HIV Prevention Outreach in the 2020s: Grindr™, Gonorrhea, and HIV PrEP

Ass. Prof. Dr. Martin Hoenigl
UCSD
Disclosures:

Research grants
(investigator initiated studies)
COVID19 and Sex

• Evidence shows that the novel Coronavirus spreads person-to-person through sustained close contact.
  o Virus is carried in respiratory droplets transmitted by sneezing and coughing.
  o Aerosols may float or drift in the air when an infected person talks, sings, or breathes. People nearby may inhale aerosols.
  o Virus can live on surfaces and may be spread when a person touches those surfaces, then touches their face.
  o Whether an infected person sheds the virus in saliva, semen, or vaginal fluids isn’t known. Although the virus has been found in feces, transmission of the virus this way appears to be rare.

• 6 – feet distance: what about intimacy?
COVID19 and Sex

• Intimacy with partner: both feeling well
  o Go for it!
  o If your partner works in high risk field, e.g. HCW: personal decision!

• Intimacy with partner who has been ill but not tested for COVID
  o Abstain intimacy and not sharing bedding:
    • at least 10 days after symptoms first started
    • and other symptoms have improved
    • and at least 72 hours fever-free without the use of any medications.

• New relationship: consider carefully
• Always safe: Masturbation, phone sex with a partner who doesn’t live with you, and sex toys (used just by you)

Internet and Sex

• Technology has changed the way men-who-have-sex-with-men (MSM) seek sex
• Over 90% of MSM have reported using the internet for information seeking and socializing, and 40% to 97% of MSM use the Internet to seek sex
• **BUT:** the internet remains an underutilized recruitment tool for HIV prevention
• Identifying better ways of using the internet for HIV prevention may increase success of advertising strategies in recruitment of “hidden” or “marginalized” high-risk populations
Online Partner Seeking and Transmission Risk

- N=147 MSM with Acute or Early HIV infection
  - 20 HIV transmission events in the year following infection were inferred

- Sex-Venue questionnaire within 3 weeks of diagnosis
  - Limitation: Lacking detailed assessment of different online venues
Results. From 147 MSM who completed the questionnaire, there were an associated 20 inferred HIV transmissions. No association with OPS was found (odds ratio 0.64 [95% confidence interval .24–1.69]; \( P = .37 \)), though individuals who reported OPS were more likely to have reported a greater number of partners \( (P = .003) \) and prior STIs \( (P = .002) \). Geospatial analysis did not indicate that OPS was associated with increased geographical reach of the user \( (P = .68) \).

Conclusions. Individuals reporting OPS did not have increased odds of inferred HIV-1 transmission in the year following infection using genetic linkage analysis despite apparently increased risk behavior.
OPS, education, sexual partners & STIs

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### Table 1. Baseline Characteristics of the 147 Men Who Have Sex With Men With Acute or Early Human Immunodeficiency Virus Infection, Stratified by Reported Online Partner Seeking in the Prior 3 Months

<table>
<thead>
<tr>
<th>Baseline Characteristics</th>
<th>OPS (n = 101)</th>
<th>No OPS (n = 46)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age, y</td>
<td>24.7</td>
<td>31.5</td>
<td>.34</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>90 (89.2)</td>
<td>20 (88.2)</td>
<td>.07</td>
</tr>
<tr>
<td>African American</td>
<td>7 (6.9)</td>
<td>5 (11.3)</td>
<td>.42</td>
</tr>
<tr>
<td>Asian</td>
<td>9 (8.9)</td>
<td>2 (4.3)</td>
<td>.50</td>
</tr>
<tr>
<td>Hispanic</td>
<td>25 (25.0)</td>
<td>19 (41.3)</td>
<td>.05</td>
</tr>
<tr>
<td>Other</td>
<td>7 (6.9)</td>
<td>6 (13.0)</td>
<td>.23</td>
</tr>
<tr>
<td>Household income &gt;$2000/mo</td>
<td>19 (18.8)</td>
<td>15 (35.7)</td>
<td>.10</td>
</tr>
<tr>
<td>Education to bachelor’s degree or higher</td>
<td>11 (10.9)</td>
<td>9 (20.0)</td>
<td>.03</td>
</tr>
<tr>
<td>Any reported prior STI</td>
<td>79 (78.0)</td>
<td>26 (56.5)</td>
<td>.002</td>
</tr>
<tr>
<td>Any reported prior stimulant drug use</td>
<td>48 (47.5)</td>
<td>20 (43.5)</td>
<td>.57</td>
</tr>
<tr>
<td>Unprotected and intercourse</td>
<td>31 (30.6)</td>
<td>36 (86.7)</td>
<td>.09</td>
</tr>
<tr>
<td>&gt;5 sexual partners</td>
<td>10 (9.9)</td>
<td>9 (19.6)</td>
<td>.002</td>
</tr>
<tr>
<td>Mean HIV viral load at recruitment, log_{10}</td>
<td>4.94</td>
<td>4.91</td>
<td>.7</td>
</tr>
<tr>
<td>Clustered individual</td>
<td>59 (58.4)</td>
<td>28 (60.4)</td>
<td>.38</td>
</tr>
<tr>
<td>Mean TNS</td>
<td>0.25</td>
<td>0.27</td>
<td></td>
</tr>
</tbody>
</table>

Data are presented as no. (%) unless otherwise indicated. P value ≤ .05 in bold.

#### Results

From 147 MSM who completed the questionnaire, there were an associated 20 inferred HIV transmissions. No association with OPS was found (odds ratio, 0.64 [95% confidence interval, 0.24–1.69]; P = .37), though individuals who reported OPS were more likely to have reported a greater number of partners (P = .003) and prior STIs (P = .002). Geospatial analysis did not indicate that OPS was associated with increased geographical reach of the user (P = .68).

#### Conclusions

Individuals reporting OPS did not have increased odds of inferred HIV-1 transmission in the year following infection using genetic linkage analysis despite apparently increased risk behavior. OPS also did not increase the geographic distance between genetically clustered HIV infections, suggesting that individuals mainly use the internet to meet partners in their local region.
Who do people meet over the internet?

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Social Media

• Social media networks are mostly reflecting offline social relationships

• Social media use is at an all-time high, with:
  o 4/5 of American internet users being on Facebook,
  o 81% of millennials checking Twitter at least once per day
  o over half of Instagram users accessing the platform daily

References:
- Martin TCS, Hoenigl M. Clin Infect Dis 2019
- Philipps G, et al. AIDS and Behavior 2014
- Beyner MR, et al. Sex transm infect 2014
- Winetrobe H, et al. AIDS Care 2014
- Rendina HJ, et al. AIDS and Behavior 2014
Geosocial networking Apps

- Geosocial apps like Grindr emerged that particularly focus on networking (i.e., meeting new people)
- Over 60% of MSM in US use internet and/or smartphone-based geospatial networking apps to find sex partners
  - Dating apps are now the primary method to meet new sexual partners
- Grindr™, a sophisticated geosocial networking app, is most frequently used dating app in US
  - 60% of MSM report some use, followed by Adam4Adam™, and Jack’d™

References:
- Martin TCS, Hoenigl M. Clin Infect Dis 2019
- Philipps G, et al. AIDS and Behavior 2014
- Beymer MR, et al. Sex transm infect 2014
- Winetrobe H, et al. AIDS Care 2014
- Rendina HJ, et al. AIDS and Behavior 2014
Grindr and “Hidden Populations”: Latinos

• 93% of Latinos <50 years of age use the internet regularly

• >70% of Latino MSM use the internet to find sex partners.

• Latino MSM are among the most frequent users of Grindr™
  o Almost half of Latino MSM report frequent Grindr™ use, which is more than both black (33%) and white (40%) MSM.
Grindr and COVID19

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**MSM who use Grindr**

- MSM who use Grindr™ have
  - Greater frequency of condomless anal intercourse (CAI)
  - Higher incidence of sexually transmitted infections (STIs)
  - More sexual partners

- Meeting partners over Grindr™ or other geosocial networking apps may also facilitate protective behavior
  - Serostatus disclosure, serosorting, negotiation regarding condom usage, discussion of sexual practices & user risk-assessment

- Use of pre-exposure prophylaxis (PrEP) among Grindr™ users remains under-explored

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**References**

- Mustanski BS. AIDS care 20007
- Beymer MR, eta. Sex transm infect 2014
- Paz-Bailey G, et al. JAIDS 2017
- Rendina HJ, et al. AIDS and Behavior 2014
- Cuess DG, et al. Arch Sex Behav 2017
Objectives

• Assess Grindr™ activity among MSM undergoing HIV & STI screening in San Diego, California
• Examine how Grindr™ use correlates with risk & prevention behavior, particularly focusing on PrEP use
Methods - Setting

• Nested cohort conducted between September 2018 - June 2019 among MSM receiving community-based HIV & STI screening in central San Diego with community-based free “Good to Go” program
  - HIV point-of-care rapid test followed by routine reflex to individual donation HIV nucleic acid amplification testing in persons with negative rapid test results
  - STI screening assessments include syphilis (using reverse screening algorithm), *Chlamydia* spp. & Gonorrhea by nucleic acid amplification test of urine, pharyngeal & rectal swab specimens (Cepheid Xpert® CT/NG, Sunnydale, CA)
Methods - Study Design

- Participants who tested positive for HIV or STI offered immediate treatment at no cost
- Those at substantial risk for HIV acquisition who tested negative for HIV & not currently prescribed PrEP offered immediate free PrEP starting November 2018
Methods - Measures

• During testing encounter, participants surveyed for
  o Grindr™ usage (opening Grindr™ on mobile device during previous 7 days)
  o demographics
  o substance use, risk behavior (previous 3 months)
  o PrEP use (any PrEP intake during last 14 days)

• Participants with iPhones instructed on how to assess Grindr™ on screen activity (time on screen during last 7 days; automatically recorded by phones) on phones & provided that data via questionnaire
Methods - Risk Categorization

• San Diego Early Test Score (SDET) score used as measure of risk behavior
  o Focuses on current risk for HIV acquisition among MSM: CRAI with HIV-positive MSM, combination of CRAI plus number of male partners, recent bacterial STI

• To consider 3-month risk reporting period in “Good to Go” we created “adjusted SDET”
  o Adjustment 1: “Combination of CRAI plus ≥5 male partners in previous 12 months” to “Combination of CRAI plus ≥2 male partners in previous 3 months”
  o Adjustment 2: “≥10 male partners in previous 12 months” to “≥5 male partners in previous 3 months”
  o We also combined self-reported recent STI with new STI diagnosis at testing encounter into one variable that informed SDET calculation
Statistical Analysis

• Statistical analysis conducted using SPSS 25 (SPSS Inc, Chicago)
• Demographics, PrEP use, PrEP initiation, substance use, risk behaviors, adjusted SDET scores, HIV/STI diagnoses compared between participants who reported recent Grindr™ use vs. non-users
  - Fisher’s exact test/Chi-square test for categorical variables & Students T-Test/Mann Whitney-U test for continuous variables

• Univariate & multivariable logistic regression analyses assessed predictors of initiating PrEP after testing encounter
  - Variables with p-value <0.2 in univariate analysis included in multivariable model (stepwise forward procedure)
    - Odds ratios (ORs) & adjusted odds ratios (aOR) including 95% confidence intervals (CIs) calculated
    - Model discrimination assessed by goodness-of-fit Hosmer-Lemeshow statistics
Results Demographics

- Survey data collected from 1256 consecutive MSM & transgender females
- 580/1256 (46%) participants indicated that they had opened Grindr™ during previous 7 days

<table>
<thead>
<tr>
<th>Variables</th>
<th>Recent Grindr™ use* (n=580)</th>
<th>No recent Grindr™ use* (n=676)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>571 (98%)</td>
<td>666 (99%)</td>
<td>0.976</td>
</tr>
<tr>
<td>Transgender female</td>
<td>5 (1%)</td>
<td>6 (1%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>4 (1%)</td>
<td>4 (1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Age, years; mean (SD)</strong></td>
<td>35 (12)</td>
<td>38 (13)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>371 (64%)</td>
<td>420 (62%)</td>
<td>0.502</td>
</tr>
<tr>
<td>Hispanic Ethnicity</td>
<td>200 (34%)</td>
<td>221 (33%)</td>
<td>0.555</td>
</tr>
</tbody>
</table>
# Results Risk and PrEP

<table>
<thead>
<tr>
<th>Variables: N(%) if not stated otherwise</th>
<th>Recent Grindr&lt;sup&gt;TM&lt;/sup&gt; use* (n=580)</th>
<th>No recent Grindr&lt;sup&gt;TM&lt;/sup&gt; use* (n=676)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adjusted SDET Score (median, IQR)</strong></td>
<td>2 (0-5)</td>
<td>0 (0-3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Male Sex Partners (recent 3 months; median, IQR)</strong></td>
<td>4 (2-7)</td>
<td>2 (1-4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Number reporting Condomless Anal Intercourse (recent 3 months)</strong></td>
<td>297 (51%)</td>
<td>310 (46%)</td>
<td>0.059</td>
</tr>
<tr>
<td><strong>Stimulant Substance Use #</strong></td>
<td>113 (19%)</td>
<td>105 (16%)</td>
<td>0.065</td>
</tr>
<tr>
<td><strong>Self-reported PrEP intake within last 14 days</strong></td>
<td>107 (18%)</td>
<td>59 (9%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Results - Grindr™ Users not on PrEP

- Overall, 472/1087 (43.4%) of participants not on PrEP reported recent Grindr™ use
- Those Grindr™ users also had significantly higher
  - Sexual risk behavior [SDET median 2 (IQR 0-5) among Grindr™ users vs. median 0 (IQR 0-3) among non-Grindr™ users, p<0.001]
  - Number of male sex partners [median 4 (IQR 2-6) vs. median 2 (IQR 1-4), p<0.001]
  - No difference regarding CRAI & recent illicit stimulant substance use
## Results Testing outcomes

<table>
<thead>
<tr>
<th>Variables: N(%) if not stated otherwise</th>
<th>Recent Grindr™ use* (n=580)</th>
<th>No recent Grindr™ use* (n=676)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported recent bacterial STI Diagnosis (recent 3 months)</td>
<td>22 (3.8%)</td>
<td>21 (3.1%)</td>
<td>0.505</td>
</tr>
<tr>
<td>Testing positive for HIV</td>
<td>9 (1.8%)</td>
<td>26 (3.8%)</td>
<td>0.014</td>
</tr>
<tr>
<td>Testing positive for Chlamydia or Gonorrhea</td>
<td>50 (8.6%)</td>
<td>32 (4.7%)</td>
<td>0.005</td>
</tr>
<tr>
<td>Testing positive for Syphilis</td>
<td>13 (2.2%)</td>
<td>11 (1.6%)</td>
<td>0.428</td>
</tr>
<tr>
<td>Testing positive for HCV</td>
<td>0</td>
<td>4 (0.6%)</td>
<td>0.129</td>
</tr>
</tbody>
</table>
Results - Grindr™ & PrEP initiation

- PrEP-eligible Grindr™ users were nearly twice as likely to start PrEP after testing encounter compared to non-Grindr™ users
  - 100/406, **24.6%** of Grindr™ users started PrEP vs. 72/514, **14.0%** of non-Grindr™ users, p<0.001

<table>
<thead>
<tr>
<th>Model</th>
<th>OR</th>
<th>95% CI</th>
<th>p value</th>
<th>aOR</th>
<th>95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recent Grindr™ use</strong></td>
<td>2.006</td>
<td>1.433 – 2.808</td>
<td>&lt;0.001</td>
<td>1.611</td>
<td>1.129 – 2.299</td>
<td>0.009</td>
</tr>
<tr>
<td><strong>Adjusted SDET score (per point)</strong></td>
<td>1.250</td>
<td>1.174 – 1.331</td>
<td>&lt;0.001</td>
<td>1.196</td>
<td>1.116 – 1.282</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Age (per year)</strong></td>
<td>0.960</td>
<td>0.944 – 0.976</td>
<td>&lt;0.001</td>
<td>0.964</td>
<td>0.948 – 0.981</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Stimulant Substance Use last 3 months</strong></td>
<td>1.634</td>
<td>1.090 – 2.450</td>
<td>0.017</td>
<td>n.s.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diagnosis of Chlamydia or Gonorrhoea infection at Testing encounter</strong></td>
<td>3.751</td>
<td>2.139 – 6.576</td>
<td>&lt;0.001</td>
<td>1.996</td>
<td>1.076 – 3.701</td>
<td>0.028</td>
</tr>
<tr>
<td><strong>Hispanic Ethnicity</strong></td>
<td>1.381</td>
<td>0.983 – 1.940</td>
<td>0.063</td>
<td>n.s.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* x² = 6.077; p = 0.639 Hosmer–Lemeshow; Forward Wald Binary Logistic Regression

Abbreviation: OR=odds ratio; aOR=adjusted odds ratio
Results - Grindr™ On-Screen Activity

- Of 580 MSM who indicated recent Grindr™ use, 376 (64.8%) were iPhone™ users, of which 340 had iPhone™ with them at testing encounter.

- Median on screen activity during previous 7 days was significantly higher in those who reported PrEP use within last 14 days (60/340) vs. those who did not (280/340):
  - Median on screen time 244 minutes (IQR 75-534) in those with PrEP vs. median 142 (IQR 47-360) in those without, p=0.017

- Those at highest risk for HIV (SDET 8 or higher) had trend towards being highest Grindr™ utilizers (i.e. >90th percentile of time on screen corresponding to >660 minutes during last 7 days):
  - 5/25 (25%) of those with highest sexual risk vs. 21/255 (8.2%) of those with lower sexual risk, p=0.053
Discussion - Study

- Grindr™ users higher sexual risk, more likely to test positive for Chlamydia & Gonorrhea infections
- Grindr™ users also more likely to have taken PrEP within 2 weeks before testing encounter (18.7% among Grindr™ users vs. 8.7% among others)
  - Possible consequence: less likely to test positive for HIV (9 new diagnoses among Grindr™ users vs. 26 new diagnoses among non-Grindr™ users)
- After testing encounter Grindr™ users more likely to start PrEP through our program
  - 24.6% of Grindr™ users started PrEP vs. 14% of non-Grindr™ users
  - Grindr™ use remained independent predictor of PrEP initiation in multivariate analysis

Chan PA, et al. Sex transm infect 2018
Winetrobe H, et al. AIDS Care 2014
Discussion - Study (2)

- Majority of Grindr™ users (81.3%) not on PrEP, despite having significantly higher sexual risk behavior compared to non-users
- Given greater acceptance of PrEP among MSM who used Grindr™, Grindr™ may provide useful platform to promote HIV & STI testing, increase PrEP uptake
- How to effectively deliver these messages needs to be assessed further
  - Commercial Grindr™ banner ads can help recruitment for HIV prevention efforts, particularly among older MSM. BUT banners & advertisements generally do not harness social dimension of geospatial networking apps

Holloway IW, et al. AIDS and Behavior 2014
Burrell ER, et al. AIDS and Behavior 2012
Huang E, et al. AIDS Education 2016
Sun CJ, et al. AIDS and Behavior 2015
Rosengren AL et al. Sexual Helath 2016
Lampkin D, et al. JAIDS 2016
Limitations (Study)

- Study at single community-based testing site thus findings not generalizable to other locations and populations

- Did not collect data on usage of other geosocial apps (e.g., Scruff, Hornet, etc.) which may be used by persons who have a higher risk profile or had a similar risk profile and biased the results of comparisons between Grindr users and non-users toward the null

- Sub analysis on on-screen activity was limited to iPhone users (higher SES?)
Grindr and Prevention Messages

- Previous studies evaluated Grindr™ ads for recruitment for HIV prevention interventions, including recruitment of Latino MSM in Los Angeles.
- Studies indicate that Grindr™ ads can help recruitment for HIV prevention efforts particularly among older MSM
  - Banner Ads can be targeted to certain geographic areas and zip codes, but not age groups, ethnicities etc.
- BUT paid display ads that are not specifically targeted may be ineffective to reach hidden-populations
  - Also costs for these ads are generally predicted to increase
- Studies have shown the effectiveness of network-based recruitment for locating undiagnosed HIV infections, but few have used dating apps recruit hidden populations.
Solution?

• Personalized delivery of prevention messages, e.g. via advertisement on profile pictures of selected “opinion leaders”?

• Frequent Grindr users, many sex partners, etc.

Mustanski AIDS Care 2007
Winetrobe AIDS Care 2014
Beymer Sex Trasm Infect 2014
Cao J Med Internet Res 2017
Alcaron Sex Transm Infect 2018
Lampkin JAIDS 2016
Connectors


Tipping point defined as "the moment of critical mass, the threshold, the boiling point". 
"Ideas and products and messages and behaviors spread like viruses do".

"The Law of the Few" : The success of any kind of social epidemic is heavily dependent on the involvement of people with a particular and rare set of social gifts. 
80/20 Principle (Economics), which is the idea that in any situation roughly 80 percent of the 'work' will be done by 20 percent of the participants.
Connectors are the people in a community who know large numbers of people and who are in the habit of making introductions.
- A connector is essentially the social equivalent of a computer network hub, and has a social network of over 100 people.
- They make a habit of introducing people who work or live in different circles.
- They are people who "link us up with the world...people with a special gift for bringing the world together".
- They are "a handful of people with a truly extraordinary knack [... for] making friends and acquaintances
- Have ability to span many different worlds is a function of something intrinsic to their personality, some combination of curiosity, self-confidence, sociability, and energy".
Incentive for Connectors to keep this picture on their Grindr profile for 4 weeks plus befriend a AVRC dummy profile so we can check that they do it.

Expiry date important, otherwise uploaded on coupon.com ....
Incentive for Connectors to keep this picture on their Grindr profile for 4 weeks plus befriend a AVRC dummy profile so we can check that they do it.

Blockchain Recruitment Identifies which wave/blockchain position: 1st seed, 2nd seed, etc.
Conclusion

- Over 60% of MSM in US use internet and/or smartphone-based geospatial networking apps to find sex partners

- Grindr™ users take more risks, but are more open to HIV pre-exposure prophylaxis

- Grindr™ could be an effective vehicle for reaching people at risk for contracting HIV or other STIs
  - Promote HIV & STI testing
  - Educate those at high risk for HIV about benefits of PrEP
  - Linking users to programs that offer PrEP