTI must be investigated.
4) Testing the efficacy of condomless behavioral risk-reduction interventions among Japanese MSM is a necessary step prior to their promotion.
5) Examine barriers and incentives for LGBT to access health services, and develop and implement LGBTI guidelines for health services.
6) Researching who MSM disclose suicidal thoughts to (peers, family etc.), and support received, could help targeted mental health first aid training interventions.

10.5 Limitations

This research was subject to a variety of limitations. Participants were recruited through an advertisement in Greater Tokyo and may not be representative of all Japanese MSM. However, our sample size was relatively large, and our study the first to examine social capital and recent suicidal ideation among gay-mobile app users, which include a large proportion of non-gay community attached MSM who may not have been represented in previous studies. The behaviours and attitudes were self-reported and may have been subject to social desirability bias (30), although because the survey was anonymous and online, this effect was likely minimized.

The resource generator is a validated and comparable scale that has been used previously in Japan (31,32). However, there remains no general consensus on how to correctly measure social capital, which poses difficulties for direct comparison with other studies. Furthermore, Japan is still quite ethnically homogenous, and exploration of associations between social capital and HIV risk-taking behaviours among MSM of different ethnic, cultural and linguistic backgrounds may produce important findings.

Although PHQ9 Item 9 is a qualified, validated measure, it is limited in that it only asks one question regarding overall frequency of suicidal thoughts. It does not distinguish actual plans to commit suicide, which are on the more severe end of the ideation continuum, but important to detect. Despite this limitation, as the first study reporting on recent suicidal ideation among this understudied and high-risk population, these findings are important, and indicate the importance for further research including the spectrum of suicidal ideation, planning, and attempts. Finally, the survey was conducted in winter, so I could not investigate seasonal changes which could have affected suicidal ideation.

10.6 A Final Word

Globally, there is a large body of literature observing that MSM are more at risk for HIV and suicide than general populations. The findings in this thesis indicate that the burden of the concentrated HIV epidemic among MSM in Japan is unlikely to abate, and Japan is unlikely to meet the 90-90-90 UNAIDS 2020 targets with the current levels of HIV testing and condom use. This thesis proposes a number of structural, behavioral, and policy interventions in order to help Japan to meet these targets and reduce new HIV transmissions among this high-risk population.

The positive associations between MSM social capital, recent engagement in gay community activities and lower suicidal ideation observed in this study indicate potential for integrating MSM social capital enhancement and community engagement programs into current mental health and wellbeing interventions. Given the associations between heterosexual exclusion and suicidal ideation in this study, legislative changes, such as legalizing same-sex marriage, introducing same-sex inclusive sex education in schools, and the introduction of laws to specifically protect sexual minorities are required to reduce stigma and discrimination, and to ensure that Japanese MSM can finally be fully accepted into mainstream Japanese society.

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Appendices

Appendix 1: Online survey

Draft version of questionnaire as an indicative guide for final Japanese survey: appropriate pre-coded response were piloted and final Japanese survey varied in certain aspects

Q1. Where do you currently live?
1) Central Tokyo 2) Yokohama 3) Chiba 4) Saitama 5) Other: **Please write in:**_____

Q2. How would you describe your sexuality?
1) Homosexual 2) Bisexual 3) Heterosexual 4) Other: **Please write in:**_____

Q3. How many gay acquaintances do you have? By acquaintance, we mean that if you were to meet on the street, you would both greet each other by name.)

1) 0
2) 1 - 9
3) 10 – 20
4) More than 20

Q4. Where were you born?
1) Japan 2) Korea 3) China 4) Nepal 5) USA 6) Other: **Please write in:**_____

Q6. What is your age? _____

Q7. What is your gender? 1) Male 2) Female 3) Other: **Please write in:**_____

Q8. At present, how long have you been living in Tokyo Prefecture?

1) Less than one year
2) Between one and two years
3) Between four and five years
4) Between six and ten years
5) Between eleven and twenty years
6) Always

Q9. What is your current occupation or field of employment? (select all that apply)

1) Student
2) Full-time employee
3) Part-time worker
4) Self-employed
5) Contract worker
6) Unemployed
7) Other **Please write in:**_____

Q11. On average how many hours do you work per week?
Please write in:_____

Q13. What is the highest level of education you have completed?

1) Less than Elementary School
2) Elementary school
3) Middle school
4) High School
5) Some college
6) Two-year college/Technical School
7) B.A.
8) Master's degree (M.A.)
9) Doctorate degree (PhD)

Q14. How would you rate your overall health?

1) Very Unhealthy
2) Unhealthy
3) Average
4) Healthy
5) Very Healthy

Q15 Are you sexually active with the following?
1) Men
2) Women
3) Both

Q16. To what extent do you identify as part of the gay (i.e. LGBT) community?
1 2 3 4 5

strongly disagree strongly agree

Q17. Who do you currently live with?
1) Family 2) Alone 3) Male Partner 4) Female partner 5) Friend(s) 6) Other: **Please write in:**_____

Q18. What is your marital status?
1) Single 2) Married 3) Widowed 4) Long-term (unmarried) partner

Q19a. Are you "out" about having sex with other men?
1) Yes 2) No (skip to Q.20)

Q19b. -If yes, which of the following are you out to?

1) Family (yes/no)
2) All friends (yes/no)
3) Only close friends (yes/no)
4) Colleagues and coworkers or classmates (yes/no)
5) Other (please specify)_____

Q20. Which of the following gay mobile apps do you use most frequently?

1) Grindr 2) Hornet 3) Gaydar 4) jack'd 5) 9Monster 6) None 7) Other **Please write in:**_____

Q21. How long have you been using gay mobile apps?
1) Never (skip to Q.24)
2) Less than one year
3) Between one and two years
4) Between three and five years
5) Between six and ten years
6) More than ten years

Q22. How often do you use gay mobile apps?
1) Never
2) Once or twice a year
3) Once or twice a month
4) Once or twice a week
5) Most days of the week

Q23. Please fill in how much you agree with the following statements from 1(strongly disagree) ~ 5 (strongly agree) for why you use gay mobile social networking services with 1(strongly disagree) ~ 5 (strongly agree)

To find sex
1 2 3 4 5
strongly disagree strongly agree

To find friends
1 2 3 4 5
strongly disagree strongly agree

To avoid being identified as gay
1 2 3 4 5
strongly disagree strongly agree

To find a serious dating relationship
1 2 3 4 5
strongly disagree strongly agree

Q24. How long have you been attending gay bars/gay events?
7) Never (Skip to Q27.)
8) Less than one year
9) Between one and two years
10) Between three and five years
11) Between six and ten years
12) More than ten years

Q25. How often do you attend gay bars/gay events?
1) Never
2) Once or twice a year
3) Once or twice a month
4) Once or twice a week

Q26. Please fill in how much you agree with the following statements from 1(strongly disagree) ~ 5 (strongly agree) for why you attend gay bars/gay events?

To find sex

1	2	3	4	5
strongly disagree				strongly agree

To find friends

1	2	3	4	5
strongly disagree				strongly agree

To find a serious dating relationship

1	2	3	4	5
strongly disagree				strongly agree

Q27. How often do you attend *hattenba*?

1) Never
2) Once or twice a year
3) Once or twice a month
4) Once or twice a week

Q28. Which of the following types of activities or groups have you participated in during the last six months?

Meetings of organizations (political, social, etc.) for gays	1) Yes 2) No
Community events (e.g., parade, fair, party, etc.) for gays	1) Yes 2) No
Volunteer work for an organization for gays	1) Yes 2) No

Q29. Which of the following questions are true or false?

HIV can be transmitted by kissing	1) Yes 2) No
Having other STI's does not increase the chance of HIV infection	1) Yes 2) No
Showering before and after sex reduces chances of HIV transmission	1) Yes 2) No

The following questions ask about attitudes towards sexual behaviors

Q30. Please fill in how much you agree with the following statements from 1(strongly disagree) ~ 5 (strongly agree)

When I feel an ache or pain, I assume it is due to HIV/AIDS

1	2	3	4	5
strongly disagree				strongly agree

I avoid watching TV programs and reading information about HIV/AIDS

1	2	3	4	5
strongly disagree				strongly agree

I frequently check my body for signs of HIV/AIDS

1	2	3	4	5
strongly disagree				strongly agree

I can say no to sex when a partner wants sex and I don't

1	2	3	4	5
strongly disagree				strongly agree

It's difficult to talk about condom use with partners

1	2	3	4	5
strongly disagree				strongly agree

I feel confident in my ability to use condoms when my partner doesn't want to use them

1	2	3	4	5
strongly disagree				strongly agree

I am able to avoid behavior that may put me at risk of HIV infection.

1	2	3	4	5
strongly disagree				strongly agree

I find it difficult to have safer sex when drunk.

1	2	3	4	5
strongly disagree				strongly agree

I encourage my friends to practice safer sex.

1	2	3	4	5

strongly disagree strongly agree

I am afraid of using a condom because if I do sex partners will think I have HIV

1 2 3 4 5

strongly disagree strongly agree

Q31. Who's advice about practicing safe sex would you be most likely to follow? (Please choose two of the following).

1) Doctor 2) Regular sex partner 3) Irregular sex partner 4) Internet resource 5) Government 6) LGBT Community Center
7) Other Please **write in:**_____

Q33. How often do you use a condom with a regular (penetrative and receptive anal sex) male partner?
1) Never
2) Rarely
3) About half of the time
4) Most of the time
5) Always
6) Don't have a regular partner

Q34. How often do you use a condom with non-regular (penetrative and receptive anal sex) male partners?
1) Never
2) Rarely
3) About half of the time
4) Most of the time
5) Always
6) Don't have a non-regular partner

Q35. How often do you use a condom with female (penetrative and anal sex) partners?
1) Never
2) Rarely
3) About half of the time
4) Most of the time
5) Always
6) Don't have female partners

Q36. Have you ever been tested for HIV? 1) Yes 2) No

Q37. Have you been tested for HIV in the last six months? 1) Yes 2) No

Q38. Are you planning on getting tested for HIV? 1) Yes 2) No

The following questions are designed to find out about networks and social capital access to specific resources

Q39. Do you personally know anyone in Tokyo prefecture or the surrounding areas with the skill or resource listed below that you are able to gain access to within one week if you needed it? Please select all that apply.

	MSM	**Heterosexual**	**Both**	**Neither**
41A. Give you access to an automobile	Y/N	Y/N	Y/N	Y/N
41B. Help you move	Y/N	Y/N	Y/N	Y/N
41C. Lend you 30,000 yen (350 AUD)	Y/N	Y/N	Y/N	Y/N
41D. Help you find a job	Y/N	Y/N	Y/N	Y/N
41E. Give you sound sexual health advice	Y/N	Y/N	Y/N	Y/N
41F. Give you sound advice about health	Y/N	Y/N	Y/N	Y/N
41G. Help you to find somewhere to live	Y/N	Y/N	Y/N	Y/N
41H. Speaks a language other than Japanese	Y/N	Y/N	Y/N	Y/N
41I Can discuss intimate matters with you	Y/N	Y/N	Y/N	Y/N
43J. You trust very much	Y/N	Y/N	Y/N	Y/N
43K. You would be willing to die for	Y/N	Y/N	Y/N	Y/N
43L. Shares the same values as you	Y/N	Y/N	Y/N	Y/N
43M. Follows the same norms as you	Y/N	Y/N	Y/N	Y/N
43N. Shares the same opinions as you	Y/N	Y/N	Y/N	Y/N
42O. Meet in more than one situation	Y/N	Y/N	Y/N	Y/N
42P. Meet regularly with in a *nomikai* (drinking party)	Y/N	Y/N	Y/N	Y/N
42Q. Meet regularly with you in a club (sporting/hobby) activity	Y/N	Y/N	Y/N	Y/N
42R. Have more than one friend not from work	Y/N	Y/N	Y/N	Y/N
43S. Excessively demands your time/attention	Y/N	Y/N	Y/N	Y/N
43T. Restricts your freedoms to act as you would like	Y/N	Y/N	Y/N	Y/N
43U. Influences you to practice unsafe sex	Y/N	Y/N	Y/N	Y/N
43V. Makes you feel excluded from a group	Y/N	Y/N	Y/N	Y/N

Q.40 "People can generally be trusted" – which of the following groups does this statement apply to?

1) MSM
2) Heterosexual
3) Family
4) Friends

Q. 41 Happiness Scale: For each of the following statements and/or questions, please circle the point on the scale that you feel is most appropriate in describing you.

1. In general, I consider myself:

	1	2	3	4	5	6	7	
not a very happy person								a very happy person

2. Compared with most of my peers, I consider myself:

	1	2	3	4	5	6	7	
less happy								more happy

3. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?

	1	2	3	4	5	6	7	
not at all								a great deal

4. Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterization describe you?

	1	2	3	4	5	6	7	
not at all								a great deal

Q.42 In the past two weeks, how often have you been bothered by 'thoughts you would be better off dead or of hurting yourself in some way':

1. Not at all
2. Several days
3. More than half the days
4. Nearly every day

Q.43 Please tell us your thoughts about life and experiences as a sexual minority or anything you feel is pertinent:

Appendix 2: Plain Language Statement

Invitation to participate in an anonymous online survey that aims to strengthen our understanding of social capital among men who have sex with men (MSM) in Tokyo Prefecture

HREC Number: 1646197.1

This is a research project undertaken by the University of Melbourne. The primary researcher is a PhD candidate at Melbourne University, Adam Hill Rolander. He is supported by sociologist Dr Leah Ruppanner at the University of Melbourne, survey expert Dr Gregory Armstrong, and University of the Ryukyus sociologist Dr Noriyuki Suzuki.

Your participation in this study will help us to better understand the factors that strengthen social capital (defined as the skills, resources and social support networks you can access through people you know within one week) among MSM, and the factors that contribute to MSM practicing safe sex. The findings for this study can be used to focus future MSM HIV prevention methods and to advocate for better MSM HIV prevention funding in Japan.

What you will be asked to do

- We would like to ask you a series of questions about your social networks and social capital, physical and mental health, social circumstances, sexual behaviours, and participation in HIV testing.
- We would like for you to complete the online survey.
- The online survey will take about 20 minutes of your time.
- If you choose to give an email address, you will enter into a lottery to receive one of 20 1500 yen *iTunes* store, *google* play, amazon.co.jp vouchers for completing the survey satisfactorily, and a further two 5000 yen vouchers, and one 10,000-yen voucher for the randomly selected winners. If you win, you will be informed after the completion of the survey in January 2017.

What will happen to the information you provide?

- The information you provide is confidential and anonymous i.e. no-one will be able to link your answers to you as an individual person.
- We will be reporting on the findings of this study by anonymously grouping together all of the participants' responses in a summarised way.
- The information from the completed questionnaires will be entered into a secure database anonymously (you will never give your name).
    - Your survey data will be completed on freeonlinesurveys.com. freeonlinesurveys.com act as only a custodian of the data. It will keep all data 100% private, anonymous and securely encrypted. It will be stored on servers securely in the USA until the completion of the survey, when it will be securely erased.
    - For more information on freeonlinesurveys.com and its privacy policy and security policy, please visit:
    - https://freeonlinesurveys.com/help/Privacy
    - https://freeonlinesurveys.com/help/Terms
- The results questionnaires will be stored securely for five years at the office of the University of Melbourne, and after this time they will be destroyed.
- The findings from this research will be reported in Japanese and international journal articles and at conferences in both English and Japanese.

Do you have to participate in this study?

- Participation in this study is VOLUNTARY.
- If you decide to participate, you are free to change your mind and withdraw from the study at any time.

- Similarly, you do not have to answer any sensitive questions you would prefer not to answer. However, we ask that you take your time and answer all questions you feel comfortable with to the best of your ability.

YOU WILL NOT BE COMPENSATED IF YOU DO THE FOLLOWING:

- If you do not answer 'prefer not to answer' for questions that you do not feel comfortable answering, you will not be compensated.
- If you do not answer all of the questions regarding social capital (Q.44, Q45), you will not be compensated.
- If you do not participate you will not be compensated.
- If you do not spend the minimum time of 10 minutes to complete the survey satisfactorily, you will not be compensated.

Where can you get more information?

- This project has been approved by the Human Research Ethics Committee at the University of Melbourne in Australia.
- If you would like to speak to someone locally about this project, please contact:

Adam Hill Rolander (PhD Candidate, University of Melbourne, Research Fellow, University of the Ryukyus):

tokyo.msm.survey@gmail.com

Phone: (070 4299 3021)

Noriyuki Suzuki (Professor of Sociology, University of the Ryukyus):

nsuzuki@ll.u-ryukyu.ac.jp

This research project has been approved by the Human Research Ethics Committee of The University of Melbourne. If you have any concerns or complaints about the conduct of this research project, which you do not wish to discuss with the research team, you should contact the Manager, Human Research Ethics, Office for Research Ethics and Integrity, University of Melbourne, VIC 3010. Tel: +61 3 8344 2073 or Fax: +61 3 9347 6739 or Email: HumanEthics-complaints@unimelb.edu.au. All complaints will be treated confidentially. In any correspondence please provide the name of the research team or the name or ethics ID number of the research project.

Appendix 3: Consent form

This form is to give consent to participate in an anonymous online respondent driven survey that aims to strengthen our understanding of social capital among men who have sex with men (MSM) in Tokyo Prefecture

HREC Number: 1646197.1

March 1st 2016: Consent Form Version 1

Investigators

The primary researcher is a PhD candidate at Melbourne University, Adam Hill Rolander. He is supported by sociologist Dr Leah Ruppanner at the University of Melbourne, field survey methods expert Dr Gregory Armstrong, and University of the Ryukyus sociologist Dr Noriyuki Suzuki.

Participation

Your participation in this anonymous online survey is voluntary. You may refuse to take part in the research or exit the survey at any time without penalty. You are free to decline to answer any particular question you do not wish to answer for any reason. The survey will take approximately 20 minutes to complete.

Benefits

- If you choose to give an email address, you will enter into a lottery to receive one of 20 1500 yen *iTunes* store, *google* play, amazon.co.jp vouchers for completing the survey satisfactorily, and a further two 5000 yen vouchers, and one 10,000-yen voucher for the randomly selected winners. If you win, you will be informed after the completion of the survey in January 2017.

Your participation in this study will help us to better understand the factors that strengthen social capital (defined as the skills, resources and social support networks you can access through people you know within one week) among MSM, and the factors that contribute to MSM practicing safe sex. The findings for this study can be used to focus future MSM HIV prevention methods and to advocate for better MSM HIV prevention funding in Japan

Risks

There is the risk that you may find some of the questions to be sensitive and possibly that some questions may cause emotional discomfort. You may feel a little embarrassed answering survey questions about sex practices. However, the survey is anonymous and therefore no one will ever have knowledge of your personal identity or answers.

While we hope that this research is interesting to you, if you find yourself distressed at all the following organizations are available for support:

MSM Community Centre Tokyo, AKTA:

Nakae Building, 3F, 2-15-13, Shinjuku-ku, Tokyo.

Tel no. (03 3226 8998)

Occur Helpline:

Non-profit organization providing telephone counselling and support for the LGBT community, information and advice about homosexuality, HIV and AIDS.

Tel no. (03 3383 5556)

English Speaking Websites:

Sort out Stress – www.sortoutstress.co.uk/site

The Samaritans www.samaritans.org

Gay, bisexual and transgender health PACE – www.pacehealth.org.uk

Confidentiality
Your survey answers will be stored in a password protected electronic format. No identifying information such as your name, email address, or IP address will be collected. Therefore, your responses will remain anonymous. No one will be able to identify you or your answers, and no one will know whether or not you participated in the study.

For Participants Who would like to receive a summary report of findings

At the end of the survey you will be asked if you are interested in receiving a summary report of findings. If you choose to provide contact information such as your phone number or email address, your survey responses may no longer be anonymous to the researcher. However, no names or identifying information would be included in any publications or presentations based on these data, and your responses to this survey will remain confidential.

Contact

If you have questions at any time about the study or the procedures, you may contact my research supervisor or myself:

Adam Hill Rolander (PhD Candidate, University of Melbourne, Research Fellow, University of the Ryukyus):

tokyo.msm.survey@gmail.com

Phone: (070 4299 3021)

If you feel you have not been treated according to the descriptions in this form, or that your rights as a participant in research have not been honoured during the course of this project, or you have any questions, concerns, or complaints that you wish to address to someone other than the investigator, you may contact Human Research Ethics Committee of The University of Melbourne:

Human Research Ethics, Office for Research Ethics and Integrity, University of Melbourne, VIC 3010. Tel: +61 3 8344 2073 or Fax: +61 3 9347 6739 or Email: HumanEthics-complaints@unimelb.edu.au.

All complaints will be treated confidentially. In any correspondence please provide the name of the research team or the name or ethics ID number of the research project.

Electronic Consent

Please select your choice below. You may print a copy of this consent form for your records. Clicking on the "Agree" button indicates that:

- **You have read and understood the above information**
- **You voluntarily agree to participate**
- **You are 16 years of age or older**
- **You identify as LGBT and/or are attracted to and/or have sexual activity with other men.**
- **You are a current resident of Tokyo prefecture.**

☐ Agree (Continue to Survey)

☐ Disagree