USING GEOSOCIAL NETWORKING APPS TO PROMOTE SYPHILIS AWARENESS AND HEALTH RESOURCES

By

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Abstract

Since 2013, the United States has seen a rise in syphilis incidence to epidemic proportions, especially among young men who have sex with men (MSM) who utilize geosocial networking (GSN) applications (apps) to find dates and hookups. Syphilis is an easily treatable sexually transmitted disease (STD). In response to this epidemic, the Pima County Health Department has been developing interventions to reduce the incidence of syphilis. In this study, we tested the effectiveness of using GSN apps to increase syphilis awareness and facilitate communication between MSM and health officials. Informed by survey results, the county created a "Health Advisor" app profile on select GSN apps for MSM. Two phases of app messaging were conducted over six months with different styles of messaging. We found a passive style of messaging was more effective in terms of user response and frequency of conversations that include health information than an active style. Geosocial networking apps are an efficient medium to distribute health information and alert community members about a syphilis or health concerns, especially to high-risk groups. Future public health efforts should be aimed at strengthening the credibility, presence, and scope of the health official on the GSN apps.

Introduction

Across the United States (US), there has been a rapid increase in the incidence of sexually transmitted diseases (STDs). The Centers for Disease Prevention and Control (CDC) reported in 2014 that the number of reported cases for all three notifiable STDs has increased for the first time since 2006. From 2013 to 2014, the rate of chlamydia, gonorrhea, and syphilis increased in US by 2.8%, 5.1%, and 15.1%, respectively (CDC, 2015). In 2013, there were roughly 110 million total STD infections and 20 million new STD infections, which costed over $16 billion USD in medical expenditures (CDC, 2013). What is more, this increasing trend of STD incidence has sustained through 2017. These national trends mirror the STD trends seen in Pima County, Arizona (Coyle, Gall, & Tippens, 2015). The focus of this thesis is the effectiveness of using social networking applications (apps) as a strategy to reduce the incidence and increase awareness of syphilis.

Syphilis

Syphilis is a bacterial infection by *Treponema pallidum*. Currently, it can be treated with an intramuscular injection of Benzathine penicillin G injection (CDC, 2016). If left untreated, syphilis will initially present as sores and/or chancres that are painless and small, and may heal on their own in three to six weeks (primary syphilis). Secondary syphilis is defined by skin rashes and/or mucous membrane lesions that also can subside on their own. The third stage is known as the latent stage, marked by no noticeable signs of syphilis infection, and 10-30 years later tertiary syphilis symptoms will develop which can be very damaging to organs and fatal if left untreated. Primary and secondary (P&S) syphilis are considered the most infectious forms of syphilis, hence those forms are the main focus of surveillance, interventions, and other activities. While the primary route of infection of syphilis is sexual transmission, syphilis can

also be acquired congenitally and lead to fetal and infant infection, causing various medical difficulties and even death (CDC, 2017).

Syphilis as a reportable disease

Syphilis is a reportable disease in all states of the US. This means that all cases of syphilis diagnosed within the US are entered into a national surveillance system. The national reporting system is initiated by local physicians, healthcare administrators, and other authority figures. A Communicable Disease Report (CDR) is filed to the local county health department or other local agency. In Arizona, CDRs feature a section dedicated to sexually transmitted diseases, with sections to indicate the stage of syphilis, whether there are neurological complications, and the sexual nature of the associated sexual experience that led to syphilis infection (i.e. MSM or not). Laboratories, pharmacies, and their administrators submit their testing results to the Arizona Department of Health Services (ADHS), and ADHS sends the reports to the CDC for national reporting. It is illegal for a case of syphilis to not be reported by a reporting entity (Arizona Department of Health Services, 2008).

Epidemiology of syphilis

National as well as county-level infection rates of syphilis reflect an epidemic. For example, during 2014-2015, the national P&S syphilis rate exceeded the highest reported rate since 1994 (19% increase from 2014, to 7.5 cases/100,000 population), and it has increased in incidence nearly every year since 2000 (CDC, 2016). Pima County had 31 total cases of P&S syphilis reported to them in 2012. In 2013, this increased to 55, and 141 P&S cases were seen in 2014 (156% more than 2013). These numbers remained high in 2015 and 2016, with 112 and 108 cases, respectively. These syphilis rates are considered epidemic levels, as they consistently

exceed the three-year historical limit mean for reported P&S syphilis cases (2013-2016) (Appendix A).

Local and national data show that there are various demographic subgroups that see higher P&S syphilis infection rates than others. As shown in Table 1, new syphilis cases in Pima County are mostly reported among men who have sex with men (MSM). Out of 107 new P&S syphilis cases in 2016 for Pima County, 93 occurred in men and 70 occurred in MSM. Nationally, 54% of reported cases of P&S syphilis were for MSM in 2015, whereas only 13% were reported for men who have sex with women (MSW), 10% for women who have sex with women, and 6% for men who have sex with men and women (CDC, 2016).

Demographics of new P&S syphilis cases, 2014 - 2016, Pima County, Arizona

Year (n=total new P&S syphilis)	**Men**	**MSM**	**Black/African American**	**Asian**	**Hispanic**	**American Indian/ Alaskan Native**	**White**
2014 (n=141)	136	125	11	4	66	3	51
2015 (n=111)	107	97	5	3	49	6	45
2016 (n=107)	93	70	4	0	50	9	41

Table 1: The demographical information of new primary and secondary syphilis cases in Pima County from 2014 through 2016. MSM = men who have sex with men

Among sexual encounters where the sex of partner is known, MSM account for 81.7% of P&S cases (CDC, 2017). This large percentage is a trend seen for all STDs in this demographic group, although to a lesser degree than syphilis. Data have shown that MSM account for roughly 50% of all new STD cases annually (Hall et al., 2008). By sex, 90.3% of new P&S syphilis cases are reported in men. Additionally, the highest rate of P&S syphilis cases is seen in men and

women aged 20-29 years old. In 2015, individuals aged 15-44 years old represented nearly 80% of new P&S syphilis cases (those with age known). In terms of race and ethnicity, Blacks, Native Hawaiians/Other Pacific Islanders, Hispanics, and American Indians/Alaska Natives have a larger P&S syphilis incidence rate than Whites in decreasing order, and Asians see the least incidence (CDC, 2016).

Co-infection with human immunodeficiency virus (HIV) among syphilis cases is another high risk for MSM. In 2015, 49.8% of the P&S syphilis cases in MSM were co-infected with HIV, which is much higher than 10% among MSW and 3.9% among all women (CDC, 2016). Men are not biologically more susceptible to co-infection; rather, the high rate in MSM may be due to socioeconomic, behavioral, or other structural factors. It is theorized that syphilis symptoms (sores and chancres) make it easier for HIV to transmit, in part because the mucous membrane is broken down (CDC, 2017). This trend may also be explained by differences in sexual habits and risk, for example less condom usage, which would also complement the heightened rate of total STDs seen in the MSM community. If there are more STDs being transmitted, especially due to unsafe sexual habits, then it would follow more cases of co-infections are also seen (CDC, 2017). In this study, HIV is not a focus but it is an integrated and important topic throughout due to its similar epidemiology to syphilis.

Risk of sexual behavior & dating and online apps

The usage of online social networking sites and applications are becoming increasingly common. Sixty-five percent of all adults say they use at least one social networking site, which increases to 90% in the 18-29 year old age group. By sex, 68% of women and 62% of men use social media. The most likely individuals to use social media live in less rural locations, are more educated, and are more wealthy, although all populations have seen a trend of increasing usage

in recent years (Lenhart, Purcell, Smith, & Zickuhr, 2010). Among MSM, 40% of individuals have used the Internet to look for sex partners (Liau, Millett, & Marks, 2006). This rate increases in the age group of 18-24 years old, with 68% of MSM having at least tried using the Internet to find a sex partner, and 48% having actually had sex via the Internet (Mustanski, Garofalo, Herrick, & Donenberg, 2007).

Geosocial networking apps (GSN apps) have also seen a rise in usage, especially among MSM. These are applications that can be downloaded on a phone for mobile usage. With 93% of young adults owning a cell phone, access to these apps is fairly ubiquitous (Lenhart, Purcell, Smith, & Zickuhr, 2010). Many apps exist to find sex partners anonymously and directly. These apps allow users to create a profile, enter their self-declared demographical information, sexual behavior, and other personal attributes, and see who is near them on the app using GPS. Grindr is one of the most popular MSM GSN apps available. Three years after its creation in 2009, Grindr has amassed over 6 million registered users in 192 countries; there were over one million daily user log ins, over seven million chat messages, and over two million photos (Grov et al., 2014). On average, each user spent 1.5 hours in the app daily with eight log-ins (Grov et al., 2014). These activity trends have continued to increase since 2013 (Grov et al., 2014). Many other similar apps exist that are popularly used by MSM, including Grindr, Scruff, and Adam 4 Adam. Most users utilize GSN apps for three to five hours daily, although 20.8% do use them over 13 hours daily (Wohlfeiler et al., 2011). Individuals aged 18-54 years old represent an overwhelming 93.9% of the population that uses GSN apps, with 92.4% of all users living in urban areas (Wohlfeiler et al., 2011).

Studies have revealed that GSN apps can lead to riskier behaviors and more sexual encounters. In Los Angeles, 76% of surveyed youth aged 18-24 years old said they have met

sexual partners through Grindr (Landovitz et al., 2013). Many other studies have had similar findings of a high rate of sexual intercourse between GSN app-connected partners. For example, it has been shown that individuals having sexual encounters through dating apps are less likely to use condoms, have more lifetime partners, more likely to have sex before age 16, and more likely to have a smoking or drinking habit (which can further increase poor decision making of sexual behaviors) (Choi et al., 2016). As GSN apps become more popular in the modern world, their specific demographic groups, that is, young to middle aged MSM that tend to partake in riskier behaviors, may be connected to recent increases in STD trends.

Study design and objectives

In response to the spikes in syphilis cases initially seen in 2013, the Pima County Health Department (PCHD) developed an action plan to reduce the incidence of syphilis. They created local public ad and awareness campaigns to promote syphilis education and testing, devoted more resources to syphilis services, and spread information about syphilis through social media and GSN app ads. In this study, we tested the impact of using GSN apps direct messaging as medium for the PCHD syphilis campaign. In cooperation with the PCHD, we created a user profile on select GSN apps for MSM with the function of the profile to answer sexual health questions, especially regarding syphilis. The goal was that through private chats with users, we would see advances in health outcomes, increased knowledge and awareness about STDs and testing, and syphilis prevention. We found that messaging users only in response to their message, and not being the profile to initiate a conversation, resulted in the most positive user interactions and health outcomes.

Methods

Geographic setting

Pima County is located in Southern Arizona with 1,016,206 residents. Maricopa County and Pinal County border to the north and the country of Mexico to the south. Tucson is the major city in Pima County at a population of 531,641 residents, 236.2 miles^2 of land (0.3 miles^2 of water), and roughly 22 miles in distance from the north to south border (PCHD, 2017). Arizona has a total population of 6.731 million residents (City of Tucson, 2017). Of those, 49.2% are male, and 40.9% of males are aged 15 to 44 years old. The median age for males is 36.5 years old (United States Census Bureau, 2017). In terms of racial and ethnic makeup of Pima County residents, 85.3% are White, 4.1% are Black or African American, 4.3% are American Indian and Alaska Native, 3.2% are Asian, 0.2% are Native Hawaiian and Other Pacific Islander, and 36.4% are Hispanic or Latino. Nearly one-fifth (18.7%) of the population lives in poverty (United States Census Bureau, 2016). Despite White residents comprising most of the population, only 12.7% of them live below poverty level, whereas that increases to 26.6% in residents of Hispanic or Latino ethnicity (United States Census Bureau, 2017).

Syphilis in Pima County tends to occur in White or Hispanic MSM that are under 40 years old. According to 2013-2014 data, 84% of MSM P&S syphilis cases in the county are White or Hispanic, 72% are under 40 years old, 63% use websites or mobile apps to meet partners, and 46% have been members of a social networking app Grindr for at least a year. Local as well as national syphilis incidence are also seeing a spike increase in incidence which mirrors the spike seen in MSM. The fact that most of these cases are primary and secondary syphilis reveals many are new infections that are acute and treated fast.

Study design and components

The goal of this study was to learn how to utilize social networking apps like Grindr to connect and communicate with individuals to reduce the incidence of syphilis. In order to accomplish this, (1) a survey was conducted that assessed public perception and knowledge of syphilis and sexual health, (2) app messaging was done in two key phases (Phase 1 "Active" and Phase 2 "Passive), and (3) free mobile STD testing events by the PCHD were advertised through apps.

Survey

The "Syphilis and Social Media Survey" was created as part of this research to assess the habits and knowledge of Pima County residents regarding syphilis and STDs (Appendix G). The survey was administered during the months of August and September 2016 to clients at a Pima County Health Clinic and two local gay bars. This one-page survey included seven questions, five of which were multiple choice (three with one follow-up question) and two of which were short, open answer. No response was an option by not selecting any answer choice.

The health department clinic was located in central Tucson, about four miles north from downtown, and it received patients for STD testing and treatment, immunizations, and family planning. Health department clinics are major providers of STD testing in Tucson, as they offer price reductions on services based on a sliding scale to an individual's income (PCHD, 2017). There was one other PCHD department clinic that offered STD testing, located roughly 12 miles south of the other clinic and 15 miles from the nearest suburb town, Sahuarita (population 25,259) (PCHD, 2017; United States Census Bureau, 2017). From August 10th, 2016 through September 20th, 2016, surveys were given to patients by front desk personnel attached with every

intake form. The surveys were collected in a folder, and picked up by the researchers at a later date; all patients were required to fill out an intake form before seeing a healthcare provider.

The two gay bars where the survey was administered were located roughly five miles north of downtown Tucson and three miles south of the surveyed health department clinic. Surveys were given to bar patrons in-person by researchers to all individuals at the bars on specific dates during afternoon/early evening hours (table 4). The demographic profiles at both bars were adult MSM, more middle aged than youth. Survey collection dates were scheduled to coincide with mobile van outreach testing as well as planned bar social gatherings.

Once the survey period was over in September, the data were analyzed to inform the efforts for the social networking app messaging. Importantly, the open-answer survey question that asked that what websites or apps an individual used to find dates, sex partners, or friends was utilized to inform what apps the Health Advisor should be present on the app. The three most frequently mentioned three apps were Grindr, Scruff, and Adam 4 Adam.

Messaging intervention

With social networking apps identified, the Health Advisor (HA) account became active with two non-overlapping phases of messaging, Phase 1 (Active) and Phase 2 (Passive). The messaging interventions occurred from June 23rd, 2016 through January 11th, 2017. The major difference between the two phases was the style of messaging, indicated by the descriptor active or passive. Table 2 summarizes the two types of messaging phases. Messaging was done on Tuesday and Thursday of every week during the given phase period from the hours of 9 am through 2 pm. The HA used an iPad (3rd generation) to download and use the apps, and the HA retained "Online" or "Recently Online" status in the apps during messaging hours. (Note: after an hour of inactivity, a user is not considered "Recently Online" and, therefore, is not visible to

other users except through a preexisting chat log). The app screen of "Online" and "Recently Online" users was consistently refreshed by the HA in order to message newly online individuals rapidly.

Characteristics of messaging phases

Messaging style	Start date	End date	Duration	Number of unique conversations	Apps used
Phase 1 (Active)	6/23/2016	8/31/2016	10 weeks	2969	Grindr, Scruff
Phase 2 (Passive)	9/1/2016	1/11/2017	19 weeks	96	Grindr, Scruff, Adam 4 Adam

Table 2: The time range, duration, conversation quantity, and app usage of both messaging styles.

The HA were two individuals with backgrounds in Public Health (one Master of Public Health student, one undergraduate Public Health student), familiarity with the specifically used social networking apps, and an understanding of disparities and services relevant to the MSM demographic groups in Pima County. Both Health Advisors were well-connected to PCHD staff who were developing STD awareness and reduction efforts. Through the study, the staff were readily available to assist the HA in answering challenging user questions.

There were many methods employed by the HA to facilitate continued conversation with users and build rapport. It was chiefly important for the HA to be approachable, friendly, and trustworthy to the user. Indeed, since all the apps were anonymous, a user anywhere had the capability to create a profile called "Health Advisor" that claimed to be from the county health department. Therefore, by deciding to message the HA, users were already taking a chance at deception. It was essential for the HA to quickly establish these qualities via conversation so that the user felt free to ask questions. In this way, strong awareness and experience regarding the

particular vernacular of the MSM community in the apps was considered key to stimulating user conversations and engagement. Training occurred between the two HAs, with the second HA having been monitored and trained on the vernacular by the first HA.

Intervention – Phase 1 (Active) – June 2016 through August 2016

In the initial, active phase of messaging, the HA individually messaged all user profiles displayed on the app screen with a health promotion and prevention message that communicated syphilis is on the rise in Pima County as an epidemic, provided information about STD testing, and welcomed the user to respond with any questions or comments (which the HA could subsequently answer). The prevention message was pre-defined text that was copied sent to all users (Appendix B). During Phase 1, the HA messaged individuals with the prevention message regardless of whether the user has already messaged the HA. Hence, Phase 1 was described as "Active" because the HA was actively taking initiative to message users. A user was sent the prevention message only once. If a user already received the prevention message, then the user was skipped for messaging and the next user was selected. If a user messaged the HA first (before the HA had an opportunity to send the prevention message), then the HA messaged in a "Passive" fashion as described in Phase 2 (Passive) below. Most conversations were not Passive in Phase 1.

User profile

All the social networking apps used in this study had similar user profile options that a user could opt-in provide information. During Phase 1, the HA profile had the following features. The profile image was a syphilis awareness campaign poster created by the PCHD. (The campaign and its images were recognizable across Pima County by public visibility due to 2013-2017 ad campaign efforts) The user name was Health Advisor. Demographic information

was set to be similar to the most common MSM demographics seen in Pima County. Any sexual preference, sex-related, or other personal information was left blank, as was the profile biography and any other text boxes. It is not guaranteed a user looks at the profile information, as a user is able skip the information and immediately begin messaging. Only the username and profile picture is clearly displayed at all times.

Outreach STD testing

The PCHD conducted free STD testing out of a mobile van during the testing period, not uniquely as part of the HA intervention. These outreach events occurred in a variety of places, including local gay bars, community events, and at the health department. Individuals were able to be tested for syphilis, HIV, chlamydia, and gonorrhea. When the PCHD was conducting outreach events of free mobile STD testing, the HA would message a hybrid prevention message that communicated the information for the outreach event, the epidemic status of syphilis in Pima County, and the importance of knowing one's STD status. This message was overall shorter than the generic prevention message. Additionally, this messaging was the only form of advertisement of the outreach event given the event was not connected to a community event (i.e. LGBTQ Pride in Tucson). There were a total of 12 outreach testing events during this study, eight of which were advertised to app users by the HA, all during Phase 1 (Active) messaging. A week before the outreach event date, the HA would actively send all app users the hybrid message regardless of whether they have received the generic or hybrid message before (i.e. for a previous outreach event date).

Data collection

All user conversations were recorded in spreadsheets. During Phase 1, conversations were noted for the quantity of user conversations, user response (positive or negative), and chat

elements (i.e. expressed interest in STD testing, whether user re-contact HA from a prior chat conversation). The full spreadsheets are included in Appendix C (Grindr) and D (Scruff), and spreadsheet definitions are given in the Data Dictionary (see Appendix E). Survey data were tabulated by location, and outreach testing data was gathered as location, quantity of people tested, and whether an individual heard of the testing from the HA.

Intervention – Phase 2 (Passive) – September 2016 through January 2017

In the second phase of messaging, the HA utilized a different messaging style and made important modifications to the HA profile in the apps. Phase 2 was described as "Passive" because the HA no longer would be the first to initiate conversations; instead, the HA would only send a message in direct response to a user's message. To do this, the HA would still retain "Online" or "Recently Online" status as in Phase 1. The HA would respond to all chats, have a conversation with a user, and avoided prompting them for a sexual health question or concern. The HA would carry on a conversation and wait for the user to ask. Regarding the generic prevention message in Phase 1, this was continued in Phase 2 except the HA would send the message at some point during a conversation with a user, not necessarily at the start. If a user never messaged with the HA, then the user would never receive the prevention message. The Phase 2 prevention message had the same contents as Phase 1, although the precise text was subject to modification in order to tailor it to conversational context. Importantly, by nature of Passive messaging, conversations tended to be even more casual and focused on HA rapport-building. The HA was no longer necessarily leading the chat with the PCHD prevention message and hence may not seem "official" to a user. Due to this, there was greater emphasis on the HA effectively integrating the discussed methods of user trust-building in Phase 2.

User profile

A significant difference between Phase 1 and Phase 2 messaging is the features of the HA app profile. In Phase 2, the following changes were made. The profile image was modified from a PCHD syphilis awareness campaign poster to a professional picture of the torso of the HA, including only the waist up to the neck and dressed in business casual clothing. Every two weeks, the HA took a new torso picture and updated the profile image to give the impression of user activity and trustworthiness. Furthermore, text was added to the biographic section of the HA profile that contained a health promotion message, the purpose, and the PCHD affiliation of the HA. The biography text read "Syphilis is on the rise in Pima County. Know your status, get tested. I answer questions you may have about STD testing/syphilis/HIV/AIDS/STDs. I'm from the Pima County Health Department, answering questions is the reason I'm on here." Given that users were able to message the HA without looking at the profile details (particularly the biography), the HA continued to communicate the prevention message in all chats. Unchanged features from Phase 1 include the user name, demographic information, and other excluded categories.

Outreach STD testing

In Phase 2, the PCHD continued to conduct events of free mobile STD, but the HA did not promote them to users in the same Active style. Rather, the HA would promote these events by giving their details only if a user conversation focused specifically on STDs (i.e. testing, symptoms). The HA would also mention other places to get testing, such as the county health clinics. The outreach events were promoted with and without an accompanying prevention message, depending on the context of the conversation. A total of four events were conducted during Phase 2, two of which were held at major Tucson community events.

Data collection

User conversations in Phase 2 were recorded in much more detail than Phase 1. Each individual conversation was recorded in reference to multiple elements: the app, date and time, username, profile picture description, demographic information, whether the prevention message was sent, whether the user was engaged in chatting, and specific health-focused details about conversation. The HA was required to describe key parts of the conversation under "Detail service activity." This allowed the HA to see patterns among users, for example how often a user re-contacted the HA or common trends among app users who contacted the HA. An example spreadsheet can be found in the Appendix F (some sections excluded), with definitions of sections and other data recorded given in the Data Dictionary (Appendix E). Results from outreach testing events were recorded no different from Phase 1 and were compiled together. No survey was conducted in Phase 2.

Data analysis

The goal of this study was to determine whether it is effective for a health advisor account on a social networking app to disseminate health information on sexual health topics, particularly syphilis. To do this, the study tested Active versus Passive messaging styles in relation to how well users responded to HA communication. Features of user profiles and conversations were recorded throughout each phase; the frequency and counts of the features were compared between the two phases. The conversations of a certain app were also compared to that of a different app during the same phase. User-inputted demographic information was analyzed for trends between phases. Survey responses were evaluated by location and question response rate, and outreach testing data was compiled to include STD testing results and HA efforts.

Results

Survey

A total of 161 surveys were completed by individuals over a two-month period from August to September 2016. Of those, 65 were collected at Gay Bar 1, 31 at Gay Bar 2, and 65 at the PCHD health clinic.

Syphilis Awareness and Perception

Less than half of respondents (43.4%) had recently seen or heard information about syphilis in Pima County (figure 1**)**. Of those that had encountered information, 71.8% (n=79 respondents) did so through print media (n=33), social media (n=25), and/or friends (n=21). A greater portion of respondents at the two gay bars had recently seen information about syphilis (52.1%) than those at the health clinic (30.8%) **(**figure 1**)**.

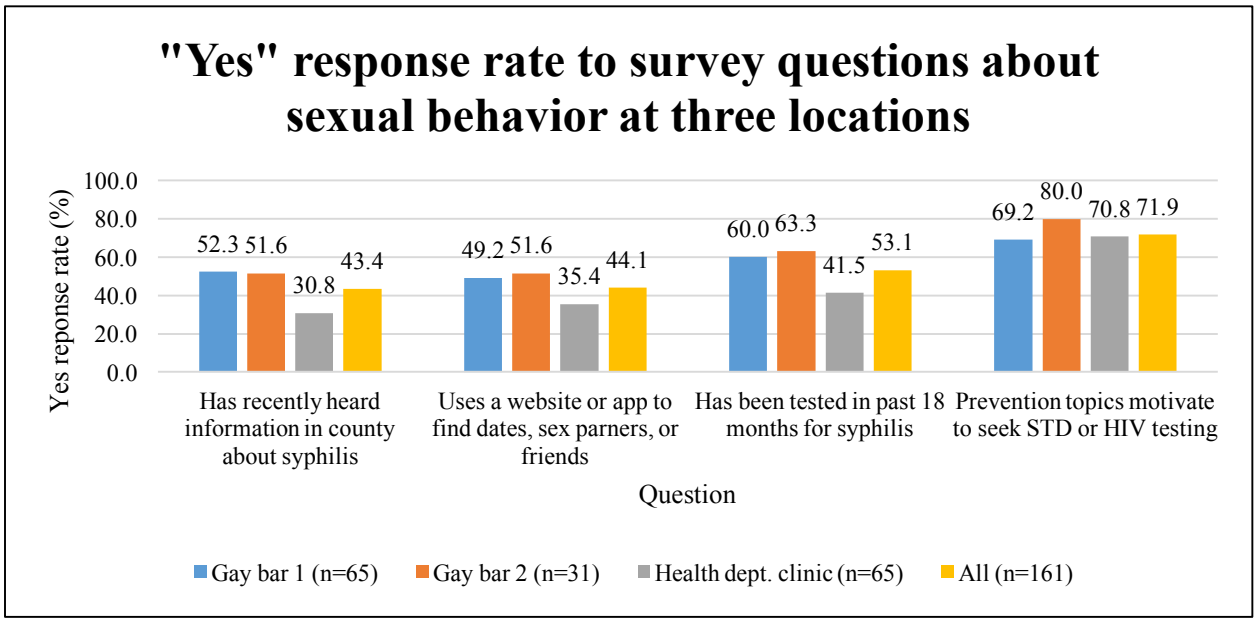


Figure 1: Survey results for four questions regarding sexual behavior and syphilis.

Website and app usage

Overall, 44.1% of respondents said they do use websites or apps to find dates, sex partners, or friends. The gay bars had a higher rate of respondent usage than the health department clinic. Respondents at Gay Bar 1 answered "Yes" 49.2% of the time, 51.6% at Gay Bar 2, and 35.4% at the health department clinic (figure 1). Grindr was the most frequent app or website mentioned (25.69% of respondents said they use Grindr), followed by Tinder (16.67%), Facebook (14.58%), and Craigslist (13.19%) (data not shown).

Respondents also were asked what websites and apps they thought the PCHD should promote health topics on. This question informed where we selected apps for the HA campaign. The most common selections were Facebook (33.5%), Grindr (23.6%), Tinder (21.1%), Scruff (21.1%), Instagram (19.3%), and Adam 4 Adam (18.6%). Of these, Grindr, Scruff, and Adam 4 Adam were the only phone applications targeted at MSM and were the target GSN apps for the intervention (figure 2).

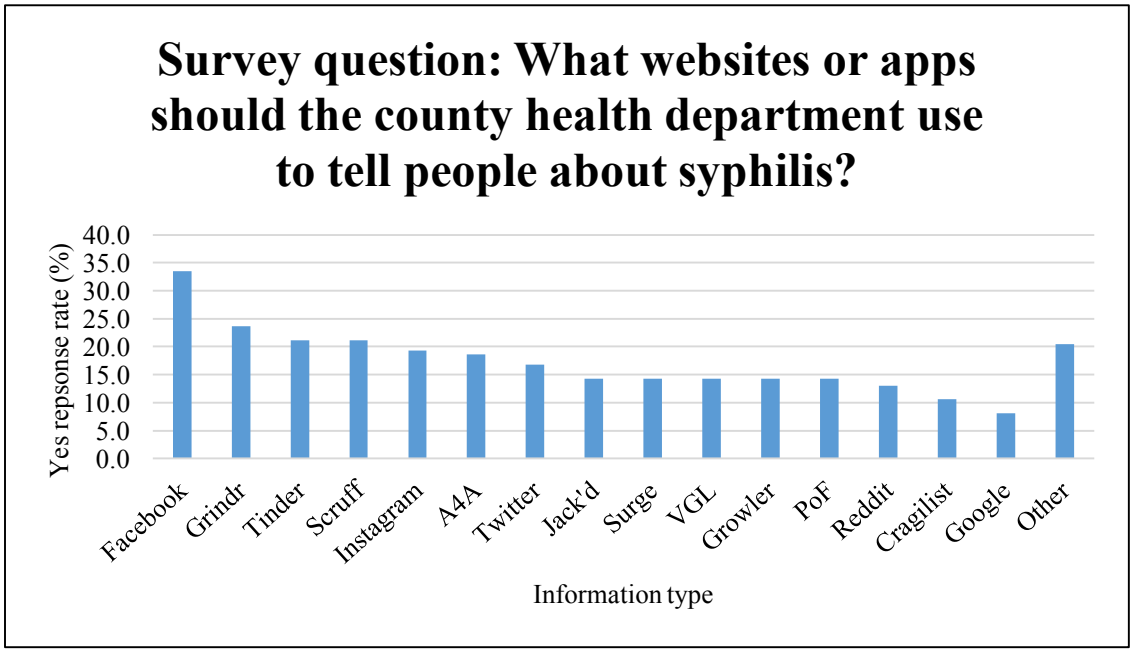


Figure 2: Survey results for four questions regarding where individuals think the PCHD should promote syphilis awareness.

Opinions on prevention messages and sexual health

The survey also asked about syphilis testing. Around half (53.1%) of respondents said they were tested for syphilis in the past 18 months, and this percentage rises to 60% and 63.3% for Gay Bar 1 and 2 alone, respectively. Of those who said no, the most common reasoning was respondents did not think they were at risk of syphilis, followed by they had no symptoms of syphilis (figure 3).

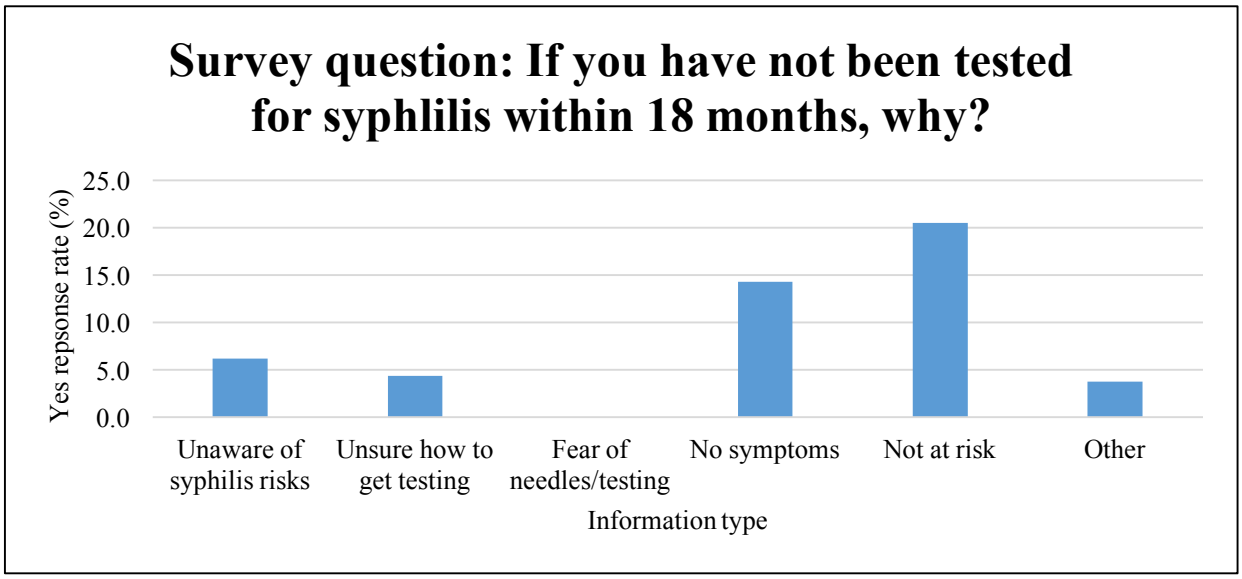


Figure 3: Survey results for four questions regarding syphilis testing.

The majority (71.88%) of survey respondents said health prevention topics do motivate them to seek STD testing. This response was higher at Gay Bar 2 (80.0%) and about equal at Gay Bar 1 (69.2%) and the clinic (70.8%) (figure 4). In a separate question, respondents revealed that the information types that motivated them the most to seek STD testing were STD symptoms (56.5% responded this as the motivation), testing/clinic details (54.7%), and treatment options (42.9%) (figure 4).

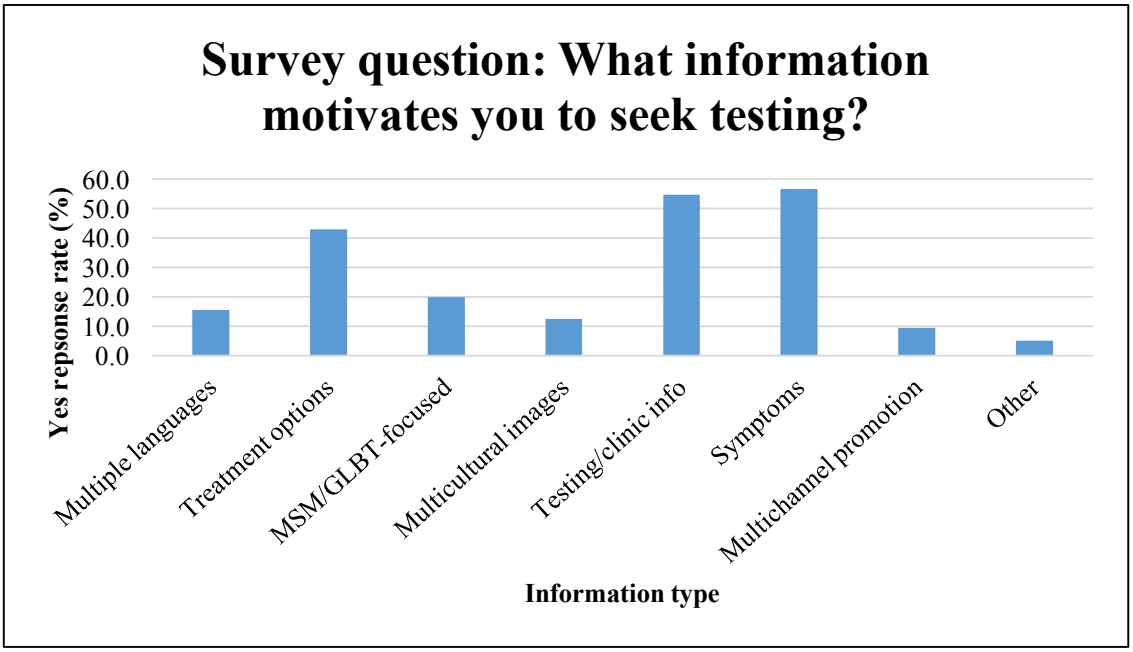


Figure 4: Survey results for four questions regarding the presentation and information quality of STD testing in relation to personal motivation.

Phase 1 (Active)

Phase 1 ran from June to August 2016 (10 weeks), utilized the apps Grindr and Scruff, and communicated with 2,969 different users. A total of 1,184 messages were sent through Grindr and 1,785 through Scruff. Overall, 92.61% of conversations did not elicit a response from the user (e.g. the generic prevention messages were sent without a response). Furthermore, 5.78% of conversations had a positive user response, 0.13% had a negative response, and 1.48% had a neutral response (table 2, table 3).

The rate of different chat elements was low for the 2,969 Phase 1 conversations. Users re-contacted the HA 0.2% of the time, had an informational chat 0.5% of the time, and requested a referral 0.2% of the time (e.g. to a testing or HIV pre-exposure prophylaxis clinic). Slightly higher rates of positive responses, re-contacts, informational chats, and user-requested referrals were seen in Grindr than Scruff (table 3).

User response and engagement for Phase 1 and Phase 2

App (n=unique conversations)	Positive user response (%)		Negative user response (%)		Contact at least twice (%)		Informational chat with user (%)		User requested referral to services (%)	
	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
Grindr (Phase 1 n=1184) (Phase 2 n=66)	6.4	63.6	0.1	0	0.3	22.7	1.1	50	0.3	36.4
Scruff (Phase 1 n=1785) (Phase 2 n=8)	2.2	50	0.5	0	0.1	37.5	0.2	50	0.1	87.5
Adam 4 Adam (Phase 1 n=0) (Phase 2 n=22)	N/A	72.7	N/A	0	N/A	0	N/A	59.1	N/A	31.8
Total (Phase 1 n=2969) (Phase 2 n=96)	3.9	64.6	0.3	0	0.2	18.8	0.5	52.1	0.2	39.6

Table 3: The rates of certain user responses and interactions in Phase 1 (Active) and Phase 2 (Passive) per *n* unique conversations. Refer to Graph 6 for the change in these rates from Phase 1 to Phase 2. Adam 4 Adam was not used in Phase 1 by the HA to message users, hence there are zero unique conversations for that phase.

Active promotion of outreach testing events fostered STD testing

The details of each outreach testing event can be seen in Table 4. Individuals were asked how they heard of the outreach testing event in-person by the phlebotomist. Eight individuals said they heard about this event from the HA on an app. These individuals were all tested during Phase 1 messaging, and they represented 16% of the total number of tested individuals during Phase 1 (total n=50). Aside from HA promotion, the only ways the outreach events were advertised was via word of mouth and coincidental co-localization to the testing van. Likely, most of the 20 individuals who were tested at the "Health department" all heard of the event from the HA (table 4). At this location, testing was conducted in a mobile van in a non-central parking lot without any outside indication of free STD testing, so it was not apparent to walk-in clients who had not previously heard of this event.

Summary of Outreach STD testing in mobile van during Health Advisor messaging period

Testing date	Location	Number of people tested	Health Advisor advertised through apps?	Number of tested individuals from (app)*
7/12/16	Health department	0	Yes	None claimed
7/13/16	Health department	3	Yes	2 (Grindr), 1 (Scruff)
7/20/16	Health department	6	Yes	1 (Grindr), 4 (Scruff)
7/26/16	Health department	3	Yes	None claimed
7/27/16	Health department	8	Yes	None claimed
8/13/16	Gay bar 2	7	Yes	None claimed
8/27/16	Gay bar 1	15	Yes	None claimed
8/28/16	Gay bar 1	8	Yes	None claimed
9/28/16	NLAAD resource fair	27	No	N/A
10/1/16	Tucson Pride	60	No	N/A
11/5/16	Gay bar 1	12	No	N/A
1/14/17	Gay bar 1	5	No	N/A

Table 4: The location, testing statistics, and Health Advisor messaging data for STD community testing events. Outreach testing is a regular activity of the Pima County Health Department, delivered via an identifiable mobile van unit. Gay bar locations 1 and 2 match those of the survey data. *Individuals were asked in person if they heard of the Outreach testing event through apps.

Phase 2 (Passive)

Phase 2 ran from September 2016 to January 2017 (19 weeks), utilized the apps Grindr, Scruff, and Adam 4 Adam, and communicated with 96 different users. Grindr saw the most activity, with communication to 66 different users. Adam 4 Adam messaging resulted in 22 conversations, and Scruff resulted in eight. Unlike Phase 1 (Active) messaging, all of these conversations were initiated by the user messaging the HA first. Most (60.42%) conversations resulted in a positive user response, 20.83% had a neutral response, 18.75% had no response, and there were no negative responses (table 2). Furthermore, in 32.2% of conversations the user explicitly thanked the HA for their work (table 5). Daily messaging counts can be seen in the figure 7, with between one and five conversations occurring daily and up to ten in a single day.

Unlike in Phase 1, the HA recorded the user-inputted user demographics gathered from app user profiles who chatted with the HA (figure 5). The mean age of app users who

communicated with the HA was 31.2 years old, 28.4% were Latino, 3.2% were Latino and Hispanic, 23.2% were White, 3.2% were Asian, and 3.2% were Other. A total of 38.9% of users who communicated with the HA did not declare a race or ethnicity, and 31.58% did not declare an age.

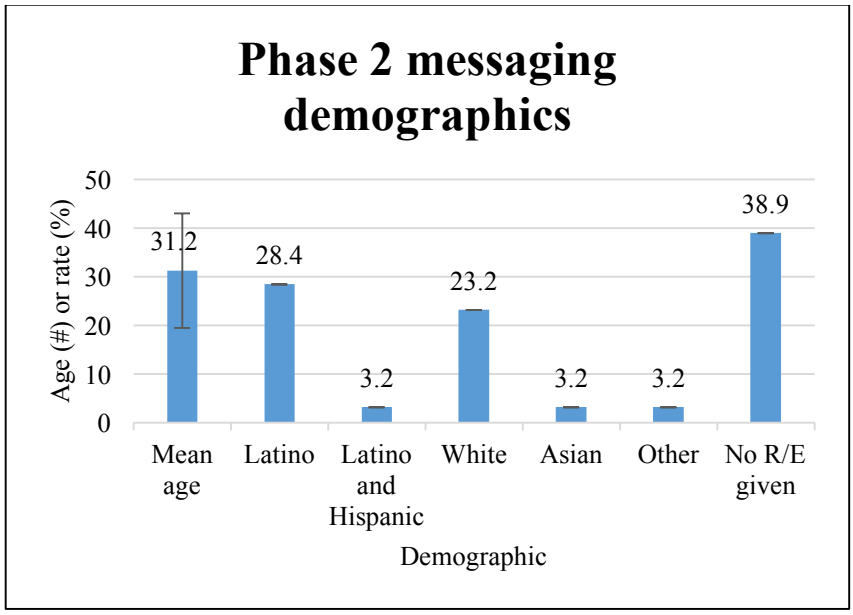


Figure 5: Self-declared demographic information of all users in Phase 2 who chatted with the HA over apps. Error bar is standard deviation.

Passive messaging resulted in a large portion of conversations that included important chat elements. In nearly one-fifth of conversations (18.8%), the user decided to re-contact the HA from a previous chat. Overall, 52.1% of conversations were informational in regards to health, and in 39.6% of conversations the user requested a referral to a clinic or physician. Variations in the frequencies by app used were observed, with Scruff having in the highest re-contact and user-request referral rate, and Adam 4 Adam having the highest informational chat and positive response rate. That being said, Grindr conversations led to the largest quantity of positive chat elements, in part because 68.75% of conversations were carried out over Grindr (table 3).

During Phase 2, the HA recorded all topics each conversation discussed under the section "Detail service activity." The most common topic users brought up was STD testing (52.1% of users mentioned), followed by 32.2% giving an an explicit "Thanks" to the HA, and 11.5% asking about risk of a specific behavior (table 5). Other topics also were discussed although less often, such as treatment options (7.3%), symptoms (6.3%), syphilis (6.3%), HIV (5.2%).

Frequency of conversation topics during Phase 2 messaging by app

	Phase 2 conversations that mention topic (%)			
Topic	**Total (n=96)**	**Grindr (n=66)**	**Scruff (n=8)**	**A4A (n=22)**
STD Testing	52.1	65.2	25.0	22.7
Explicit "Thanks" to HA	32.3	33.3	12.5	36.4
Risk of behaviors	11.5	12.1	25.0	4.5
Treatment options	7.3	9.1	0.0	4.5
PrEP	6.3	4.5	0.0	13.6
STD Symptoms	6.3	6.1	12.5	4.5
Syphilis	6.3	7.6	0.0	4.5
Social stigma around STDs or queerness	6.3	7.6	0.0	4.5
HIV	5.2	6.1	0.0	4.5
Wants to meet HA person	5.2	3.0	12.5	9.1
Insurance-related	4.2	6.1	0.0	0.0
Undetectable STD status-related	4.2	4.5	0.0	4.5
Spanish speaker	4.2	6.1	0.0	0.0
Will tell friends about services	3.1	3.0	12.5	0.0

Table 5: The rate of specific conversation topics during Phase 2 (Passive) messaging style by app for (n=unique conversations). A single conversation can be counted in multiple Topic categories, only once per category.

Comparison of Phase 1 (Active) versus Phase 2 (Passive)

Passive messaging resulted in better user responses

The Phase 2 messaging style resulted in higher number and frequency of all conversation elements than that of Phase 1, except negative user responses were slightly less frequent (figure 6). These differences were observed overall and for each app. Only Grindr and Scruff are included in this comparison because Adam 4 Adam was not used in Phase 1. Compared to overall active messaging, passive messaging saw a 60.7% increase in positive responses, 18.5% more re-contacts, a 51.5% rise of informational chats, 39.4% more user-request referrals, and an elimination of negative responses (0.3% rate decline from Phase 1). Grindr and Scruff saw similar responses for these chat elements, although Grindr had slightly more positive responses and Scruff had slight more re-contacts and many more user-requested referrals. Adam 4 Adam saw the largest frequency of positive responses (72.7%) and informational chats (59.1%).

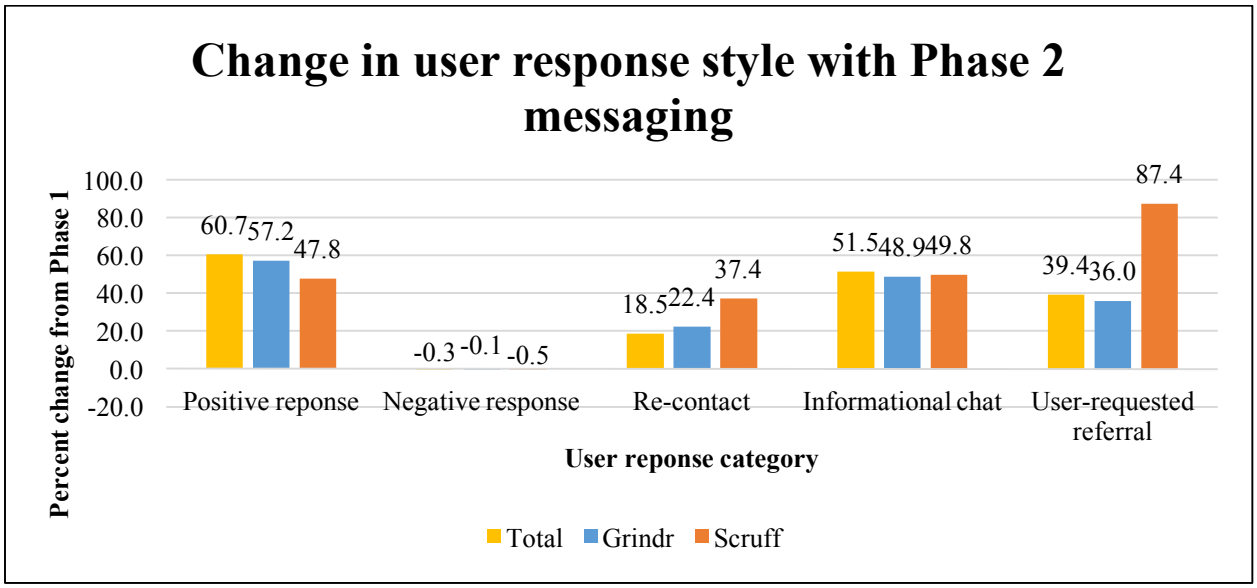


Figure 6: Percent change in user responses and interactions from Phase 1 (Active) to Phase 2 (Passive) messaging. Number above each bar indicates the actual frequency.

Discussion

Using a Health Advisor profile on social networking apps has many positive impacts and applications with health promotion and prevention. It is clear from the survey results that many individuals use website or apps to find partners, and Grindr, Scruff, and Adam 4 Adam are particularly used. Communicating health topics through apps enables access to a very specific demographic, in this case MSM youth who were predominantly Latino or White (figure 5). Importantly, this is a very similar demographic to that of new syphilis cases reported in Pima County, lending support for messaging through these apps as a strong way to target high-risk groups (table 1).

The anonymity of the apps appeared to increase the willingness of users to ask questions, in terms of both diversity and frequency of questions. This was true even if the HA focused on a particular health topic, i.e. syphilis. In this study, it was seen that despite the fact that HA utilized syphilis-centric health promotion messages and biographies, the HA was able to assist individuals in many other ways. Syphilis was the topic of passive conversations only 6.3% of the time (table 5). Over 13 other recorded health topics were discussed during the study period, with STD testing being the most common. This in itself was useful, for the HA was able to refer clients to county clinics and even free testing events when available. The HA could also connect users with other health resources to address their concerns. Not only were questions diverse, but they were also frequent, especially during passive messaging. Around 50% (n=50) of passive messaging conversations included an informational chat about a health topic, which was greater than the frequency during active messaging (frequency=0.54%, n=16). The diversity and frequency of health topics reflected that the MSM community who were utilizing these apps

were concerned about their health, and their apparent willingness to ask questions could show they had a desire to improve their health.

The data clearly show that passive (Phase 2) messaging was much more effective than active (Phase 1) messaging at having positive, informational interactions with users, and promoting user questions, re-contacts, and referrals. Mostly notably, passive messaging resulted in 60.42% of users responding positively to a HA interaction, an absolute increase of 54.64% from active messaging. Plus, there were no negative reactions to passive messaging, unlike active messaging (table 3). For example, 24 Grindr users requested a referral to a health clinic or physician during passive messaging (Grindr total n=66), whereas only four did so during active messaging (Grindr total n=1184). The number of users that initiated contact with the HA during Phase 2 (19 weeks) was over four times higher than Phase 1 (10 weeks). Altogether, this reflects that Phase 2 methodology (passive messaging and the given HA profile changes) was more effective at generating openness about health questions with app users. An increased level of trust might be also reflected in the Phase 2 data; the quantity of user-initiated conversations in Phase 2 (which they all were by definition, n=96) was higher than the quantity in Phase 1 (n=23).

An important change related to passive messaging was adding an official profile biography. It was not until the start of Phase 2 that the HA profile indicated its affiliation with county health department and its purpose on the app. The HA also began posting a professionally dressed torso picture every two weeks. These changes shifted the perception of the HA profile from a seemingly anonymous profile ambiguously named “Health Advisor,” to a profile that was clearly active, professional, affiliated with Pima County, and whose sole purpose was to answer questions.

An additional and unavoidable disadvantage to active messaging was the HA account could be banned from the app due to user complaint. Indeed, during active messaging, the HA was banned multiple time from both Grindr and Scruff. This might have been because users saw the generic promotional method as a spam message and not a helpful health message since the HA sent it to all users unsolicited. The fact that the HA was never banned from apps during Phase 2 passive messaging further reflected the benefits of that messaging style.

This study and the HA methodology were not without limitations. The sample size of users, especially during Phase 2, was relatively small and hard to accurately interpret statistically. The number of conversations per day when passively messaging was also not large (figure 7). Similarly, the duration of this study was a constraint. It would have been better to conduct Phase 1 over one year and Phase 2 over the next year in order to reduce the impact of confounding variables (i.e. seasonal trends in STD incidence, STD test frequency, or social networking app usage). A longer duration would also allow more data to be collected. Despite the dramatic differences seen in active versus passive messaging, many of findings in this study were without statistical testing. This is due to a lack of data quantity, a large data diversity, and time constraints.

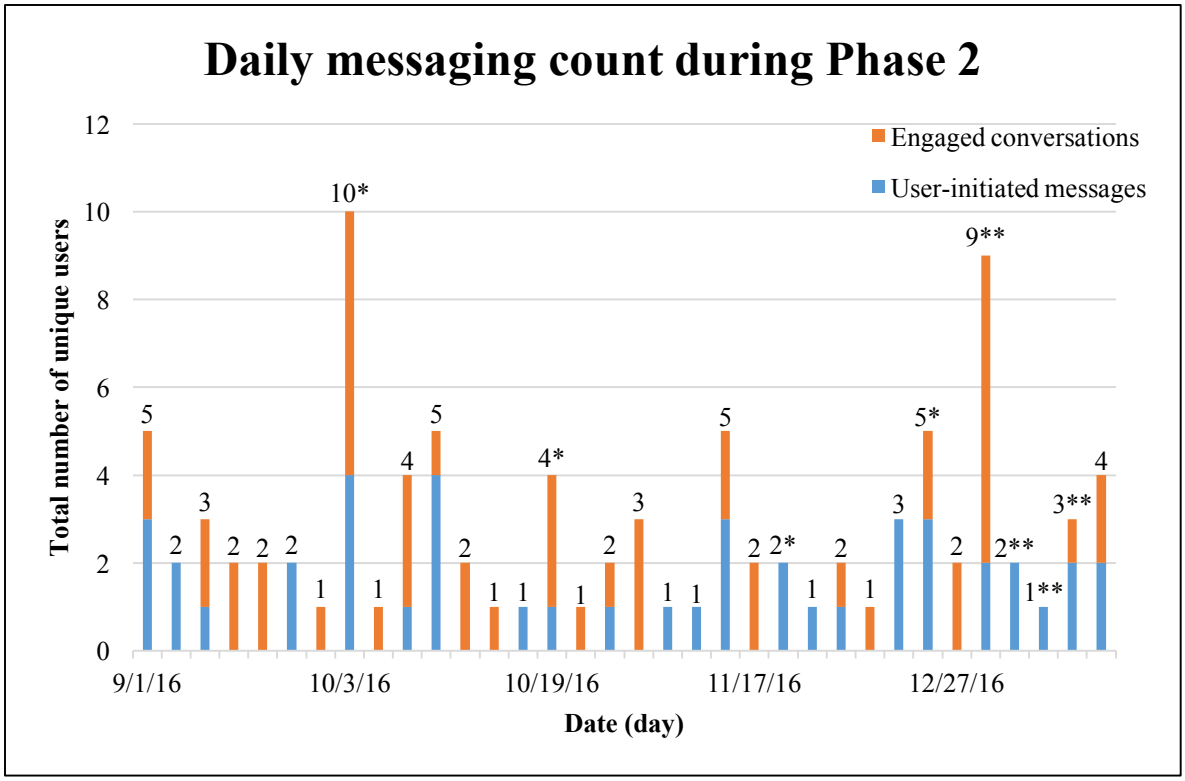


Figure 7: The total number of unique conversations between users and the Health Advisor (HA) for every day the HA was messaging on apps. "Engaged conversations" are Unique conversations in which the user responds in a thoughtful, active way. The number above each column represents the total number of Unique conversation on that day. The messaging period was 9/1/16 through 1/11/17. *Changed HA profile picture to a new professional image of the HA. **Days when

Recommendations

Based on this project's experiences, there are multiple recommendations for HA interventions, both in terms of the type of apps to use, format of the messaging campaigns, personnel, and future research. They are listed in no particular order.

1. **Social networking apps should designate "approved Health Advisor accounts" to official health entities that request one.** Approved accounts would be labeled as a health official, instantly designating the role of the account on the app and generating

credibility and trust. These approved accounts would require more user reports in order to be banned from the app (the HA would not have to worry if they are spamming users too much). The process of being banned from an app site is negative because not only does the HA have to re-construct the app account entirely, but it also erases all conversations between users and the HA, which makes it impossible for a user to re-contact the HA via their chat log (or vice versa). The only other way to contact the HA is to select them from the list of "Online" or "Recently Online" accounts which are generally sorted by proximity, both of which represent major limitations to a user finding the HA. There are no limitations to messaging if a user has the HA in their chat log; they can even "favorite" the HA and find the account even easier ("Favorites" are also cleared upon banning). Future HA individuals should speak all languages commonly encountered in the region (in Pima County, Arizona, a HA should speak Spanish and English) and they should be well-versed in the vernacular of the specific app community.

2. **The HA should be available to meet users for in-person consultation, and be well-versed in language that are commonly encountered in the region and app vernacular.** Meetings could occur in a health department office or clinic location. Being familiar with languages and vernaculars is important so that all users can be effectively communicated with and receive correct information and advice.
3. **The HA should fully fill out the GSN app profile with a health-focused biography, demographics, and rotating profile pictures.** The HA should also maintain a list of users who opt-in for notification about future health outreach events (i.e. organized by the county health department). This way, the scope of abilities of the HA is not limited to app

conversations, the HA profile generates trust, and public engagement with outreach events is efficiently bolstered.

4. **The HA position should be created in county health departments as a permanent position, either as a new job or a duty of an existing job.** This would help make the outreach campaign available for longer hours; the HA should be online apps the maximum amount of time. This could mean during regular business hours, or it could also mean during weekends and after-hours. The difference in effectiveness of timing has yet to be determined, but certainly different users (and potentially different types or risk groups) would be "Online" depending on the time of day. The more often the HA is online, the more active they appear and the more users will ask them questions. If the HA is offline for an hour or more, their profile is not discovered by anyone (except through chat logs). Additionally, the ideal individual to be the HA should be mobile. Users will only see the HA if the HA is near them in proximity; by being mobile, the HA substantially increases the number of users that see the profile (and have a chance to contact). In fact, the HA could be the same individual who participates in mobile STD outreach testing, if it exists. This way the HA would be mobile and could advertise for the mobile testing in its very proximity. The HA would also always have accurate details about an upcoming outreach event and hence would be the best person to answer user questions about it. In this study, outreach testing was an often-mentioned conversation topic.
5. **The HA should be able to refer a user to STD testing at a health department clinic with a code for free STD testing.** The code would be unique to the specific conversation with the user. Importantly, not only would this code encourage the user to get tested, it

would also allow the HA to directly connect the conversation to the STD test. By doing this, the HA intervention can be better evaluated for effectiveness since there is otherwise no clear indication that the existence of a HA leads to more STD testing. If HA are to be used, this is a key statistic to obtain for assessment.

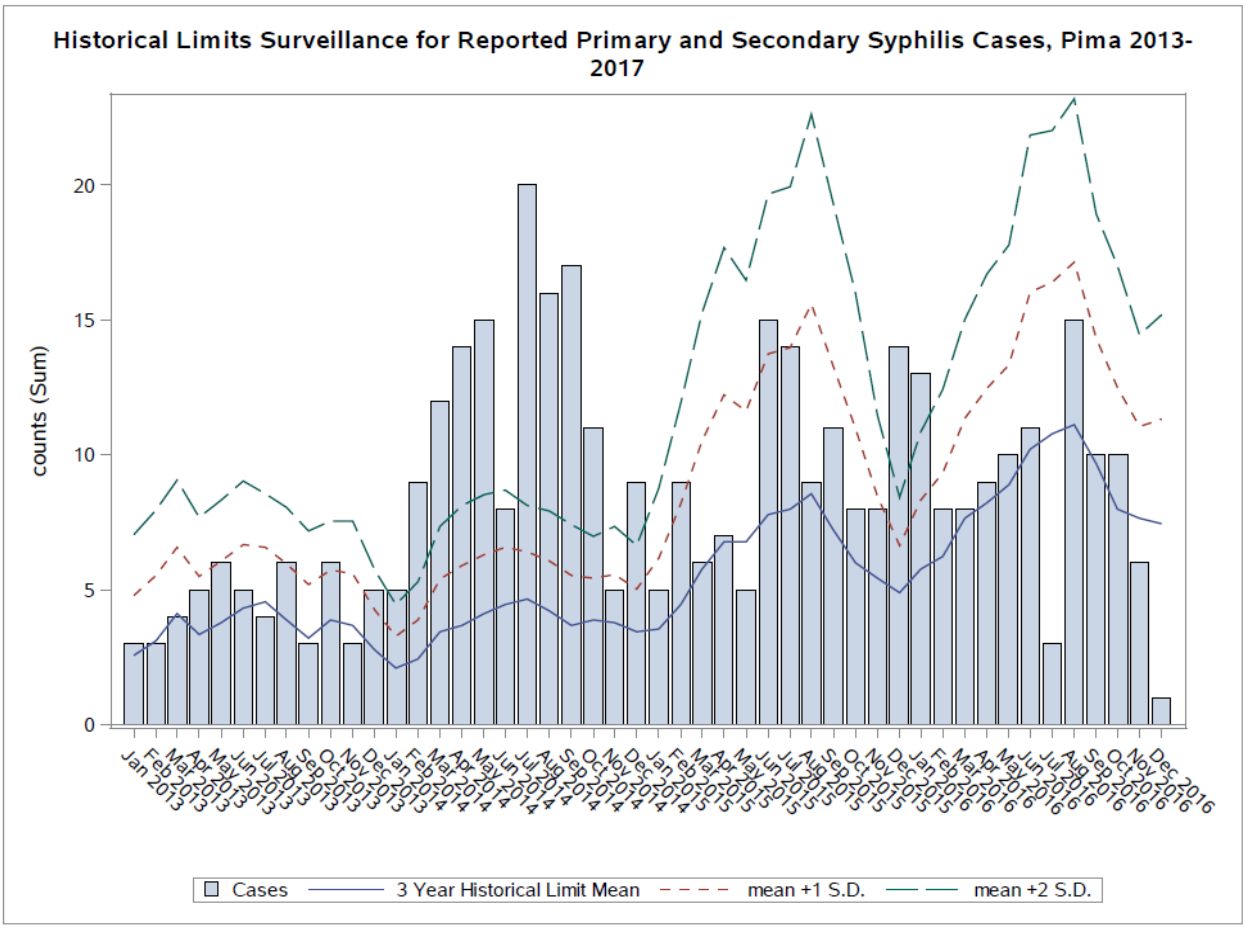
6. **The HA should be able to link health events, such as a user's STD test, to a user conversation.** This could be through a free STD testing code as previously described; alternatively, it could be valuable for research to determine the best way to link health events and conversation. The suggestion of a code could be problematic if a user would prefer the HA not to know the result of their STD test, or simply know they had a test. We expect this could be a barrier given the stigmatization of STDs. Research should also be done to determine the best effective way to foster trust and authority on apps and in specific situations. Rapport and expertise is built differently among different demographics and health issues; in the case of social networking apps, they are particularly subject to user population variation. Simply using the same app in a different location may be enough to significantly alter the demographic groups seen on the app, as is using a different app in the same location. Therefore, the interventions and challenges of a HA should be researched by specific region and app to tailor the HA efforts for maximum effectiveness. In a similar vein, there should be multiple HA accounts per city in order to cover the largest percentage of the city. The view radius of a HA to users and vice versa is inversely proportion to the density of users, so more populous cities will require more HA accounts (more spatially distributed cities will not require any more or less since apps always show a specific quantity of users).

Conclusions

The development of a county Health Advisor account on MSM social networking apps was effective at its main goal to promote syphilis awareness and testing. It also appeared to have additional impacts, such as connecting individuals to health resources. Active messaging was able to target and engage more Pima County residents than no messaging, and passive messaging was a dramatic improvement over active messaging. Passive messaging did not contact as many users, but the quality of each conversation in terms of health topics and user perception was much improved from the active message. We believe quality is more important for an app messaging campaign than quantity. Passive messaging was also much less demanding of a workload for the HA to manage, which is a key advantage when considering its integration into the health department workforce. We hope that using health advisor accounts on various GSN technology apps is an intervention that is continued to be used by the Pima County Health Department and other health departments, nationally and internationally. The intervention appeared to be particularly useful for targeting a specific demographic group, a significant advantage if that demographic is challenging to reach in the first place. Here we show HA messaging is effective when it is syphilis-centric, and we believe it would be effective for other broad health topics too.

Appendices

Appendix A: Figure 8, Historical Limits for Reporting Primary and Secondary Syphilis, Pima County 1/2013 – 12/2016



Appendix B: Table 6, Phase 1 Data Dictionary

Data Dictionary: Phase 1 (6/23/16 - 8/31/16)

Variable name	Question/concept	Type of variable	Categories	Comments
Date	Day that user sends a message	Numerical date	Day, month, and year	
HA	Refers to the Health Advisor, the individual messaging users on behalf of the Pima County Health Department	Individual (intern)	N/A	During this study, the Health Advisor was two individual co-workers, for the entire duration

Informational chat	Number of unique conversations that educate a user about sexual health beyond the Prevention Message	Numerical	Quantity	A conversation where the HA gives more sexual health information than just the Prevention Message, by user request/questions
Interested in testing	Number of users who inquire details about STD testing	Numerical	Quantity	
Messages sent	Number of unique users in a day that HA sends a message	Numerical	Quantity	In a day, the number of user conversations plus the number of HA-initiated messages that users do not respond to
Negative responses	Number of users who express distaste toward HA for assistance	Numerical	Quantity	i.e. user is annoyed at HA
Personal concerns	Specific notes about user conversations regarding STD concerns	Text	Freehand short notes	
Positive responses	Number of users who express gratitude toward HA for assistance	Numerical	Quantity	i.e. user says "Thanks" to HA
Prevention Message	The message that every user is sent early in a conversation, warning that syphilis is on the rise	Text	One message that is sent in all conversations	"Syphilis is on the rise in Pima County, so make sure to be safe and get tested regularly"
Profile views	Number of unique users who have clicked on the HA profile in an app	Numerical	Difference in quantity since previous view count	Scruff (app) only
Re-contacts	Number of unique conversations with users that have messaged the HA also on a previous date	Numerical	Quantity	A conversation where a user has asked a question on a previous date or the HA has previously messaged the user
STD symptom question	Number of conversations in which a user asks a question related to an STD symptom	Numerical	Quantity	
User-initiated conversations	Number of unique conversations in which users message the HA first	Numerical	Quantity	A given user can have at maximum one (1) conversation per day. Follow-up questions during the same day are not considered a new unique conversation unless the question is asked on another day.
User-requested referrals	Number of conversations in which a user asks for contact or location information of a service	Numerical	Quantity	Including STD clinic, PrEP clinic, and non-clinic STD testing referrals
Will get tested	Number of users who explicitly say they will get STD testing	Numerical	Quantity	Includes users who are "Interested in testing"

Appendix C: Table 7, Phase 1 Messaging Log (Grindr)

Date	Conversations (#)	Positive user reponses (#)	Negative user responses (#)	Users that said would get testing (#)	Users that express interest in testing (#)	User-initiated conversations (#)	User re-contacts HA (#)	Informational chat (#)	User-requested referrals (#)	Personal concerns (#)
23-Jun	124	10	1	2	5	0	0	0	0	0
29-Jun	70	3	0	0	2	0	0	0	0	0
30-Jun	119	11	0	0	0	0	0	0	0	0
7-Jul	173	5	0	0	0	0	0	0	0	0
13-Jul	51	3	0	0	0	0	0	0	0	0
14-Jul	75	5	0	0	0	0	0	0	0	0
20-Jul	112	10	0	0	0	0	0	0	0	0
21-Jul	35	1	0	0	0	0	0	0	0	0
27-Jul	132	6	0	1	0	1	1	1	0	0
28-Jul	5	4	0	0	5	2	1	2	0	0
3-Aug	4	3	0	0	1	3	0	2	2	0
11-Aug	7	2	0	0	5	8	0	4	2	0
17-Aug	195	8	0	0	0	1	0	0	0	0
24-Aug	78	5	0	1	3	3	1	3	0	0
29-Aug	4	0	0	0	1	4	1	1	0	0

Appendix D: Table 8, Phase 1 Messaging Log (Scruff)

Date	Conversations (#)	Positive user responses (#)	Negative user responses (#)	Users that express interest in testing (#)	Users that said would get testing (#)	User-initiated conversations (#)	User re-contacts HA (#)	Informational chat (#)	User-requested referrals (#)	Personal concerns (#)
23-Jun	23	2	0	0	1	0	0	0	0	0
30-Jun	183	5	2	0	0	0	0	0	0	0

7-Jul	94	4	0	0	0	0	0	0	0	0
13-Jul	161	1	0	0	0	0	0	0	0	0
14-Jul	80	0	0	0	0	0	0	0	0	0
20-Jul	287	13	1	0	2	0	0	0	0	0
21-Jul	96	5	0	0	0	0	0	0	0	0
27-Jul	330	2	0	0	0	0	1	0	0	0
28-Jul	0	1	0	0	0	0	0	0	0	0
3-Aug	0	0	0	0	0	0	0	0	0	0
11-Aug	0	0	0	0	0	0	0	0	0	0
17-Aug	352	4	1	0	0	0	0	0	0	0
25-Aug	167	1	1	0	0	0	0	0	0	0
29-Aug	4	0	3	0	0	0	0	1	0	0

Appendix E: Table 9, Phase 2 Data Dictionary

Data Dictionary: Phase 2 (9/1/16 – 1/11/17)

Variable name	Question/concept	Type of variable	Categories	Comments
App	Social media application used for conversation	Text, app	Grindr, Scruff, Adam 4 Adam (A4A)	
Date	Day that user sends a message	Numerical date	Day, month, and year	
Detail service activity	Notes about conversation content	Text	Notes	Detailed notes entered by HA
Distance from HA	The distance between the user and HA by app geolocation	Text	Feet or miles	
Educational and/or risk counseling?	Whether the conversation resulted in the HA providing the user with detailed counseling on a subject	Text	Yes/No	If a follow-up conversation, made note if "Previously" and/or "Today" sent counseling
Engaged in conversation?	Whether a user is engaged in a conversation with the HA	Text	Yes/No	A user is engaged if they respond to information in a meaningful or intentional way, or if ask follow-up questions
HA	Refers to the Health Advisor, the individual messaging users on behalf of the Pima County Health Department	Individual (intern)	N/A	During this study, the HA was one individual
Location of HA	Where the HA is messaging from	Text, 5-digit zip code	Abrams Building Pima County Health Department (85714), University of Arizona (85719)	University of Arizona was the location during 12/27/16 through 1/9/17
Picture description	Profile picture of app user	Text	Infinite	A profile picture is changeable at any time by the user's choice. General description of unique foreground and background elements, and the photo perspective
Prevention Message sent?	Whether the HA sent the user the Prevention Message at some point	Text	Yes/No	Prevention Message consisted of at least "Syphilis is on the rise in Pima County, so make sure to be safe and get tested regularly." If a follow-up conversation, did not re-send message.
Referral to services?	Whether at some point the HA referred the user to specific health care services	Text	Yes/No; what service	Including STD clinic, PrEP clinic, and non-clinic STD testing referrals
Response type	How a user responds to the HA in conversation	Text	Positive, Negative, Neutral with STD question, Neutral without STD question, None, Block	A neutral response (e.g. "Are you in the medical field?") is not expressly Positive ("Thanks") or Negative ("Go away")
Time	Time that user sends a message	Numerical	24-hour format hour:minutes	
Unique conversation	Definition of term	Text	N/A	A given user can have at maximum one (1) conversation per day. Follow-up questions during the same day are not considered a new unique conversation unless the question is asked on another day.
User demographics	Self-declared user demographics as listed on biography section of app	Numerical, text	As given by user	i.e. age, race, ethnicity
Username	Name of app user	Text	Infinite	A username is changeable at any time by the user's choice

Appendix F: Table 10, Phase 2 Messaging Log (Grindr, Scruff, Adam 4 Adam)

App	Date	Username	Demographics	Time	HA gave education or risk counseling?	HA referred user to services?	Distance
grindr	9/1/16	none	26 yo	10:46	no	yes testing	
grindr	9/1/16	Cowboy	latino	10:34	yes	yes testing	
grindr	9/1/16	cat smiling emoji	22 yo	12:43	no	yes testing	4 mi
grindr	9/1/16	Jorge	26 yo, latino	12:46	no		5 mi
grindr	9/1/16	BJ?	none	11:45	no		
grindr	9/7/16	2 puerto rico emojis and one flexed bicep emoji	21, latino	9:54	yes	yes testing	
grindr	9/7/16	Hi……..	32 yo, latino	11:12	no	yes testing	
grindr	9/12/16	Double sided arrow up/down	none	9:23	yes	yes testing	
grindr	9/12/16	none	25 yo	9:25	no	yes testing	
grindr	9/12/16	E	latino	12:46	yesy	yes testing	from NYC, traveling
grindr	9/14/16	Sex you host?	23 yo, latino	10:59	yes	yes testing	1 mi
grindr	9/14/16	Bear face emoji	latino	11:15	yes	yes testing	
grindr	9/21/16	Curious	other ethnicity	10:44	yes	yes testing	
grindr	9/21/16	Double sided arrow up/down	none	11:38	yes	yes testing	
grindr	9/27/16	eyes emoji	none	16:54	no	yes testing	
grindr	9/27/16	Cap'n	latino	17:25	no	yes testing	3 mi
grindr	9/28/16	Vers4Fun! (eggplant emoji)	white	12:06	no		
grindr	10/3/16	none	26 yo	9:15	yes		
grindr	10/3/16	Let's Play Ball	latino	10:44	yes	yes testing	5 mi
a4a	10/3/16	awesome53kr	53 yo, white	9:44	yes		4 mi
grindr	10/3/16	none	latino	10:13	yes		2 mi

grindr	10/3/16	none	latino	11:03	yes		1 mi
grindr	10/3/16	none	latino	11:12	yes		2 mi
a4a	10/3/16	hungbeast	47 yo, white	12:10	yes		
a4a	10/3/16	hard_hard_hard	33 yo, white	12:10	yes		
a4a	10/3/16	arizonacutie	30 yo, white	12:30	yes		2 mi
grindr	10/3/16	"Sex spanish"	26 yo, spanish speaking	13:00	yes	yes testing	
grindr	10/4/16	none	31 yo, spanish speaking	10:00	yes	yes testing	
grindr	10/5/16	none	18 yo, white	16:09	yes	yes testing	
grindr	10/5/16	#teamkatya	white	16:49	yes	yes testing	
grindr	10/5/16	Eddie	52 yo, latino	17:00	yes		
scruff	10/5/16	Hello	33 yo, hispainc/latino, married	17:04	no		8 mi
grindr	10/10/16	none	22 yo, white	10:05	no		4 mi
grindr	10/10/16	DL	25 yo	10:07	no		
a4a	10/10/16	GT3825	21 yo, other ethnicity	11:01	no		7 mi
a4a	10/10/16	TucsonGuy2008	53 yo, white, selfie with cowboy hat on	10:14	no	yes testing	9 mi
grindr	10/10/16	none	20 yo	13:25	no		3 mi
scruff	10/12/16	Don	64 yo, white	9:50	yes	yes testing	10 mi
grindr	10/12/16	Randy	white	10:17	no	yes testing	4 mi
scruff	10/16/16	Don	64 yo, white	14:10	yes		10 mi
grindr	10/17/16	_dlmasc	latino	11:25	no		4 mi
grindr	10/19/16	(angry face emoji)send face pic	mixed	10:46	yes		
scruff	10/19/16	ijhzo	24 yo, hispanic/latino	9:32	no	yes testing	26 mi
a4a	10/19/16	Budalinz	54 yo	9:42	no		8 mi
grindr	10/19/16	Handyman	none	10:05	no		13 mi
grindr	10/24/16	none	26 yo	11:35	yes		
grindr	10/31/16	Skyrim & chill	26 yo	13:05	yes	yes testing	4 mi
a4a	10/31/16	HoneyBadgerr	30 yo	13:24	no		4 mi
a4a	11/2/16	Dlcollegekid816	21 yo, white	10:06	yes	yes, outreach and	

						peterson for prep	
grindr	11/2/16	none	32 yo, white	11:01	yes	yes, outreach	4 mi
grindr	11/2/16	Fuck, sex, fun	23 yo	14:03	no	yes testing	1 mi
scruf	11/3/16	J	28 yo, hispanic/latino	6:49	no		8 mi
grindr	11/7/16	Lets fuckuhost	23 yo	14:03	yes	yes testing	1 mi
a4a	11/14/16	juanito90	26 yo, latino	10:30	no		2 mi
a4a	11/14/16	1MOMENT	32 yo	10:45	yes		3 mi
grindr	11/14/16	none	26 yo, latino	11:32	no	yes testing	
grindr	11/14/16	Amanhasnoname		11:20	no		
grindr	11/14/16	DL		11:42	yes		
grindr	11/17/16	DL (same as above entry)		9:34	yes	yes testing	
grindr	11/17/16	visit tuczon.	26 yo, spanish speaking	9:07	no		5 mi
a4a	11/21/16	cockycomposer	22 yo	9:43	no		4 mi
a4a	11/21/16	Marcus	22 yo, white	10:34	yes	yes testing	
grindr	11/27/16	(monkey eyes covered)(chicken)(wink tongue out)(top)	29, latino	13:23	yes	yes testing	
grindr	11/28/16	No Pic No Reply	19, latino	11:12	no	yes testing	2 mi
grindr	11/28/16	Visit	22 yo	11:49	yes		
grindr	12/5/16	Bottom here!!	Latino	9:56	yes	yes peterson	4 mi
scruff	12/7/16	123sx	22 yo	10:30	no		
a4a	12/7/16	sirenman	49 yo, white	10:43	no		5 mi
grindr	12/7/16	Brosexdl	24 yo, *description says bi	11:58	yes		1 mi
grindr	12/19/16	Tucson	26 yo, asian	9:15	no		
grindr	12/19/16	turtle emoji	28 yo	9:26	no		2 mi
A4A	12/19/16	a49erlk4u	66 yo, white	10:42	no	yes testing	
grindr	12/19/16	none	23 yo	10:33	no	yes	13 mi

						testing	
grindr	12/19/16	none		11:12	yes	yes testing	268 ft
grindr	12/27/16	Cavalski	30 yo, latino	11:12	no	yes prep	4 mi
grindr	12/27/16	smile emoji with drool		15:45			
grindr	12/27/16	Justin		15:42			11 mi
grindr	12/28/16	none		10:50	yes	yes prep	
a4a	12/28/16	Topfknlatino	44 yo, latino	9:42	yes		9 mi
a4a	12/28/16	batamonte	50 yo	10:51			green valley
a4a	12/28/16	rm85658	37 yo	11:10	yes	yes hep c treatment - el rio, banner	13 mi
grindr	12/28/16	Hosting now	grad student	13:05			3 mi
grindr	12/28/16	3way	latino	13:13			
grindr	12/28/16	none	26 yo, asian, bio says lives in Bushwick, NY	13:24		yes testing	4374 ft
a4a	12/28/16	coconut373	31 yo, white	14:00	yes	yes peterson	
grindr	12/28/16	Fun?(tounge emoji)	24 yo	15:57			1 mi
grindr	1/4/17	(coffee cup emoji)(swim emoji)(bike emoji)	29 yo, asian	14:11		yes testing	
scruff	1/4/17	Back in the wild	31 yo	23:38			3 mi, traveling
grindr	1/6/17	none	30 yo, white	13:15			
grindr	1/9/17	Bad Wolf	29 yo, white	10:29			3 mi
a4a	1/9/17	steel69	40 yo, latino	10:54	yes		1931 ft
a4a	1/9/17	BoyScoutAZ	50 yo, white	12:55		yes testing	
grindr	1/11/17	TWY (pigeon head emoji)	18 yo, white	9:25	yes		2 mi
scruff	1/11/17	fast	26 yo, multiracial	10:55		yes peterson	1 mi
grindr	1/11/17	none		10:47			1555 ft
a4a	1/11/17	Teamjesus1990	26 yo, latino	12:19			6 mi

Appendix G: Figure 9, Survey

SYPHILIS AND SOCIAL MEDIA SURVEY
August 2016

1. Have you recently seen or heard information about syphilis in Pima County?

☐ Yes ☐ No

If yes, where? (choose all that apply)

☐ Friends ☐ Social media (Facebook, Twitter…)
☐ Online app ☐ Print media (Posters, brochures, flyer's…)
☐ Other _____

2. Do you use a website or apps to find dates, sex partners, or friends?

☐ Yes ☐ No

If so, which ones? (choose all that apply)

☐ Craigslist ☐ Facebook ☐ Grindr
☐ Instagram ☐ Tinder ☐ Other _____

3. What websites or apps should we be on to tell people about syphilis?

_____

4. Why these sites?

_____

5. What information on an ad would motivate you to seek testing or information about testing?

☐ Multiple languages ☐ Treatment options ☐ MSM/GLBT-focused
☐ Multicultural images ☐ Testing and clinic information ☐ Symptoms
☐ Other _____ ☐ Different promotion methods

6. Have you been tested in the past 18 month for syphilis?

☐ Yes ☐ No

If not, why?

☐ Unaware of the risks of getting syphilis ☐ Fear of needles or testing ☐ No symptoms
☐ Didn't know where to get tested ☐ Not at risk
☐ Other _____

7. Do prevention messages about Health Topics motivate you to seek STD or HIV testing?

☐ Yes ☐ No

PIMA COUNTY HEALTH DEPARTMENT **A Healthy Pima County** Every one. Every where. Every day.

Thank you!

Your feedback will help us create messages that make a difference

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