**Final Study Report**

# CHIPTSAhoy: A Time-Venue Based Survey of Young Men Who Have Sex with Men to Evaluate the Epidemiology, Sexual Risk Behavior, and Optimal Incentivization of Participation in an HIV Prevention Clinical Trial

A Research Study Sponsored by The
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## Executive Summary

We created a modified technique of Time-Space Sampling (TSS) exploiting the functionality of GPS-enhanced social networking applications on mobile smart-phones to sample young men who have sex with men (YMSM) in the metropolitan Los Angeles City Area.

Over 5 ½ months from 2010-2011, we recruited 375 YMSM using the GRINDR platform, and administered a brief computer-assisted self-interview (CASI) in the field.

The median age was 25 years, 42.4% were Caucasian, 6.4% African-American, 33.6% Latino, and 14.1% Asian/Pacific Islander.

4.3% self-reported a diagnosis of HIV infection.

17.9%, 13.6%, and 9.1% reported a previous history of gonorrhea, chlamydia, and syphilis infections, respectively.

Mean numbers of sexual partners for anal intercourse were 1.9, 3.9, and 10.0 in the past 1 month, 3 months, and 1 year, respectively.

40.8% reported inconsistent condom use for receptive anal intercourse (RAI).

56% had met a sex partner on GRINDR in the previous 3 months.

76.3% believed that they were unlikely or very unlikely to acquire HIV-infection in their lifetime.

11.2% had previously participated in a clinical trial, but 51.7% stated they definitely would participate in a future HIV prevention study.

3.6% reported previously using post-exposure prophylaxis (PEP) for HIV prevention, and 1.7% had used pre-exposure prophylaxis (PrEP) for HIV prevention.

GPS-based social networking applications are used by YMSM to facilitate sexual partnering, and represent a potential novel mechanism for engaging, recruiting, and educating YMSM in HIV prevention activities and clinical research. Barriers exist in ongoingly partnering with the current market-leading application's ownership, GRINDR.

## 1. Background

Young men who have sex with men (MSM) disproportionately contribute incident and prevalent HIV infections in the 21st century domestic HIV epidemic; particularly in the City and County of Los Angeles, where MSM age 13-29 have the highest incidence rates of any age-risk population segment.

HIV prevention interventions have reached their saturation in efficacy in stemming new infections, most profoundly in MSM populations, particularly young minority MSM, the risk groups domestically in whom HIV infections are on the rise.

Attempts to enroll young MSM in HIV prevention studies have been particularly challenging, with mean enrollment ages in the late 30's to 40's, making this high risk population particularly challenging to study, and similarly difficult to intervene upon.

Young MSM are extremely "technology savvy," and therefore, the use of technology may be an ideal mechanism for an intervention to this high-risk population. Although absent from the HIV literature thus far, geo-social networking applications (GPS-enabled mobile-internet social networking applications for smart phones) are increasingly being used to facilitate sexual partnering by young MSM. GRINDR, available without cost on iPhone, iPod touch, iPad, Android, and Blackberry platforms, and targeted to MSM populations, is the most popular of these, having over 1.5 million users worldwide in 180 countries, 500,000 users in the US, and 28,300 users in the city of Los Angeles, as of July, 2010. Estimates include new user uptake at 3,000 users per day worldwide. Approximately 280,000 users log on to the GRINDR platform daily, spending a mean 1.5 hours on the application. While GRINDR does not publish the aggregate demographics of its user base, its creator, Joel Simkhai, notes that the majority of users are age 20-30.

Despite extensive reporting by the lay press on the phenomenon of geo-social networking, there has been little systematic study or characterization of the users themselves or the sexual behaviors of such application users. The importance of such evaluation is suggested by GRINDR-use being implicated by the Texas Department of State Health Services as a potential contributor to a recent outbreak of syphilis in northern Texas.

GRINDR and applications like it may be an ideal tool to accessing hidden and/or difficult-to-access communities of young MSM at high risk for HIV seroconversion – for epidemiologic, observational, and interventional studies. We therefore proposed a pilot survey of young MSM recruited via GRINDR.

Specifically, the project aimed to evaluate the demographic and sexual risk behavior characteristics of young MSM GRINDR users in the City of Los Angeles; to assess whether these individuals would be willing to participate in future HIV prevention trails, and how best to optimize such participation; and to characterize GRINDR used, and assess attitudes towards and impact of GRINDR use on partner finding, numbers of sexual partners, and sexual risk behavior.

## 2. Methods

### 2.1 Questionnaire Instrument Construction

The items on the questionnaire included 37 assessments, modified from sources such as the National HIV Behavioral Survey (NHBS), and including face-valid assessments for GRINDR-focused questions that were piloted with a population of 4 research assistants. Assessment items parsed into 9 domains: Demographics, HIV Testing Behavior, Sexually Transmitted Disease History, Sexual Risk Behavior, Drug/Alcohol use, HIV-related attitudes/beliefs, Prevention Strategies, Clinical Trial Participation, and GRINDR use. The final items deployed in the questionnaire are included as Appendix A. All questions had a "refuse to answer" option, as obligated by regulatory bodies for computer-assisted surveys.

The questionnaire was programmed onto a secure server by the UCLA Computer Technology Research Laboratory (CTRL) for internet-based administration. The server website was password protected, with access only provided to key study personnel, and contained an audit trail for any changes to data after initial entry. Data was downloaded directly to a server-based secure database. The user interface was customized for questionnaire administration on iPad (1.0) devices. Field-testing of the iPad-delivered web-based questionnaire (using 3G connection technology) met with excellent acceptability and a completion time of 10-20 minutes for the entire questionnaire; differences in completion time were largely governed by a) intrinsic skip logic within the questionnaire and b) network connection speeds.

### 2.2 Territory Mapping

The City of Los Angeles and its surrounding areas were mapped using an iterative process. An Internet search was performed for MSM-focused/themed venues within the City of Los Angeles. Key Informants from the target population of young MSM were then convened to review the results of the Internet search and amend the list based on locations they or their friends would be likely to frequent. Additionally, key informants provided days of the week and times for maximizing attendance at individual locations.

Over a 2-month period, key informants refined the map list, which included bars, dance clubs, commercial sex venues, public locations (parks, alleys, beaches, malls), restaurants, and special events. Research staff then attended each VDT unit (provided that it was not a special event) to confirm its appropriateness (defined as proximate men on the GRINDR platform). Mapping was revised monthly based on research team field experience and ongoing assessment of key informants. Non-productive VDT units were removed, and new VDT units added at each revision. The mapped list of VDT units was revised a total of 5 times during study conduct. On a monthly basis, the number of VDT units from which random selection took place ranged from 68 to 143.

Productive locations were determined based on hit-rates alone (ratio of enrolled participants vs. attempted contacts via GRINDR).

### 2.3 Regulatory Oversight

The UCLA South General Institutional Review Board (IRB) provided regulatory oversight for, and reviewed all procedures and documents associated with study conduct. The study was deemed "low risk" by the IRB, and therefore no written Informed Consent was required. Instead, a "Research Information Sheet (RIS)" was created which was the opening page of the survey, and participants were required to read the RIS and click to acknowledge understanding prior to survey participation.

### 2.4 Participant Recruitment

After selection of a VDT unit, teams of 2 research assistants were deployed to the VDT location and identified a safe location for study conduct. Study staff logged onto the GRINDR application using their own personal profiles. GRINDR users who self-identified as under age 30 were then messaged in order of proximity to the study staff based on GRINDR's GPS functionality. If study staff identified a proximate GRINDR user as having previously participated in the study, they were not re-contacted. A standardized script was used in interactions with potential participants and is included as Appendix B. Participants who, in the opinion of study staff, were sufficiently intoxicated or altered that they were unable to understand the research information sheet (Appendix C) and/or provide appropriate assent to participation were not enrolled in the study.

Participants who agreed to participate in the study met the study team at the previously identified safe location and were provided the electronic research information sheet, and if terms were accepted, the questionnaire. Participants were administered the questionnaire on the iPad device (CASI – Computer Assisted Self-Interview) without assistance from research staff, unless so requested by the participant; research staff did (and could) not review participant responses.

Upon completion of the questionnaire, participants were provided a $25 iTunes gift card. Participants were required to sign for receipt of the gift card.

While performing GRINDR-application based recruitment, study teams were often approached by other VDT attendees, requesting to participate in the study. If such participants were self-reported to be between the ages of 18 and 29 and were able to demonstrate the GRINDR application on their smart-phone, such "walk-on" participants were allowed study participation.

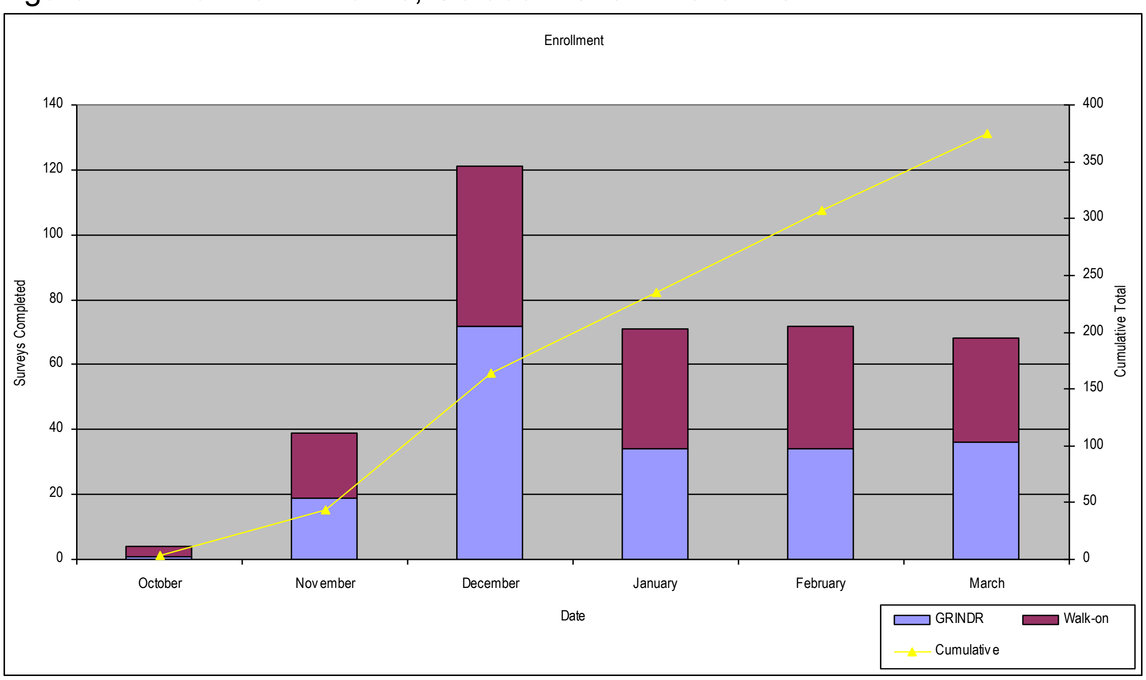
### 2.5 Recruitment Timeline

Participants were recruited from October 25, 2010 through March 15, 2011, according to Figure 1, below. Participant recruitment was non-trivial. 4,808 individuals were messaged over the course of the five-month enrollment period in order to recruit 375 participants, yielding an overall “hit-rate” of 8.7%. When adjusted for the 219 participants who enrolled from GRINDR-based messaging contacts (in contrast to “walk-on” enrollment), the adjusted hit-rate was 4.5%.

Although there was no mechanism to assess reasons for non-participation, nor to assess the characteristics of those who were using GRINDR but did not participate in the study, the following observations were made anecdotally by study staff:

1. Many participants abruptly terminated GRINDR chat with study staff when it became clear that sexual partnering was not what was sought be study staff.
2. Potential participants were more likely enroll in the study either before, or after time periods of maximum traffic at the venue.
3. Later time periods, i.e. when GRINDR users were exiting a venue, were particularly challenging, as potential participants were frequently sufficiently impaired by alcohol or other substances to be unable to complete the research consent process and therefore were not enrolled.
4. The GPS functionality of the GRINDR application is imprecise, and frequently would identify GRINDR users as proximate when in fact they were at large distances away, often in their homes.

Figure 1. Enrollment timeline, October 2010 – March 2011.




Parenthetical note should be made that for a 2-week period in December-January, the GRINDR management de-activated study staff’s GRINDR accounts for alleged breach of Terms of Service. After a discussion with clarification of the purposes of the study with GRINDR leadership, the accounts were reinstated and recruitment and study conduct allowed to continue.

## 3. Results

### 3.1 Descriptive Statistics

Results of responses to each of the 37 assessments are presented below in table format.

#### 3.1.1 Question 1: How old are you? (n=375)

| | |
|---|---|
| Mean | 24.9 |
| Median | 25 |
| Standard deviation | 3.6 |
| Interquartile range (IQR, 25-75%) | 22-27 |
| Minimum – Maximum | 18-39 |

#### 3.1.2 Question 2: What is the zip code of your home or primary residence? (n=373)

| | |
|---|---|
| City of Los Angeles | 176 (46.9%) |
| City of West Hollywood | 42 (11.2%) |
| Mixture (Zip is shared City of LA/WeHo) | 21 (5.6%) |
| Northern California | 10 (2.7%) |
| Los Angeles County (excluding City of LA) | 66 (17.6%) |
| Orange County | 27 (7.2%) |
| Riverside County | 8 (2.1%) |
| San Bernardino County | 3 (0.8%) |
| San Diego County | 3 (0.8%) |
| Santa Barbara County | 2 (0.5%) |
| Ventura County | 6 (1.6%) |
| Out-of-State | 9 (2.4%) |

#### 3.1.3 Question 3: What gender do you identify with? (n=375)

| | |
|---|---|
| Male | 374 (99.7%) |
| Female | 1 (0.3%) |
| Transgender (MTF) | 0 |
| Transgender (FTM) | 0 |
| Refuse to Answer | 0 |

#### 3.1.4 Question 4: What is your race? (n=375 individuals responding – multiple responses possible)

| | |
|---|---|
| White/Caucasian | 94 (25.1%) |
| Black/African-American | 24 (6.4%) |
| Latino/Hispanic | 126 (33.6%) |
| Asian/Pacific Islander | 53 (14.1%) |
| Native American | 4 (1.1%) |

| | |
|---|---|
| Mixed Race | 28 (7.5%) |
| Other | 1 (0.3%) |

### 3.1.5 Question 5: When was the last time you were tested for HIV? (n=375)

| | |
|---|---|
| < 1 month ago | 94 (25.1%) |
| 1-6 months ago | 185 (49.3%) |
| 7-12 months ago | 33 (8.8%) |
| 12-24 months ago | 28 (7.5%) |
| > 24 months ago | 18 (4.8%) |
| Never been tested | 16 (4.3%) |
| Refuse to Answer | 1 (0.3%) |

### 3.1.6 Question 6: What was the result of your last HIV test? (n=359)

| | |
|---|---|
| Positive | 16 (4.5%) |
| Negative | 337 (93.4%) |
| Never got result | 3 (0.1%) |
| Don't remember | 1 (0.1%) |
| Refuse to Answer | 2 (0.1%) |

### 3.1.7 Question 7A: Have you ever been told by a health care provider that you had gonorrhea? (n=375)

| | |
|---|---|
| Yes | 67 (17.9%) |
| No | 304 (81.1%) |
| Refuse to Answer | 4 (1.1%) |

### 3.1.8 Question 7B: Have you ever been told by a health care provider that you had chlamydia? (n=375)

| | |
|---|---|
| Yes | 51 (13.6%) |
| No | 321 (85.6%) |
| Refuse to Answer | 3 (0.8%) |

### 3.1.9 Question 7C: Have you ever been told by a health care provider that you had syphilis? (n=375)

| | |
|---|---|
| Yes | 34 (9.1%) |
| No | 338 (90.1%) |
| Refuse to Answer | 3 (0.8%) |

### 3.1.10 Question 7D: Have you ever been told by a health care provider that you had another Sexually Transmitted Infection (herpes, warts, chancroid, etc.)? (n=375)

| | |
|---|---|
| Yes | 34 (9.1%) |
| No | 334 (89.1%) |
| Refuse to Answer | 7 (1.9%) |

### 3.1.11 Question 8: In the past year have you had sexual intercourse or oral sex with (n=375 individuals responding)

| | |
|---|---|
| Men | 369 (98.4%) |
| Women | 37 (9.9%) |
| Transgender women (MTF) | 2 (0.5%) |
| Transgender men (FTM) | 1 (0.3%) |
| None of the above | 5 (1.3%) |

### 3.1.12 Question 9: Which best describes you? (Choose the term you most strongly identify with, n=375)

| | |
|---|---|
| Gay | 308 (82.1%) |
| Queer | 6 (1.6%) |
| Homosexual | 19 (5.1%) |
| Bisexual | 32 (8.5%) |
| Bi-curious | 7 (1.9%) |
| Heterosexual | 0 |
| Straight | 0 |
| Refuse to Answer | 3 (0.8%) |

### 3.1.13 Question 10: How many sex partners for anal sex have you had:

| | In the last month? | In the last 3 months? | In the last year? |
|---|---|---|---|
| Mean | 1.9 | 3.8 | 10 |
| Standard deviation | 3.0 | 7.2 | 21.7 |
| Median | 1 | 2 | 4 |
| IQR | 0-2 | 1-4 | 2-10 |
| Min/Max | 0/40 | 0/100 | 0/300 |

### 3.1.14 Question 11: How many sex partners for oral sex have you had:

| | In the last month? | In the last 3 months? | In the last year? |
|---|---|---|---|
| Mean | 2.6 | 5.0 | 11.6 |
| Standard deviation | 3.4 | 7.9 | 22.0 |
| Median | 2 | 3 | 5 |
| IQR | 1-3 | 1-6 | 2-12 |
| Min/Max | 0/40 | 0/100 | 0/300 |

### 3.1.15 Question 12: How many sex partners for vaginal sex have you had:

| | In the last month? | In the last 3 months? | In the last year? |
|---|---|---|---|
| Mean | 0.1 | 0.2 | 0.3 |
| Standard deviation | 0.6 | 1.0 | 1.3 |
| Median | 0 | 0 | 0 |
| IQR | 0-0 | 0-0 | 0-0 |
| Min/Max | 0/5 | 0/10 | 0/13 |

### 3.1.16 Question 13: How often did you use condoms for receptive anal intercourse (bottoming) in the past 3 months? (n=375)

| | |
|---|---|
| Always | 202 (53.9%) |
| Frequently | 61 (16.3%) |
| Sometimes | 38 (10.1%) |
| Rarely | 12 (3.2%) |
| Never | 42 (11.2%) |
| Refuse to Answer | 20 (5.3%) |

### 3.1.17 Question 14: How often do you use condoms for insertive anal intercourse (topping) in the past 3 months? (n=375)

| | |
|---|---|
| Always | 202 (53.9%) |
| Frequently | 61 (16.3%) |
| Sometimes | 42 (11.2%) |
| Rarely | 15 (4.0%) |
| Never | 45 (12.0%) |
| Refuse to Answer | 10 (2.7%) |

### 3.1.18 Question 15: Where have you met your male sex partners over the last 3 months? (click all that apply, n=375)

| | |
|---|---|
| At work | 55 (14.7%) |
| Through friends | 166 (44.3%) |
| Bars | 139 (37.1%) |
| Dance clubs | 125 (33.3%) |
| Internet dating focused sites | 94 (25.1%) |
| Internet sex-focused sites | 152 (40.5%) |
| Bath houses/sex clubs | 29 (7.7%) |
| Parks/Public areas | 8 (2.1%) |
| Bookstores | 6 (1.6%) |
| GRINDR | 210 (56%) |
| Other | 18 (4.8%) |
| Refuse to Answer | 4 (1.1%) |

### 3.1.19 Question 16: In the PAST MONTH, have you had sex with someone while high or feeling the effects of a drug, including alcohol? (n=375)

| | |
|---|---|
| Yes | 181 (48.3%) |
| No | 194 (51.7%) |

### 3.1.20 Question 17: If you answered "yes" to Question 13, which of the following drugs have you used before, during, or just after sex with someone? (Click all that apply, n=181)

| | |
|---|---|
| Alcohol | 166 (91.7%) |
| Marijuana | 108 (59.7%) |

| | |
|---|---|
| Poppers/inhalants (amyl nitrates) | 63 (34.8%) |
| Cocaine (powder) | 49 (27.1%) |
| Crack cocaine | 3 (1.7%) |
| Methamphetamine/crystal meth | 26 (14.4%) |
| Ecstasy | 55 (30.4%) |
| Gamma Hydroxybutyrate (GHB/"G") | 20 (11.0%) |
| Ketamine ("K", Special K) | 12 (6.6%) |
| Heroin | 0 |
| Refuse to Answer | 1 (0.6%) |

### 3.1.21. Question 18: Do you believe that you are likely to become HIV-positive in your lifetime (asked only for non-HIV-positive identified participants who had ever HIV tested, n=358)

| | |
|---|---|
| Very unlikely | 136 (37.9%) |
| Unlikely | 138 (38.4%) |
| Somewhat likely | 57 (15.9%) |
| Likely | 5 (1.4%) |
| Very likely | 10 (28%) |
| Refuse to Answer | 12 (3.3%) |

### 3.1.22 Question 19: How often do you worry about becoming HIV infected? (n=358)

| | |
|---|---|
| Never | 24 (6.7%) |
| Rarely | 63 (17.5%) |
| Occasionally/Sometimes | 122 (34%) |
| Frequently | 71 (19.8%) |
| All the time | 75 (20.9%) |
| Refuse to Answer | 3 (0.8%) |

### 3.1.23 Question 20: How often do you think about HIV while having sex? (n=358)

| | |
|---|---|
| Never | 38 (10.6%) |
| Rarely | 73 (20.3%) |
| Occasionally/Sometimes | 120 (33.4%) |
| Frequently | 61 (17%) |
| All the time | 65 (18.1%) |
| Refuse to Answer | 1 (0.3%) |

### 3.1.24 Question 21: How often do you ask your sex partners about their HIV status before having sex? (n=374)

| | |
|---|---|
| Never | 24 (6.4%) |
| Rarely | 31 (8.3%) |
| Occasionally/Sometimes | 54 (14.4%) |
| Frequently | 89 (23.7%) |

| | |
|---|---|
| All the time | 175 (46.7%) |
| Refuse to Answer | 1 (0.3%) |

### 3.1.25 Question 22: What percentage of your sex partners are: (must ad up to 100%) (n=338)

| | HIV-positive | HIV-negative | Don't know |
|---|---|---|---|
| Mean | 6.3% | 81.5% | 12.2% |
| Standard dev | 19.2 | 31.3 | 26.1 |
| Median | 0 | 100 | 0 |
| IQR | 0/1 | 75/100 | 0/10 |
| Min-Max | 0-100 | 0-100 | 0-100 |

### 3.1.26 Question 23: Have you ever used HIV Medications to prevent you from getting HIV infection (either before or after sex)? [only asked if HIV-negative, n=354]

| | |
|---|---|
| Yes, after sex (PEP) | 13 (3.7%) |
| Yes, before sex (PrEP) | 6 (1.7%) |
| No | 336 (94.9%) |
| Don't know/Refuse to answer | 2 (0.6%) |

### 3.1.27 Question 24: Have you ever participated in a clinical trial? (n=373)

| | |
|---|---|
| Yes | 42 (11.2%) |
| No | 330 (88.0%) |
| Refuse to answer | 1 (0.3%) |

### 3.1.28 Question 25: If a clinical trial were available that provided a menu of possibilities to help you stay HIV-negative, and asked you to come in and get HIV tested every month for 1 year, would you be interested? (n=357)

| | |
|---|---|
| Yes | 194 (51.7%) |
| No | 54 (14.4%) |
| Maybe | 97 (25.9%) |
| Depends on Incentive/Work schedule/Details | 8 (2.1%) |
| Refuse to answer | 4 (1.1%) |

### 3.1.29 Question 26: Please rate the following "incentives" as to how much each would motivate you to participate in a clinical trial on HIV prevention, and to return for monthly study visits over the course of 1 year (n=360, rated on scale of 0-9, 9 most attractive):

| | Mean | Std Dev | Median | IQR | Min-Max |
|---|---|---|---|---|---|
| $10 cash | 3.8 | 3.3 | 4 | 0/6.5 | 0-9 |
| $10-$20-etc cash | 5.4 | 3.4 | 6 | 2.5/9 | 0-9 |
| $10 voucher | 3.6 | 3.2 | 3 | 0/6 | 0-9 |
| $10-$20-etc voucher | 4.1 | 3.3 | 4 | 0/7 | 0-9 |

| | | | | | |
|---|---|---|---|---|---|
| Lottery for $50 | 2.9 | 3.2 | 2 | 0/5 | 0-9 |
| Lottery for $100 | 3.1 | 3.3 | 2 | 0/6 | 0-9 |
| Lottery for $500 | 3.9 | 3.5 | 3 | 0/7 | 0-9 |
| $100 Bill payment | 5.7 | 3.3 | 7 | 3/9 | 0-9 |

### 3.1.30 Question 27: What is the minimum amount of reimbursement in cash you would accept for each visit? (n=373)

| | |
|---|---|
| Median | $25 |
| IQR | 10/50 |

### 3.1.31 Question 28: What is the minimum amount of reimbursement in vouchers you would accept for each visit? (n=373)

| | |
|---|---|
| Median | $25 |
| IQR | 10/50 |

### 3.1.32 Question 29: When did you first begin using GRINDR? (n=373)

| | |
|---|---|
| < 1 month ago | 39 (10.4%) |
| 1-3 months ago | 35 (9.3%) |
| 3 months – 1 year ago | 125 (33.3%) |
| > 1 year ago | 170 (45.3%) |
| Refuse to answer | 4 (1.1%) |

### 3.1.33 Question 30: How often do you log-on to GRINDR? (n=373)

| | |
|---|---|
| At least once-a-day | 228 (60.8%) |
| More than once-a-week, but not every day | 77 (20.5%) |
| Once-a-week | 2.6 (6.9%) |
| Less often than once-a-week | 37 (9.9%) |
| Refuse to answer | 5 (1.3%) |

### 3.1.34 Question 31: What do you use GRINDR for? (check all that apply, n=373)

| | |
|---|---|
| Friendship | 289 (77.1%) |
| Dating | 252 (67.2%) |
| 1-on-1 sex | 233 (62.1%) |
| Group sex | 64 (17.1%) |
| Phone sex | 22 (5.9%) |
| Refuse to answer | 10 (2.7%) |

### 3.1.35 Question 32: How often do you have sex with someone you met on GRINDR? (n=373)

| | |
|---|---|
| At least once-a-day | 6 (1.6%) |
| More than once-a-week, but not every day | 20 (5.3%) |
| Once-a-week | 29 (7.7%) |
| Less often than once-a-week | 170 (45.3%) |

| | |
|---|---|
| Don't have sex with people I meet on GRINDR | 134 (35.9%) |
| Refuse to answer | 14 (3.8%) |

### 3.1.36 Question 33: Since beginning to use GRINDR are your sex partners (n=373)

A.

| | |
|---|---|
| More in number | 82 (21.9%) |
| About the same | 190 (50.7%) |
| Fewer | 71 (18.9%) |
| Refuse to answer | 30 (8.0%) |

B.

| | |
|---|---|
| Closer to my age | 79 (21.1%) |
| About the same | 190 (50.7%) |
| Older or Younger than previous | 64 (17.1%) |
| Refuse to answer | 40 (10.7% |

C.

| | |
|---|---|
| Live closer to me | 167 (44.5%) |
| About the same | 145 (38.7%) |
| Live further away from me | 20 (5.3%) |
| Refuse to answer | 41 (10.9%) |

D.

| | |
|---|---|
| Are easier to meet | 163 (43.5%) |
| About the same | 156 (41.6%) |
| Are harder to meet | 16 (4.3%) |
| Refuse to answer | 38 (10.1%) |

E.

| | |
|---|---|
| Are more like me | 61 (16.3%) |
| About the same | 195 (52%) |
| Are less like me | 69 (18.4%) |
| Refuse to answer | 43 (11.5%) |

### 3.1.37 Question 34: When you meet people from GRINDR in person where do you go to have sex? (n=373)

| | |
|---|---|
| Their house | 185 (49.3%) |
| Your house | 140 (37.3%) |
| A park | 11 (2.9%) |
| A sex club | 11 (2.9%) |
| Don't use GRINDR for sex | 100 (26.7%) |
| Other | 33 (8.8%) |
| Refuse to answer | 18 (4.8%) |

### 3.1.38 Question 35: How many of your friends use GRINDR? (n=373)

| | |
|---|---|
| All | 25 (6.7%) |
| Most but not all | 84 (22.4%) |
| Many | 115 (30.7%) |
| Some | 81 (21.6%) |
| A few | 50 (13.3%) |
| I don't know anyone else who uses GRINDR | 11 (2.9%) |
| Refuse to answer | 7 (1.9%) |

### 3.1.39 Question 36: My favorite thing about GRINDR is: (n=373)

| | |
|---|---|
| Accessibility | 29 (7.7%) |
| The GRINDR Users | 27 (7.2%) |
| Entertainment | 22 (5.9%) |
| GPS feature | 78 (20.8%) |
| Local "gaydar" | 20 (5.3%) |
| Socializing | 103 (27.5%) |
| Photos | 13 (3.5%) |
| Ease of sex | 24 (6.4%) |
| Functionality of the application | 24 (6.4%) |
| Everything | 3 (0.8%) |
| Nothing | 15 (4%) |
| Other | 11 (2.9%) |
| No response | 4 (1.1%) |

### 3.1.40 Question 37: My least favorite thing about GRINDR is: (n=373)

| Variable | p-value |
|---|---|
| Age | 0.02 |
| Gender identity | 0.02 |
| Timing of last HIV Test | 0.003 |
| Prior gonorrhea | 0.02 |
| Prior chlamydia | 0.002 |
| Prior syphilis | <0.001 |
| Increased numbers of sex partners for anal or vaginal sex (all time horizons) | 0-0.006 |
| Frequency of condom use for RAI | <0.001 |
| Meet sex partners at Bathhouse/sex club | 0.03 |
| Use of Amyl Nitrites during sex | 0.09 |
| Use of methamphetamine during sex | 0.03 |
| Use of GHB during sex | <0.001 |
| Use of Ketamine during sex | 0.009 |
| Prior participation in clinical trial | <0.001 |
| Frequency of logging on to GRINDR | 0.07 |

| | |
|---|---|
| Use GRINDR for “friendship” | 0.02 |
| Use GRINDR for “1-on-1 sex” | 0.061 |
| Frequency of having sex with someone met on GRINDR | <0.001 |

## 3.2 Associations

### 3.2.1 HIV Last Test Results, HIV+ vs. HIV-, never got result, don’t remember, refuse to answer

#### *3.2.1.1 Univariate analyses (p< 0.10)*

| | |
|---|---|
| Functional application problems | 57 (15.2%) |
| Wastes time | 8 (2.1%) |
| “Older” men | 16 (4.3%) |
| Spread of HIV and other STIs | 7 (1.9%) |
| Sex-focused | 63 (16.8%) |
| The GRINDR Users | 41 (10.9%) |
| “Creepers”/ “Perverts” | 23 (6.1%) |
| Profile limitations | 43 (11.5%) |
| GPS feature limitations | 13 (3.5%) |
| Deceptive profiles | 20 (5.3%) |
| “Flakes” | 10 (2.7%) |
| Being ignored or rejected | 7 (1.9%) |
| Perpetuating stereotypes of the gay community | 2 (0.5%) |
| Nothing | 29 (7.7%) |
| Other | 30 (8%) |
| No response | 4 (1.1%) |

#### *3.2.1.2. Multivariable Analyses*

| Variable | OR (95% CI) | p-value |
|---|---|---|
| Number of anal sex partners, last 3 months | 1.53 (0.97-2.40) | 0.05 |
| Met sex partner in a bookstore, last 3 months | 33.84 (0.99-1152) | 0.04 |
| Inconsistent inquiry about partners’ serostatus | 3.63 (1.37-9.64) | 0.008 |
| Purpose for GRINDR includes “friendship” | 0.17 (0.03-1.06) | 0.05 |

### 3.2.2 Previously Used PEP or PrEP (either or both vs. never used)

#### *3.2.2.1 Univariate Analyses (p<0.10)*

| Variable | p-value |
|---|---|
| Non-Latino race | 0.035 |
| Timing of last HIV test | 0.009 |
| Increased numbers of sex partners for anal or vaginal sex (all time horizons) | 0.016-0.113 |
| Frequency of condom use for IAI | 0 |
| Meet sex partners at dance clubs | 0.073 |

| | |
|---|---|
| Meet sex partners via GRINDR | 0.059 |
| Use of Amyl Nitrites during sex | 0.028 |
| Use of methamphetamine during sex | 0.007 |
| Greater number of HIV+ sex partners | 0.01 |
| Willing to participate in a future HIV prevention trial | 0.07 |
| Since using GRINDR, sex partners are “more like me” | 0.005 |

##### *3.2.2.2 Multivariable Analyses*

| Variable | OR (95% CI) | p-value |
|---|---|---|
| Since using GRINDR, increased # of sex partners | 4.7 (1.6-14.3) | 0.006 |
| Met sex partner at work, last 3 months | 3.6 (1.1-12.2) | 0.04 |
| Methamphetamine use in past month | 5.8 (1.5-21.9) | 0.01 |
| Non-Latino race | 9.3 (1.1-76.9) | 0.04 |

## 4. Discussion

### 4.1 Background and Demographics

Recent CDC epidemiologic reports note that young MSM (YMSM), age 13-29 have the most consistent and dramatic increases in HIV incidence of any age-risk demographic in the United States.[1] African-American and Latino YMSM disproportionately contribute to these rates. Engaging YMSM in HIV prevention activities has been challenging: In the iPrEx study, the first randomized placebo-controlled trial of FTC/Tenofovir for HIV pre-exposure prophylaxis in MSM to demonstrate protective efficacy, although 50% of the study population of 2499 were under the age of 25, the overwhelming majority of these were not enrolled in the US; of US participants, only 12% were under 25; Forty-seven percent were over 40 years old. In the HPTN 061 “Brothers” study, a protocol aimed at accruing a cohort of African-American MSM (both HIV-positive and HIV-negative) with a goal of describing behavior and ability to retain such a cohort – the median age was 39 in the overall study (n= 6 US sites: Atlanta, Boston, Los Angeles, San Francisco, New York, and Washington DC), and 40 in the Los Angeles cohort (S. Shoptaw, personal communication, December 19, 2011). Thus, the challenge of recruiting a YMSM sample with a median age of 25, as was accomplished in this study, of considerable interest.

The aegis for this study was the observation that the explosion of social media applications has revolutionized communication; indeed, it appears to have created a generation of individuals, particularly young individuals, who are most comfortable communicating, receiving information from, socializing, and in many respects “living” in the on-line social media world.

GRINDR, a social networking application based on the GPS-functionality of smart-phone devices, caters to MSM. In particular, GRINDR facilitates sexual partnering by promoting live chat between proximate GRINDR users, each of whom displays a profile containing a photo, basic demographics, and a personal statement.

We proposed to recruit a sample of YMSM in the Los Angeles Metropolitan Area using GRINDR by using a novel Time-Space Sampling (TSS) method deployed at venues frequented by YMSM. The novel aspect was to employ GRINDR's chat feature as the primary recruitment tool. The gold-standard for epidemiologic surveillance is a randomly selected sample of the target population, most often accomplished by random-digit dialing. The CDC promotes Snowball Sampling, or in its weighted/modified form as Respondent-driven Sampling (RDS). Of increasing interest is TSS, which is characterized by ethnographic mapping of locations and times of attendance of the target population, and then weighted random selection of venue-date-time (VDT) units for surveillance. A systematic method is used to randomly sample the population attending the selected VDT unit. To our knowledge, this is the first time a GPS-based social networking application was used to facilitate a TSS methodology for epidemiologic or behavioral surveillance.

Recruitment of the 375 individuals proved significantly challenging. Teams of 2 research staff were deployed to each VDT location for safety reasons, and to allow one team-member to recruit participants using the GRINDR platform, and the second team-member to administer the CASI-based questionnaire on the iPad device. Ideally, the total number of MSM in the venue would have been tallied, as well as the number of GRINDR users logged-in during the VDT; however the number of GRINDR users was sufficiently dynamic in its fluctuation, and the lag-time in application updating of on-line status sufficiently long that this was infeasible. The low "hit rate" (Section 2.5) demonstrates the high frequency of non-response from GRINDR-based chat contacts. The process of confirming from study databases whether study staff had previously contacted GRINDR participants found to be currently on line proved time consuming and challenging. The initial estimate of 3 months to recruit 375 participants via the GRINDR mechanism was a considerable underestimate of the 5 ½ months required to recruit the sample, and required substantial commitments from research staff to be out until extremely late hours on a recurrent basis.

We hoped to recruit a sample of whom a primary residence was identified in the City of Los Angeles among 80% or more; the final sample is 46% with an identified zip code of residence in the City of Los Angeles (Section 3.1.2); however, all recruited individuals were recruited and surveyed at locations in the City of Los Angeles and the City of West Hollywood. In order to determine if the sample reporting residence in the City of Los Angeles were significantly different from the rest of the sample, we compared key parameters of self-reported City of Los Angeles residents to all others, including demographics, sexual risk behaviors, and reports of HIV test results. There were no significant differences observed (Appendix D).

All participants save one identified as "male," with one participant identifying as "female." The distribution of race/ethnicities encountered roughly parallels that of Los Angeles County (LAC): Our sample found 25.1% Caucasians (LAC 30.1%), 6.4% African-American/Black (LAC 8.8%), 33.6% Latino (LAC 47.3), 14.1% Asian/Pacific Islander (LAC 13.3%), and 1.1% Native

American (LAC 0.5%). We suspect that the race/ethnicity profile may be biased by the availability of the GRINDR platform being limited to Apple's iPhone device; during the course of study conduct, the GRINDR platform became available on some Blackberry devices, however, there was limited uptake. The GRINDR platform is now available on Apple's iTouch as well as Google's Android devices. Based on 2000 Census data of the median per-capita income for a given zip code (2010 Census income data by zip code has not yet been made public), we estimate the median income of participants to be $25,200 (IQR $15.1K-39.6K); extrapolating a 3% increase per year across populations, we would estimate a median household income of $35,929 (IQR $21.5K - $56.5K) for participants. The median value for Los Angeles County is $26,983 in 2009 dollars from the 2010 census, again suggesting that study participants were above the median in household income, although this data is imperfect due to the numerous assumptions: Particularly that we did not ask participants their annual income, but are extrapolating it from zip code data from their reported zip code of residence. For young individuals, this may be particularly non-representative, as some may be living with parents or other family, and therefore the median income of the zip code may not be representative of the individual's current earnings. Additionally, the lack of 2010 individual zip code data makes the extrapolation of 3% increase per year also problematic, particularly in light of the recession that has taken place in the intervening years.

### 4.2 HIV Testing Behavior

The CDC recommends that all individuals age 13-64 be HIV tested at least once, and that those in risk groups with higher HIV incidence rates be tested regularly, on an annual basis.[2] In our population, 312 (83.2%) reported having been HIV tested in the past year. Of concern, however, was that 16 (4.3%) had never been HIV tested – only one of these 16 participants reported no anal intercourse in the past year.

### 4.3 History of Prior Sexually Transmitted Infections

Lifetime history of sexually transmitted infections is a problematic assessment when done by self-report; however without the ability to take direct biologic samples and/or cull medical records, these results indeed suggest high rates of unprotected sexual contact. 17.9% reported having had gonorrhea, 13.6% chlamydia, 9.1% syphilis, and 9.1% another sexually transmitted infection. By way of comparison, the CDC estimates that the prevalence of gonorrhea in MSM nationally is 15.5%, chlamydia 13.3%, and primary and secondary syphilis rates among MSM are 91-173 per 100,000 (http://www.cdc.gov/std/stats10/default.htm, accessed December 20, 2011).

### 4.4 HIV Serostatus

Only 16 (4.5%) of the sample reported an HIV+ test result, which suggests that, consistent with other reports, a large percentage of MSM with HIV infection are not aware of their serostatus. National and LA County prevalence estimates among MSM suggest a 19% prevalence rate[3] – thus one might anticipate that approximately 14% of the sample were likely to be HIV-infected and undiagnosed – thus a reasonable estimate would be that approximately ¾ of those HIV infected in this population were undiagnosed.

### 4.5 Sexual Risk Behaviors

The GRINDR users surveyed had overwhelmingly (98.4%) had sex with a male in the past year, but 9.9% reported having sex with a woman in the past year. Of these 37 YMSM who reported sex with a woman in the past year, 36 had also reported sex with a man in the past year. This emphasizes that MSM, perhaps particularly YMSM, may also serve as an important bridge population for STI transmission to women. The racial/ethnic breakdown of these men who have sex with men and women (MSM/W) was 10 (27.8%) Caucasian, 5 (13.9%) African-American, 13 (36.1%) Latino, 1 (2.8%) Asian/Pacific Islander, and 7 (19.4%) mixed race.

Participants overwhelmingly identified as "gay," and reported numbers of anal sexual partners consistent with other behavioral surveillance studies recently completed in MSM in Los Angeles. Notably, the National HIV Behavioral Surveillance System (NHBS), a CDC-funded survey which began in 2003, targeting MSM, IDU, and high-risk heterosexual populations in areas with high HIV incidence and prevalence, to assess risk behavior, testing behavior, and use of prevention services; and the Web-based HIV Behavioral Surveillance (WHBS), run by the University of California, San Francisco. Subsets of the NHBS and WHBS for Los Angeles have been examined, and key parameters are tabulated with the current data set for comparison below (Table 1).

### 4.6 Condom Usage

Although 53.9% of the sample indicated they "always" use condoms for RAI, approximately 43% of the sample had imperfect condom use for RAI in the past 3 months. Similarly, 53.9% responded that they "always" use condoms for IAI, but 44.6% had imperfect condom use for IAI in the past 3 months. These data clearly indicate that there are high rates of ongoing transmission-associated risk behavior in this population. This also suggests that this population is ripe for deployment of combination HIV prevention strategies (see below, Section 4.16).

### 4.7 Meeting Sex Partners

56% of participants had met a sex partner via GRINDR in the previous 3 months, the most commonly reported mechanism for meeting sex partners. While GRINDR does not market itself explicitly as a mechanism for sex partnering, that is clearly the intent of most users, and apparently a fairly efficient one. GRINDR was more often reported to be a source of sexual partnering in the previous 3 months than "through friends" and using "Internet sex-focused sites," which were the next two most commonly reported mechanisms for sexual partnering. This data is biased, however by the recruitment method, and it is unclear if this hierarchy would be maintained in a more general population of MSM; recent behavioral surveys have not enquired about use of applications such as GRINDR.

Table 1. Comparison of key parameters of recently completed behavioral risk surveys in Los Angeles.

| | WHBS (LA) | NHBS-MSM2 (LA) | GRINDR |
|---|---|---|---|
| Year of Survey | 2007 | 2008 | 2010-11 |
| N | 1234 | 537 | 375 |
| Age | | | |
| 18-29 | 771 (62.5)** | 201 (37.4)** | 349 (93.1) |
| Race/Ethnicity** | | | |
| White | 691 (56.0) | 172 (32.0) | 159 (42.4) |
| Black/AA | 85 (6.9) | 105 (19.6) | 24 (6.4) |
| Latino | 352 (28.5) | 189 (35.1) | 126 (33.6) |
| Anal Sex Partners | | | |
| Last 12 Months, Median | 5.0 | 4.0 | 4.0 |
| Self-report HIV+ | 118 (9.6)* | 67 (12.5)** | 16 (4.3) |
| HIV Testing Behavior | | | |
| Never HIV Tested | 218 (17.7)** | 26 (4.8) | 16 (4.3) |
| Tested in last 24 mos | 840 (68)** | 399 (74.3)** | 340 (90.7) |

*p =0.004 ** p<0.001

### 4.8 Drug Use

48% of the sample reported having used drugs or alcohol at the time of sex in the past month. Overwhelmingly, the substance most commonly reported was alcohol (91.7%), with more modest rates of marijuana use (59.7%), poppers or other inhalants (34.8%), ecstasy (30.4%), cocaine (27.1%), and methamphetamine (14.4%). Rates of stimulant use are consistent with previous reports of cocaine and methamphetamine use rates among MSM in Los Angeles County (T. Bingham, personal communication).

### 4.9 HIV Anxiety/Burden

Interestingly, approximately 75% of the population thought it was “unlikely” or “very unlikely” that they were going to become HIV-infected – this despite the above-noted high rates of unprotected sexual contact. Additionally, 52.8% of the sample did not always ask sex partners about their HIV status – and as noted in the analysis below (Section 4.15), those less likely to inquire as to their sex partners HIV status were more likely to be HIV-infected.

### 4.10 Sex partner serostatus

Although self-report of a partner's HIV serostatus is a notably unreliable assessment, we did note that participants reported that the majority of their sex partners are HIV-uninfected (81.5%). Interestingly, the remainder (encompassing "known" HIV-infected partners [6.3%] and "don't know" [12.2%]) roughly approximates the known HIV-seroprevalence among MSM in both Los Angeles County and the US (19%) – suggesting that perhaps in this population, YMSM are not wrong (at the population level) about their assessments of their sex partners' serostatus. This clearly is a dangerous presumption on anyone's part, and therefore this information must be used and interpreted cautiously. Distributions of sex partner serostatus was significantly different between those self-reporting HIV-positive serostatus and all others, see Table 2, below. It is notable that participants reporting that they themselves were HIV+ were significantly more likely to report that their sex partners were HIV infected as well; and similarly, participants self reporting HIV-negative serostatus were more likely to report fewer HIV-positive sex parterns. This is of course not a biologically confirmed serostatus, and reflects participant's perceptions of their own, and their partners' infection statuses.

Table 2. Distribution of reported serostatus of sex partners, by GRINDR respondent serostatus

| Variable | | HIV-positive | All Others | p-value |
|---|---|---|---|---|
| | n | 16 | 322 | |
| % Sex Partners who are HIV + | | | | <.001 |
| | Mean | 35.6 | 4.9 | |
| | Std Dev | 33.81 | 16.97 | |
| | Median | 33.5 | 0 | |
| | IQR | 0,55 | 0,0 | |
| | Min, Max | 0,100 | 0,100 | |
| % Sex Partners who are HIV- | | | | <.001 |
| | Mean | 38.8 | 83.6 | |
| | Std Dev | 37.54 | 29.42 | |
| | Median | 36.5 | 100 | |
| | IQR | 0,56.2 | 80,100 | |
| | Min, Max | 0,100 | 0,100 | |
| % Sex Partners who are unknown status | | | | 0.078 |
| | Mean | 25.6 | 11.5 | |
| | Std Dev | 38.64 | 25.23 | |
| | Median | 5 | 0 | |
| | IQR | 0,25 | 0,10 | |
| | Min, Max | 0,100 | 0,100 | |

### 4.11 Use of HIV Chemoprophylaxis

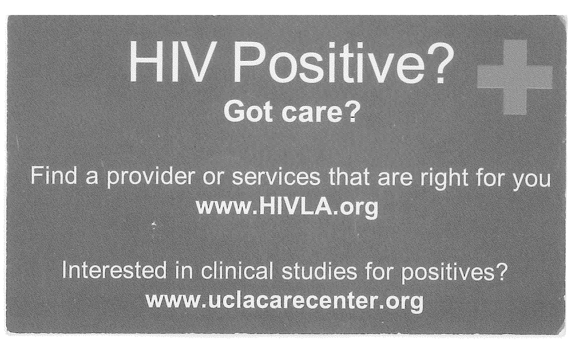
13 (3.7%) of participants reported using post-exposure prophylaxis (PEP) in the past. It is worth noting that a free PEP service delivery program became available in Los Angeles in March 2009 (and continues) at two locations: The Los Angeles Gay and Lesbian Center and the OASIS Clinic. Additionally, 6 participants reported using pre-exposure prophylaxis for HIV prevention; 3 of these participants were also reporters of prior PEP use. The source of the pre-exposure prophylaxis medications and the details around such use were not assessed; however it is interesting that so few participants reported using PrEP despite significant excitement around the results of the iPrEx study, published in the New England Journal of Medicine in November, 2010.[4] This is consistent with the clinical observation that despite these salutary results, there has been minimal uptake of this intervention by at-risk MSM communities.

### 4.12 Past and Future participation in Clinical Trials

Although the majority of participants had not previously participated in a clinical trial, more than half of participants said they would be interested in participating in a future HIV prevention study; an additional 25% of participants indicated that they might be interested in participating, depending on the details of the study, the incentives associated with participation, various other parameters. Only 14.4% of participants categorically indicated that they were not interested in participating in such a future study. A stipulation of our IRB approval which allowed us to not employ a formal signed Informed Consent Form (ICF) for this field-based study was not collecting and/or retaining any personally identifying information. However, we did create a palm card provided to all participants (Figure 1), which included an email and telephone number through which participants interested in being contacted for a future prevention study could leave their contact information. To date, three participants have left contact information for a future study.

While the extra step of having participants need to contact us separately for future contact, this was clearly outweighed by the ease of participation in the current study obviating the need for formal written informed consent (instead allowing a “Research Information Sheet” as noted above.)

Figure 1. Front and Back of palm-cards provided to all participants.




### 4.13 Incentives for a future HIV Prevention Trial

Having demonstrated through this epidemiologic and risk behavior survey that a high-risk population of YMSM could be recruited using the GRINDR platform, the next question is whether this platform can be exploited to either recruit participants for a future HIV prevention trial, or deliver appropriate HIV messaging in an efficient manner to GRINDR users. As YMSM have been historically difficult to recruit into HIV prevention trials, there is a lack of data as to the optimal incentives that might encourage YMSM to participate in such studies. We thus took the opportunity as part of this survey to ask participants to rate a variety of potential incentives on their relative attractiveness.

It appears that the optimal incentives in this population are an escalating cash incentive of $10 per visit, which would increase by $10 per month over the 1 year course of the study ($10, followed by $20, then $30, etc., up to $120 for the final month – a total of $780 if all visits are attended). A $100 bill payment was also an attractive alternative to participants. Voucher-based escalating remuneration was also acceptable, although less so than cash. Lottery-based options were less attractive, unless the amount of the lottery pay-out were approximately $500, which would rapidly more cost-effective to deploy in a study as the number of participants increases past 8-10.

### 4.14 Details of GRINDR-associated use and behavior

The plurality of participants had been using GRINDR for more than 1 year at the time of this survey, and almost 80% of participants had been using GRINDR for at least 3 months. 60% of the study sample reported logging on to the GRINDR platform at least once per day. This is in contrast to the overall worldwide GRINDR population, in which approximately 280,000 individuals log on daily, out of approximately 1,500,000 total users (18.7%). Our sample is clearly biased with respect to this parameter, as participants would have to have been on-line with GRINDR on the specific VDT to be recruited, unless they happened to visualize the study team and actively seek participation via the walk-on mechanism.

Although the majority of study participants reported using GRINDR for "friendship," as noted above, the aggregate data suggest that the primary motivation for GRINDR use was sexual partnering (noted here by approximately 63.5% of the survey population when 1-on-1 and group sex respondents, not mutually exclusive, were combined). Of particular interest is that of our population of GRINDR users, only approximately 3% of participants noted that they were the only person they knew who used GRINDR – an indication of the rapid diffusion of GRINDR use among the MSM community.

### 4.15 Associations with an HIV-positive serostatus

With the important caveat that the self-reported HIV prevalence rate found in this cohort is certainly an underestimation of true prevalence rates, we found several interesting associations with self-report of HIV-positive serostatus. In univariate analyses, using a p-value < 0.1 as a cutoff, a large number of variables cosegregated with an HIV-positive self report (see Section 3.2.1.1). However, in multivariable analyses, controlled for age, race, and zip code of residence only four variables had a $p < 0.05$: number of sex partners for anal sex in the previous 3 months (with the odds of an HIV-positive report increasing by 1.53 for every increased sex partner reported), having met a sex partner in a bookstore in the past 3 months (33.8-fold more likely to report HIV-positive status if a sex partner were met at a bookstore in the past 3 months), any response other than "always" inquiring about a partners' serostatus during sex increased the odds of an HIV-positive serostatus by 3.6-fold, and listing the reason for GRINDR-use as "friendship" DECREASING the chance of an HIV positive result by 5.8-fold. These results, despite the noted limitations, including that a cross-sectional analysis such as this is unable to establish causality, instead merely observing associations – are provocative. It is not surprising that an increased number of sex partners segregates with an HIV-positive status, but the lack of an association with data from the past 1 month and the past year suggests that perhaps recall of sexual partnering events is in aggregate most accurate for a 3 month horizon. This is important, as there is no "gold standard" for the horizon of inquiry regarding sexual risk behavior - - with some behavioral epidemiologists arguing that too short a time-horizon (one month, for example) may not be representative of behavior over the long-term, but long others arguing that longer time-horizons are very sensitive to recall-bias.

Indeed, the finding of an association between finding a sex partner at a bookstore and HIV status is interesting; we suspect that the majority of references to a bookstore are to the well known West Hollywood bookstore Circus of Books, which is a known location for sexual partnering, particularly late at night after local bars and dance clubs close. The area in back of the bookstore colloquially referred to as "Vaseline Alley" may be the source of this unique finding. Unfortunately, further details about this are unavailable from the dataset – however this suggests that Circus of Books may be an important location for the deployment of HIV-prevention interventions and/or recruitment for HIV prevention studies.

The association of NOT responding that friendship was a reason for using GRINDR with HIV positive status is an interesting one, as this was a multiple-response question – and responding that friendship was being sought on GRINDR was not an exclusion to also seeking sexual partnering via GRINDR - - thus one wonders with a larger sample size if the associations with sexual partnering (directly) would have been stronger.

### 4.16 Associations with previous PEP or PrEP use

Again, despite multiple univariate associations with PEP or PrEP use in this population, using multivariable regression controlling for age, race, and zip code of residence, 4 variables retained statistical significance. Meeting a sex partner at work was associated with a 3.6-fold increase in odds of having used PEP or PrEP; this is a somewhat inscrutable result, unless in this population actually having vocational employment was a marker for a threshold of educational level, and therefore could more logically segregate with use of biomedical chemoprophylaxis.  Alternatively, having a job might co-segregate with having private medical insurance, which would increase access to these preventive modalities.

Interestingly, reporting a perceived increase in the number of sex partners since beginning to use GRINDR was associated with increased odds of having used PEP or PrEP, perhaps suggesting a "threshold" effect for the deployment of such prevention strategies.  Previous work sponsored by the City of Los Angeles (Landovitz RJ, Crowe MN, Larkins S, et al, under review at *Sexual Health*) suggests that Los Angeles-based MSM would need a "threshold" level of sexual activity on a regular basis before they would consider the utility of pill-based chemoprophylaxis for HIV prevention.

Paradoxically, methamphetamine use during sex in the past month was associated with reported PEP or PrEP use (5.8-fold); the only plausible explanation for this is an ongoing study protocol in the Los Angeles area being run from the Friends Community Center at La Brea Avenue and Sunset Boulevard, studying deployment of PEP services in combination with Contingency Management to facilitate drug abstinence and therefore medication adherence.   This study has been operational for almost 3 years, and advertises widely across the City and County of Los Angeles.

Finally, a strong association was seen for non-Latino race and prior PEP or PrEP use (9.3-fold odds).  This clearly indicates the need for more a) education b) monolingual-Spanish and culturally appropriate educational materials and prevention messaging and c) greater outreach to YMSM from Latino communities regarding myriad prevention opportunities, including (but not limited to) chemoprophylaxis strategies.

## 5. Conclusions

We successfully recruited a sample of 375 YMSM using the GRINDR platform. The sample was racially and ethnically diverse, and demonstrated high risk sexual behavior.  The sample was time-intensive to recruit due to a low "hit rate" using the GRINDR platform.  This represents the first time that we are aware of that a GPS-based social networking application has been used to facilitate TSS techniques.

The sample also yields important insights into the potential for recruitment for a future HIV prevention study using GRINDR, and the incentives potentially required to engage and retain a YMSM population like the cohort surveyed in this study.  A major limitation is that GRINDR management seems disinterested in partnering with research teams to further these efforts.  It would be futile to attempt larger scale recruitment or messaging campaign without explicit partnership with the GRINDR management, *vis a vis* our experience being shut down briefly mid-study.   We have additionally heard from other research enterprises that GRINDR has been similarly uninterested in partnering with them.

We plan to continue to attempt to engage the GRINDR leadership in discussions around these results and partner with them to consider delivery of educational messaging and/or additional recruitment via their platform.

The study yielded important epidemiologic and risk behavior data on a difficult to recruit population, and exploited novel technologies. The conclusions are limited by the sociodemographic skew of the GRINDR platform's availability only on iPhone smartphones at the time of conduct.

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**3.** Centers for Disease Control and Prevention. Prevalence and awareness of HIV infection among men who have sex with men -- 21 cities, United States, 2008. *MMWR* 2010 2010;59:1201-1207.

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## Appendix A. Questionnaire Items

1. How old are you? ____ [End if <18]

2. What is the zip code of your home or primary residence? _ _ _ _ _

3. What gender do you identify with?

    a. Male
    b. Female
    c. Transgender (M->F)
    d. Transgender (F->M)
    e. Refuse to answer

4. What is your race? (click all that apply)
    A. White/Caucasian
    B. Black/African-American
    C. Latino/Hispanic
    D. Asian/Pacific Islander
    E. Native American
    F. Other
    G. Mixed race
    H. Refuse to answer

5. When was the last time you were tested for HIV?

    A. < 1 month ago
    B. 1-6 months ago
    C. 7-12 months ago
    D. 12-24 months ago
    E. > 24 months ago
    F. Never been tested
    G. Refuse to answer

6. What was the result of your last HIV test?
    A. Positive
    B. Negative
    C. Never got result
    D. Don't remember
    E. Refuse to answer

7. Sexually Transmitted Infections (other than HIV)

6A. Have you ever been told by a health care provider that you had gonorrhea? [Yes] [No] [Don't know/refuse to answer]

6B. Have you ever had been told by a health care provider that you had chlamydia? [Yes] [No] [Don't know/refuse to answer]

6C. Have you ever had been told by a health care provider that you had syphilis? [Yes] [No] [Don't know/refuse to answer]

6D. Have you ever been told by a health care provider that you had another Sexually Transmitted Infection (herpes, warts, chancroid, etc.)? [Yes, specify] [No] [Don't know/refuse to answer]

8. In the past year have you had sexual intercourse or oral sex with (check all that apply):
   a. Men
   b. Women
   c. Transgender women (M->F)
   d. Transgender men (F->M)
   e. None of the above
   f. Refuse to answer

9. Which best describes you? (Choose the term you most strongly identify with)
   a. Gay
   b. Queer
   c. Homosexual
   d. Bisexual
   e. Bi-curious
   f. Heterosexual
   g. Straight
   h. Refuse to answer

10. How many sex partners for anal sex have you had:
    a. In the last month? ___
    b. In the last 3 months? ___
    c. In the last year? ___

11. How many sex partners for oral sex have you had:
    a. In the last month? ___
    b. In the last 3 months? ___
    c. In the last year? ___

12. How many sex partners for vaginal sex have you had:
    a. In the last month? ___
    b. In the last 3 months? ___

c. In the last year? ___

13. How often did you use condoms for receptive anal intercourse (bottoming) in the past 3 months
    a. Always
    b. Frequently
    c. Sometimes
    d. Rarely
    e. Never
    f. Refuse to answer

14. How often did you use condoms for insertive anal intercourse (topping) in the past 3 months
    a. Always
    b. Frequently
    c. Sometimes
    d. Rarely
    e. Never
    f. Refuse to answer

15. Where have you met your male sex partners over the last 3 months? (click all that apply)
    A. At work
    B. Through friends
    C. Bars
    D. Dance Clubs
    E. Internet DATING focused sites (Match.com, findfred.com, gay.com etc.)
    F. Internet Sex-focused sites (Manhunt.com, Adam4adam.com, etc.)
    G. Bath houses/sex clubs
    H. Parks/Public Areas
    I. Bookstores
    J. GRINDR (or other mobile GPS-based smart-phone applications)
    K. Refuse to answer
    L. Other ___________

16. In the PAST MONTH, have you had sex with someone while high or feeling the effects of a drug, including alcohol? [Yes] [No] [Refuse to answer]

17. If you answered “yes” to 13, which of the following drugs have you used before, during of just after sex with someone? (Click all that apply)

a. Alcohol
b. Marijuana
c. Poppers/inhalants (amyl nitrites)
d. Cocaine (powder)
e. Crack cocaine
f. Methamphetamine/crystal meth
g. Ecstasy
h. GHB ("G")
i. Ketamine ("K" or Special K)
j. Heroin
k. Refuse to answer
l. Other, specify__________________

18. Do you believe that you are likely to become HIV-positive in your lifetime? (skip if HIV +)
    a. Very unlikely
    b. Unlikely
    c. Somewhat likely
    d. Likely
    e. Very likely
    f. Refuse to answer

19. How often do you worry about becoming HIV infected: (skip if HIV+)
    a. Never
    b. Rarely
    c. Occasionally/Sometimes
    d. Frequently
    e. All the time
    f. Refuse to answer

20. How often do you think about HIV while having sex (skip if HIV+)
    a. Never
    b. Rarely
    c. Occasionally/Sometimes
    d. Frequently
    e. All the time
    f. Refuse to answer

21. How often do you ask your sex partner about their HIV status before having sex:
    a. Never
    b. Rarely
    c. Occasionally/Sometimes

d. Frequently
e. All the time
f. Refuse to answer

22. What percentage of your sex partners are: (must add up to 100%)
    a. HIV-positive [Text box]
    b. HIV-negative [Text box]
    c. Don't know their HIV status [Text box]
    d. () Refuse to Answer [there should be an automatic check that the text boxes sum to 100; unless refuse to answer is checked]
    e.

23. Have you ever used HIV Medications to prevent you from getting HIV infection (either before sex or after sex)? (Skip if HIV+)
    a. Yes, after sex (like post-exposure prophylaxis or PEP)
    b. Yes, before sex (like pre-exposure prophylaxis, or PrEP)
    c. No
    d. Don't know/Refuse to answer

24. Have you ever participated in a clinical trial? [Yes] [No][Refuse to answer]

25. If a clinical trial were available that provided a menu of possibilities to help you stay HIV-negative, and asked you to come in and get HIV tested every month for 1 year, would you be interested? [Yes] [No] [Maybe] [Depends on________________]

26. Sometimes clinical trials provide incentives (money, prizes, gift vouchers, payment of bills, food/meals etc.) for trial participants to reimburse them for their time and trouble. These incentives may be given either to participate in the study initially, or to encourage participants to come in repeatedly for the study visits over the course of the study. Please rate the following "incentives" as to how much each would motivate you to participate in a clinical trial on HIV prevention, and to return for monthly study visits over the course of 1 year.

    Please use a 0-9 scale with 0 being "not motivated at all" and 9 being "extremely motivated":

    a. $10 cash per visit
    b. $10 cash for the first visit , $20 cash for the second visit, $30 cash for the third visit… increasing by $10 per visit for the duration of the study

c. Gift card or voucher for $10 per visit
d. Gift card or voucher as per the second option, above (same dollar amounts, but as gift cards or vouchers, rather than cash)
e. Entry in a lottery for a drawing of $50 every month
f. Entry in a lottery for a drawing of $100 every month
g. Entry in a lottery for a drawing of $500 every month
h. Payment of a bill of value up to $100 (for example, your rent payment, your car payment, your car insurance, your electric bill), specify bill type and amount ___________

27. What is the minimum amount of reimbursement in cash you would accept for each visit? _________

28. What is the minimum amount of reimbursement in vouchers you would accept for each visit? _________

29. When did you first begin using GRINDR?
    a. () < 1 month ago
    b. () 1-3 months ago
    c. () 3 months-1 year ago
    d. () > 1 year ago
    e. () Refuse to answer

30. How often do you log-on to GRINDR?
    a. () at least once-a-day
    b. () more than once-a-week, but not every day
    c. () once-a-week
    d. () less often than once-a-week
    e. () refuse to answer

31. What do you use GRINDR for? (check all that apply)
    a. [] Friendship
    b. [] Dating
    c. [] 1-on-1 sex
    d. [] Group Sex
    e. [] Phone Sex
    f. [] Other [Text box]
    g. [] Refuse to Answer

32. How often do you have sex with someone you met on GRINDR?
    a. () at least once-a-day
    b. () more than once-a-week, but not every day
    c. () once-a-week
    d. () less often than once-a-week
    e. () Don't have sex with people I meet on GRINDR

f. () Refuse to answer

33. Since beginning to use GRINDER, are your sex partners:
    a. () More in number () About the same () Fewer () Refuse to Answer
    b. () Closer to my age () About the same () Older or Younger than previous () Refuse to Answer
    c. () Live closer to me () About the same () Live further away from me () Refuse to Answer
    d. () Are easier to meet () About the same () Are harder to meet () Refuse to Answer
    e. () Are more like me () About the same () Are less like me () Refuse to Answer How? [Text box]

34. When you meet people from GRINDR in person where do you go to have sex?
    a. Their house
    b. Your house
    c. A park
    d. A sex club
    e. Don't use GRINDR for sex
    f. Refuse to answer
    g. Other [Specify]
    h. Rarely
    i. Don't use GRINDR for sex
    j. Refuse to answer

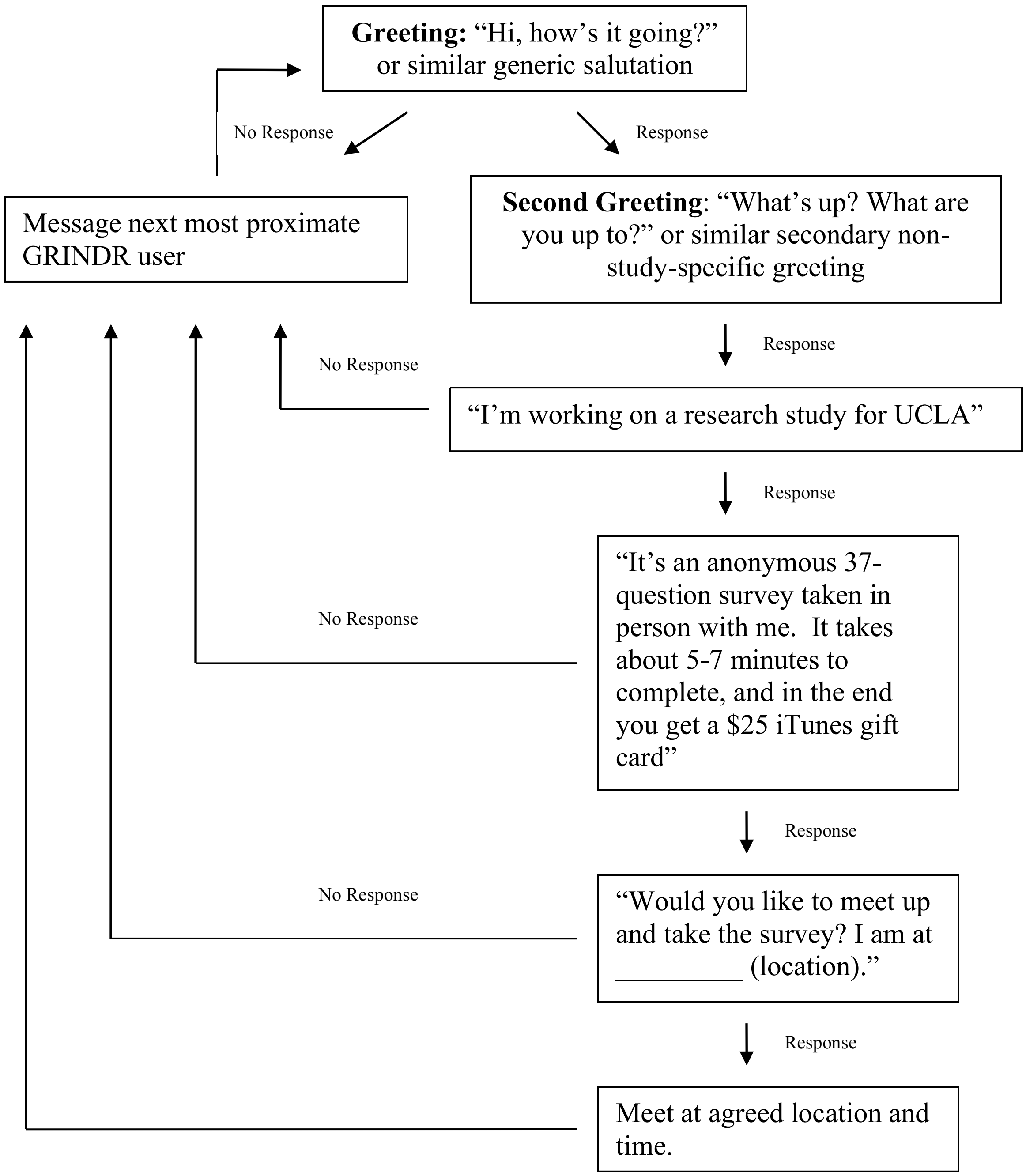
35. How many of your friends use GRINDR?

    a. All
    b. Most but not all
    c. Many
    d. Some
    e. A few
    f. I don't know anyone else who uses GRINDR
    g. Refuse to answer

36. My favorite thing about GRINDR is [Text box]

37. My least favorite thing about GRINDR is [Text box]

## Appendix B. SMS GRINDR Contact Flow Sheet



## Appendix C.  Research Information Sheet

*This is a research study designed by Dr. Raphael Landovitz at UCLA to determine what kind of incentives (rewards) would encourage young gay and bisexual men to maintain their HIV negative status.  Dr. Landovitz can be reached at the UCLA CARE Center at 310-557-1891 if you have any questions or concerns.*

*This study is voluntary and your participation will be anonymous. You can tell the researcher at any time while answering questions that you do not wish to continue. If you wish to ask questions about your rights as a research participant or if you wish to voice any problems or concerns you may have about the study to someone other than the researchers, please call the Office of the Human Research Protection Program at (310) 825-7122 or write to Office of the Human Research Protection Program, UCLA, 11000 Kinross Avenue, Suite 102, Box 951694, Los Angeles, CA 90095-1694. If you do wish to continue and you give your consent for us to ask the questions in this survey, please click the "CONTINUE" button below.*

*Thank you for your participation.*

## Appendix D. City of Los Angeles vs. Others, Key parameters

| Variable | | City of LA | Other | p-value |
|---|---|---|---|---|
| Age | | | | 0.278 |
| | n | 176 | 197 | |
| | Mean | 25.1 | 24.7 | |
| | Std Dev | 3.45 | 3.68 | |
| | Median | 25 | 24 | |
| | IQR | 22,27 | 22,27 | |
| | Min, Max | 18,39 | 18,37 | |
| Race | | | | |
| | Caucasian | 71 (40.3 %) | 88 (44.7 %) | 0.404 |
| | Black/African-American | 17 (9.7 %) | 7 (3.6 %) | 0.02 |
| | Latino | 61 (34.7 %) | 63 (32 %) | 0.66 |
| | Asian/Pacific Islander | 17 (9.7 %) | 36 (18.3 %) | 0.018 |
| | Native American | 0 (0 %) | 4 (2 %) | 0.125 |
| | Mixed Race | 15 (8.5 %) | 13 (6.6 %) | 0.557 |
| Anal Sex Partners, Past 1 month | | | | 0.472 |
| | Mean | 2.1 | 1.7 | 0.509 |
| | Std Dev | 3.67 | 2.26 | |
| | Median | 1 | 1 | |
| | IQR | 1,2 | 0,2 | |
| | Min, Max | 0, 40 | 0, 22 | |
| Anal Sex Partners, Past 3 months | | | | 0.525 |
| | Mean | 4.3 | 3.4 | |
| | Std Dev | 8.93 | 5.3 | |
| | Median | 2 | 2 | |
| | IQR | 1,5 | 1,4 | |
| | Min, Max | 0,100 | 0,50 | |
| Anal Sex Partners, Past Year | | | | 0.462 |
| | Mean | 11 | 9.1 | |
| | Std Dev | 26.33 | 16.59 | |
| | Median | 4 | 4 | |
| | IQR | 2,10 | 2,9 | |
| | Min, Max | 0,300 | 0,120 | |
| HIV Serostatus | | | | 0.219 |
| | Positive | 10 (5.7 %) | 6 (3.3 %) | |
| | Negative | 160 (92 %) | 175 (95.6 %) | |
| | Never Got Results | 0 (0 %) | 1 (0.5 %) | |
| | Refuse to Answer | 1 (0.6 %) | 1 (0.5 %) | |