



## **TECHNICAL** REPORT

# Understanding the impact of smartphone applications on STI/HIV prevention among men who have sex with men in the EU/EEA

**ECDC** TECHNICAL REPORT

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This report was commissioned by the European Centre for Disease Prevention and Control (ECDC), led and managed by Teymur Noori with technical input from Andrew J Amato-Gauci, Gianfranco Spiteri and Anastasia Pharris.

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## Abbreviations

BME	Black and minority ethnic
EU	European Union
G or GBL	gamma-Butyrolactone
GPS	Global positioning system
HIV	Human immunodeficiency virus
LGBT	Lesbian, gay, bisexual and transgender
MSM	Men who have sex with men
PrEP	Pre-exposure prophylaxis
PSE	Public sex environment
SoPV	Sex on premises venue
STI	Sexually transmitted infections
THT	Terrence Higgins Trust
UAI	Unprotected anal intercourse
WHO	World Health Organization

## Glossary

Adam4Adam	An MSM website, popular with BME MSM communities
App	Application – referring to applications used on Android or Apple iOS smartphones or tablets.
Banners	A common form of advertising on apps, using image adverts which link through to external websites or apps
BarebackRT	A website for MSM to seek partners to have condomless anal sex
Bender	An MSM app
Chems	UK MSM terminology for recreational drugs, typically methamphetamine, mephedrone, GBL and MDMA
Chemsex	Sex involving the use of recreational drugs, usually amongst MSM in a group setting
Cruising Ground	A public sex environment. Typically an outdoor area, such as a park, used by MSM to meet, or 'cruise' for sex
Crystal Meth	Methamphetamine, a recreational drug, one of the three drugs used more commonly by MSM in a sexual setting
Dudesnude	An MSM website
Facebook	The most popular social media platform worldwide
Fitlads	A predominantly UK-based MSM website
Gaydar	A predominantly UK-based MSM dating website and app, founded in 1999
GayRomeo	An EU MSM website and app, founded in 2002
GIF	A small, usually animated, image used on websites and apps
Growlr	An MSM app, geared towards the 'bear' subculture within the gay community
Guyspy	An MSM app and website
Hornet	An MSM app
iBoyz	A Czech MSM website
Jack'd	An MSM app
Mephedrone	A recreational drug, one of the three drugs used more commonly by MSM in a sexual setting
Mobile optimised	A website which has been tailored to work on mobile devices
Manhunt	An MSM website
Push message	A form of direct messaging advertisement, commonly available on smartphone apps
Queerty	A gay men's focused online blog
Recon	An MSM website and smartphone app, geared towards the fetish community
Scruff	An MSM app, targeted towards the 'bear' subculture within the gay community
Seroadaptive	Changing behaviour based on an individual's or a partner (perceived) HIV status
<i>Shigella</i>	A serious bacterial gut infection, which can be passed on sexually from anal-oral contact
Skype	An online video and phone call service
Social media	A broad term that describes forms of digital media which allow communication between users (such as Facebook and Twitter) but also can include MSM specific websites and apps
Squirt	An MSM website, based around supporting the use of public sex environments (cruising)
Tinder	A dating app used by MSM and the wider heterosexual community
Towleroad	A blog published by Andy Towle; includes news, politics, entertainment, technology, gay video, design

# Introduction

Men who have sex with men (MSM) have remained a group who, in the European Union (EU) and European Economic Area (EEA), have been impacted disproportionately by high rates of sexually transmitted infections (STIs), including HIV, over the last 30 years [1]. Over this crucial period, we have seen significant and differing changes between countries in areas such as equality, marriage, sexual tourism, recreational drug use and STI testing and treatment. These have all had an impact on MSM sexual culture.

A universal change, internationally, has been the early adoption and proliferation of digital platforms used for connecting individuals, sourcing sexual partners and facilitating the formation of communities of interest among MSM.

Smartphone applications designed to facilitate MSM meeting each other began to emerge around 2009 and their use has continued to increase. The importance of digital platforms has been emphasised by recent research in the UK. This found that 76% of MSM respondents (who were not in a closed, monogamous relationship) had used online platforms to source sexual partners in the last six months [2]. The use of apps increased for those with higher numbers of partners.

For many MSM, smartphone apps have replaced desktop-based websites as the principle means by which they meet sexual partners.

## Background

### From websites to smartphone apps

Use of the technology by gay and bisexual men, and other men who have sex with men (MSM) has often been the subject of research. As the technology has changed and developed with time, so men have adapted their use for socialising, sharing information and forming communities. Previous research has focused on the progressive technical iterations of different Internet or online platforms (from early online bulletin boards, chat rooms, to profile based websites), and the varying uses of these platforms by MSM [3]. Smartphone applications (which are programs used on smartphones or tablets) are another stage in this progression.

Much of the published research has continued to focus on core themes: men's use of the internet to seek sexual partners and develop sexual networks online, and the relationship of these behaviours to their sexual health. Available evidence on the impact of smartphone apps is extremely limited in scope and geographic location. Much of the published research is from the United States and there is very little from EU countries. The extent to which US-based study findings can be extrapolated to apply to MSM networks in the EU is uncertain. In addition, even within the US, available research is for the most part observational rather than explanatory. It is also constrained by important methodological issues, particularly to do with sample bias and limited measurements in survey questionnaires. Such issues are not specific to MSM smartphone apps though, and have been persistent in the majority of research on gay men and the internet.

An additional challenge arises from trying to make assumptions about smartphone app use based on previous research on internet use for sex by MSM. Although apps can, and possibly should, be seen as related to the internet, they present novel features by integrating GPS technology on a mobile platform. These factors, which facilitate more frequent and easier ways for MSM to meet, could potentially contribute to the creation of specific sexual networks in which both sexual risk-taking and STI prevalence could be high. Nonetheless, data is currently unable to support or discount presuppositions regarding these fundamental differences between the internet and mobile apps.

Scientific literature appears largely unable to show direct causality between internet use and STI trends. Indeed, even within similar kinds of studies there are inconsistencies and contradictions due to methodology. Furthermore, there is also some evidence that internet-based networks provide protective factors (rather than more risk exposure), particularly making HIV status disclosure online easier than in person [4].

In addition, some have noted that web use also allows men to socialise and form relationships in what are otherwise isolated or hostile circumstances and that this can help with identity, belonging, improved mental health and community engagement [5]. Most of the available research on the online sexual behaviour of MSM can thus only show associations and relationships between the use of the internet for sex, sexual risk and individual STI histories rather than provide explanatory evidence for STI trends.

This is not to say that online networks, be they apps or websites, do not play a role in networks of STI transmission (as a tool which clearly aids the sourcing of new sexual partners for many MSM), but this role may be complex, varied, and is not easily evidenced.

## Accentuation or self-selection

In broad terms, the literature has been concerned with supporting or discounting what can be seen as two main hypotheses with regards to the impact of the use of the internet by MSM on their sexual health and behaviours:

### The accentuation hypothesis

Internet use increasing sexual risk and consequently contributing to rises in STIs among MSM populations.

### The self-selection hypothesis

Internet use for casual and/or high-risk sex is undertaken by men who would engage in sexual risk anyway and who would do so 'offline' as well [6].

These two perspectives are of course relevant, also, to an understanding of the impact of the use of smartphone apps on the sexual health of MSM.

It is worth considering whether smartphone apps should be seen as a new social space for men looking for sexual partners or as a continuation of existing web platforms. Smartphone apps principally differ from the first generation of websites. This is because they are optimised for use on smartphones or tablets and utilise more precise technology to determine other users' geographical locations<sup>1</sup>.

As many people access their smartphones throughout the day, the possibility of contacting, and being contacted by others via smartphone apps is arguably greater than via the use of websites accessed on desk-based or even home laptop computers. Indeed, studies report a high frequency of usage of these apps by MSM, with men checking their profiles at repeated points during the day, every day (more details in the following sections). Smartphone apps thus present different opportunities for sexual encounters from those hitherto offered by the internet and all 'offline' sexual spaces. However, the only qualitative study found in the literature review cautions against an understanding of smartphone apps as separate and discrete entities. Instead it suggests that apps should be seen alongside a continuum of networking which takes place in person, on the internet, on different kinds of websites and social networking sites and, also, on different types of Smartphone apps [7].

Study participants generally report that smartphone apps are their main means of identifying sexual partners and, simultaneously, that the main use they make of apps is seeking sexual partners [4, 8, 9]. Nonetheless, men make other uses of these apps too – for example to meet friends, socialise, and organise social activities.

Furthermore, different apps cater for different needs and preferences. While some apps and smartphone-optimised websites are predominantly and explicitly geared towards finding sexual partners, they are also used for connecting men with similar identities and community affiliation (for example, HIV positive MSM). It is thus crucial not to over-generalise about MSM app use and to allow for nuances in behaviours.

The full literature review covered:

- demographics of MSM smartphone users
- uses of MSM smartphone apps
- number of sexual partners of smartphone apps
- prevalence of unprotected anal intercourse (UAI) among smartphone app users
- HIV status, HIV/STI prevalence and HIV/STI testing among MSM app users
- seroadaptive behaviours and 'barebacking' among MSM app users
- sexual networks and STI epidemiology of MSM app users
- sexualised drug use amongst MSM and its relation to smartphone apps

Overall, available evidence on the impact of smartphone apps is extremely limited in scope and in geographic location. The extent to which either US findings, or previous website-based research can be extrapolated to cover MSM smartphone apps in the EU is debatable.

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<sup>1</sup> Many websites now have mobile optimised versions which allow parity with apps, so the distinction is arguably less important. The important shifts from previous internet technology remain centred on: 1) increased and easier access to the app/site via mobile technology, and 2) the use of GSN technology to facilitate physical meetings.

## Aims and objectives

The report aims to provide a better understanding of the role which MSM smartphone applications play within the HIV epidemic, both as a tool that MSM use to source sexual partners and as a platform for reaching MSM by organisations who work in the field of HIV prevention and sexual health.

The report sets out to describe:

- the importance of smartphone apps to MSM in the EU, and the role which they currently play in the HIV prevention activities of organisations across Europe
- what the wider social and sexual health impact of smartphone apps might be on MSM.

This was explored through the views of individuals working for MSM HIV prevention organisations, and the narratives of a small cohort of MSM from across the EU.

It is beyond the scope of the project to either quantify the impact of the apps on the sexual health of MSM or to show causal links between digital developments and sexual health trends in Europe. Rather, this report presents a practical overview of the role which smartphone apps currently occupy within HIV prevention, alongside a series of hypotheses of the possible impact on MSM, which future research may undertake and test in more detail.

The hypotheses considered are whether:

- smartphone apps have increased partner numbers and frequency of partner change among MSM
- smartphone apps provide new opportunities for MSM to communicate, meet and form non-sexual connections
- the short nature of conversations on smartphone apps can have an impact on successful negotiation of sex or sexual health practices
- smartphone apps facilitate the mixing of sexual networks which may have previously been separated by age, identity, or sexual practices
- smartphone apps facilitate the organisation of private sex parties involving recreational drug use
- smartphone apps influence MSM tourism within Europe, functioning as a common way for MSM travelling to a new country to meet other MSM in that location
- online platforms, and increasingly smartphone applications, will often be the first point of contact for young MSM with other MSM or MSM culture.

Finally the report makes some suggested recommendations on both the immediate and long-term goals of utilising smartphone apps for HIV prevention with MSM. It also suggests what some of the potential impacts may be, for guiding both future research and organisations' continued work with MSM on a local and international level.

## Methods

### Literature review

A literature review was conducted in June 2014. This included searching Pubmed, Science Direct, Google Scholar and also European health surveillance, grey literature and citation-tracking within journals and included articles. Keywords for the review were: online; smartphone apps; apps; Grindr; Gaydar; internet, MSM, gay; bisexual; social networks; sexual health; HIV and STIs. Findings from the literature review were used to create the interview script and survey questions for the stakeholders.

### Stakeholder in-depth interviews

After an initial analysis of the literature review against the original research questions, a set of questions were created for stakeholder interviews with workers and volunteers who undertake HIV prevention work with MSM.

These questions covered:

- the importance of apps and other online spaces to MSM in their area
- historical shifts in terms of the importance of online spaces and more traditional gay physical meeting spaces
- HIV prevention work by the stakeholder which has used online MSM spaces, including apps.
- what their opinions are on the impact of MSM smartphone apps on the sex lives of MSM.



Interviews were conducted via smartphone or over Skype, with four different stakeholders from the UK, Germany, and Italy. Feedback and analysis of the interview data was used to refine the questions into an online survey and to form seven hypotheses to be explored.

## Stakeholder survey

The online survey was created based on the interview data and questions, and circulated to stakeholders across Europe via existing LGBT and sexual health/HIV stakeholder networks.

The survey was completed by 189 stakeholders from 39 different countries. Of those, 164 were from 29 EU/EEA countries<sup>2</sup>:

### Participating EU countries

Austria (N=4)	Latvia (N = 2)
Belgium (N=7)	Lithuania (N=4)
Bulgaria (N=6)	Luxembourg (N=2)
Croatia (N=2)	Malta (N=1)
Czech Republic (N=6)	Netherlands (N=2)
Denmark (N=2)	Norway (N=3)
Estonia (N=5)	Poland (N=3)
Finland (N=3)	Portugal (N=14)
France (N=6)	Romania (N=5)
Germany (N=11)	Slovakia (N=3)
Greece (N=12)	Slovenia (N=2)
Hungary (n=1)	Spain (N=16)
Iceland (N=1)	Sweden (N=3)
Ireland (N=10)	United Kingdom (N=28)
Italy (N=4)	

Participants were also asked what type of work they do in relation to MSM HIV prevention. They could choose all options which applied.

What type of work in relation to MSM or HIV do you do?		
Answer options	Response percentage	Response count
HIV prevention	84.6%	143
General sexual health promotion	51.5%	87
Support for LGBT people	43.2%	73
Support for people living with HIV	56.2%	95
Counselling	46.2%	78
Clinical services (such as HIV testing)	39.1%	66
HIV policy or activism	40.8%	69
Drug and alcohol services	11.8%	20
Mental health services	10.1%	17

## MSM in-depth interviews

The stakeholder interviews and surveys established hypotheses on the potential impacts of smartphone apps on MSM social-sexual practices. These were conducted over Skype or smartphone. Interview participants were recruited via Facebook advertising across EU countries. Content from the interviews do not provide definitive answers to the hypotheses, but rather provided some personal experiences to illustrate the depth and complexity of each issue, and its importance for future research.

<sup>2</sup> In some analysis, country responses were combined and the mean or median was used rather than individual responses.

## Expert meeting

The expert meeting was held on 4–5 February 2015 and was attended by stakeholders from EU countries, the United States and Australia. The meeting provided a platform to discuss and collect feedback on the research findings and explore experiences of the issues which were included throughout this Final Report.

For the detailed expert meeting report, please refer to Appendix 2.

## Results

### MSM spaces and HIV prevention

'If I hadn't moved to London I would definitely be on the apps, definitely.' (MSM aged 24, UK)

In order to understand the impact and influence smartphone apps have on the ways in which MSM meet partners, the survey asked stakeholders to rate the popularity of MSM meeting spaces in their area (with one being 'unpopular' and five being 'very popular').

Overall, participants rated MSM websites and smartphone apps as the most popular spaces for MSM in Europe<sup>3</sup>. This was true in all three regions of WHO Europe (EU/EAA countries only): West, Centre and East<sup>4</sup>.

Spaces/venues	European-wide average (mean, scale 1–5)
MSM websites	4.29
Smartphone applications	4.04
Gay clubs or discos	3.9
Gay bars	3.62
Gay saunas or bath houses	3.01
Gay cruising grounds	2.66
Gay sex clubs	2.39
Gay community groups	2.56

Physical spaces such as gay bars and clubs were also rated as popular in West and Central Europe, but less so in Eastern Europe where perhaps there are fewer gay-specific venues and less LGBT infrastructure. In East Europe, websites and smartphone apps were rated the most popular MSM spaces by a much larger margin compared to physical spaces than the rest of Europe.

In your opinion, how popular are these spaces to MSM in your area? (Mean, scale 1–5)			
Regional average (mean)	Western Europe	Central Europe	Eastern Europe
Gay community groups	2.77	3.03	2.3
Gay bars	4.15	3.96	3
Gay clubs or discos	4.19	4	3.36
Gay saunas or bath houses	3.85	3.18	2.73
Gay cruising grounds	3.32	2.88	1.7
Gay sex clubs	3.44	3	2.3
MSM websites	4.40	4.73	4.27
Smartphone applications	4.52	3.96	4.0

<sup>3</sup> For the averages by country, see Appendix 2.

<sup>4</sup> Western Europe includes: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Republic of Ireland, Italy, Luxembourg, Malta, the Netherlands, Norway, Portugal, Spain, Sweden and the United Kingdom. Central Europe includes: Bulgaria, Croatia, Cyprus, the Czech Republic, Hungary, Poland, Romania, Serbia, Slovakia, and Slovenia. Eastern Europe includes: Estonia, Latvia, and Lithuania.

When asked which of these spaces were the most important for them in terms of HIV prevention work, once again MSM websites topped the ranking with gay saunas or bathhouses, gay clubs and smartphone apps following close behind<sup>5</sup>.

Importance to prevention work	European-wide average (mean, scale 1–5)
MSM websites	4.10
Gay clubs or discos	3.69
Gay bars	3.57
Smartphone apps	3.49
Gay saunas or bath houses	3.42
Gay cruising grounds	3.07
Gay community groups	3.17
Gay sex clubs	2.55

It is perhaps not surprising that 26 of the 29 EU/EEA countries who participated in the survey reported conducting HIV prevention work online, with only respondents from Slovakia, Luxembourg and Iceland not reporting online work. In contrast, the number of countries with an organisation working on smartphone apps was much lower, totalling only 16 out of 29 (55%). For a comparison between the importance of spaces to MSMS and HIV prevention, please see Appendix 3.

## Changing spaces – websites and smartphone apps

This disparity in the presence of prevention workers on smartphone apps can be explained in part by the fast changing nature of MSM technology use (alongside the numerous barriers organisations may experience in trying to work on apps – see below). In total, 87% of respondents agreed that: ‘the popularity of specific websites or smartphone apps changed in recent years’.

‘[An app] has become the clear market leader, other apps have also increased in usage. Websites are now less popular.’ (Bilthoven, Netherlands)

Many stakeholders commented in a similar vein, that the rise of smartphone apps had largely taken over from websites, with most of the successful websites now all having smartphone applications working in tandem with their (often mobile-optimised) websites.

‘Smartphones and internet connection have become widely available and affordable, which contributed to increased popularity of apps.’ (Tallinn, Estonia)

Respondents from around Europe observed a similar shift. In the same way that smartphones have enabled people to spend more time online and on social media, such as Facebook and Twitter, so too has this shift also enabled MSM to spend more time looking for sexual partners.

‘App and smartphone use has increased in availability and users, thus producing more and better results. They [the apps] also can be used at work, during their lunch break, in discos and other physical spaces, increasing their use.’ (Lisbon, Portugal)

But although smartphone apps have increased in popularity, desktop websites are still used by many MSM but perhaps in more specialised ways.

‘Apps are now very common to use for sexual meetings, but still the web-based gay communities keep most of their popularity. Maybe they partly fulfil another function like social venues do, not only sexual, as the apps are usually seem to be used for.’ (Stockholm, Sweden)

In the UK, this split was also seen, with smartphone apps taking over the mainstream MSM space, while certain websites remained popular due to their niche appeal:

‘Possibly websites that are more specialist have become more popular than general websites which have been replaced with common apps.’ (Brighton, England, UK)

In other areas of Europe, such as Slovakia, MSM also reported that online usage was split between popular international apps and a local website mainly for Czech MSM which has maintained popularity in this area through providing localised information and support, and simultaneously developing apps to support the site.

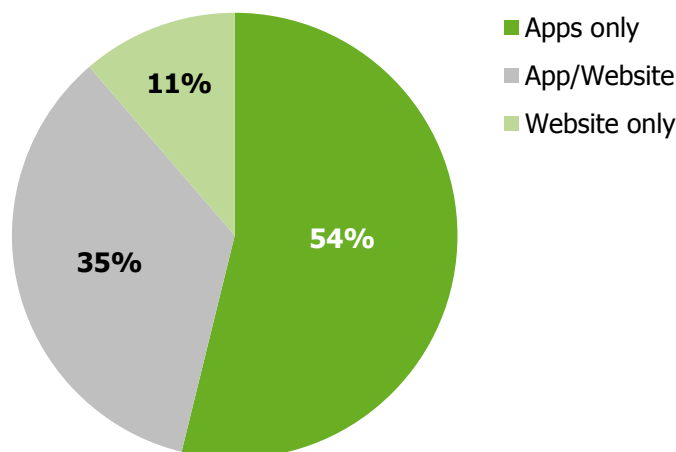
<sup>5</sup> See Appendices 2–4 for country averages

## Smartphone app and website preference and popularity

Grindr was reported to be not only the most popular smartphone app, but also the most popular MSM online space across the EU. Indeed, smartphone apps occupied five of the top 10 choices, with websites which also had apps occupying the remaining four. There was only one website only platform (Manhunt) in the top 10 choices (and even this was optimised for mobile browsers).

App or website name	Weighted score (0–5)
Grindr	4.35
GayRomeo	3.50
Scruff	1.41
National websites or apps	0.88
Gaydar	0.86
Hornet	0.70
Tinder	0.40
Manhunt	0.33
Recon	0.30
Growlr	0.29
BarebackRT	0.10
Squirt	0.10
Fitlads	0.05
Dudesnude	0.05
Jack'd	0.03
Adam4Adam	0.02

**Figure 1. Popularity of MSM space by smartphone and website classification.**



Generally, while smartphone apps are perceived to have either taken over from, or now be an important component of, the most popular MSM online spaces, it should be remembered that in certain countries in the EU, websites may remain the most popular MSM space. This was particularly apparent in countries which had a website which catered to a particular MSM national identity or language.

In a similar vein, while apps emerged overall as the most popular online space across the EU, in individual countries and regions, there were important local differences in the popularity of apps, with Gay Romeo, for example, being very close to Grindr in perceived popularity in Central and Eastern Europe<sup>6</sup>.

<sup>6</sup> Please see Appendix 4 for a detailed breakdown of popularity of online spaces by EU country.

Popularity of smartphone apps by region				
Ranking	#1	#2	#3	#4
Western Europe	Grindr	GayRomeo/Scruff	Gaydar/Scruff	Hornet
Central Europe	Grindr/GayRomeo	Grindr/Scruff/national websites	Gaydar/Scruff/Recon	Hornet
Eastern Europe	Grindr/GayRomeo	Grindr/Hornet	Gaydar	Scruff/national websites

## HIV prevention online – smartphone apps and websites

'My preference would be for a [push] message as a user, but I can see the point of view of someone who wanted to talk to someone that a profile would be better. Also, I think a lot of people may ignore the pop-up message, whereas [with] a message from a profile they'll go into [it] to see what it's about.'  
(MSM, aged 24, Malta)

When asked if respondents had undertaken HIV prevention work online, there was a large disparity between the work undertaken more generally online, and that which was carried out on apps.

	Online	On smartphone apps
Percentage of respondents who work in HIV prevention who had done so online or on smartphones	73% (n=81)	37% (n=42)

Focusing on the apps specifically, Grindr, GayRomeo, Scruff and Gaydar were the ones most often listed as being used for HIV prevention work. Of the work reported, the majority (60.4%) involved some form of advertising – either to promote a service, a campaign or health information.

What type of work was the intervention?		
Answer options	Response percentage	Response count
Advertising a campaign or information	28%	21
Advertising a service	35%	26
Recruiting to research	8%	6
Outreach via a worker profile	29%	22

## Advertising services, campaigns and recruiting to research: push messages and banner adverts

### Background

Advertising on smartphone apps uses the app's specific system for providing a type of direct message or banner to advertise to its users, or a wider integrated advertising model from a company like Google. Broadly, most of the advertising falls into two types; a form of direct messaging to app users, and a type of banner advertising on the app itself.

Direct messages, commonly called a 'push message', tend to function as a type of pop-up message when a user logs in to the app. These can usually be targeted with some degree of accuracy to a specific geographical location (usually based on a specific postcode and a chosen radial distance which determines to how many users it goes).

Banner adverts on the other hand are more similar to traditional graphical banners which are often displayed in 'free' versions of the app, usually taking the form of an animated GIF. The animated GIF needs to be created, which may require additional expertise to create over the simple text of a push message. Banners tend to be purchased via a number of impressions (every time they are displayed) in large quantities, and again can be tracked for the number of clicks.

## Survey respondents

Of the respondents who undertook advertising, the majority (60%) had done so via free support in kind from an app company, with 40% reported having paid the app to advertise.

### *Paid and free advertising*

Smartphone app	Number of respondents reporting paid advertising on apps	Number of respondents reporting free advertising on apps
Grindr	18	18
GayRomeo	6	7
Scruff	3	10
Gaydar	3	9
Scruff	1	10
Growlr	0	6
Hornet	0	7
Recon	0	3
Bender	0	2

Paid advertising activity was reported on five apps.

Free support from apps was seen from a wider number of apps (9), with the addition of some of the more niche or smaller apps.

### *Paid or free advertising: work types*

	Paid activity	Free activity
Advertising services or campaigns	42% (n=19)	57% (n=26)
Recruiting to research	20% (n=1)	80% (n=4)

In terms of the work types, the majority of all recruitment to research took place as free support from the apps. It isn't clear why research was more successful in getting this support in kind from app owners.

## Research

Some (7.5% of respondents) used apps to recruit to community surveys or other research. In the UK, Sigma Research at the London School of Hygiene and Tropical Medicine used several apps to recruit to the *Gay Men's Health and Sex Survey*, which received over 15,000 submissions.

The UK-based PROUD clinical trial into Pre-exposure prophylaxis (PrEP) was also proactively supported by HIV prevention organisations. They used a Grindr push message to contribute towards the required sign-ups of 500 MSM to the trial.

HIV Prevention England (HPE) uses push messages on Grindr to advertise a postal HIV testing service. A single push message (a direct pop-up message sent to users in a given geographical area) on a smartphone app, nationally, consistently generates more than 1,000 orders for HIV tests.

Other uses for push messages have included providing information on Post-exposure prophylaxis (PEP), sexually transmitted infection (STI) information following outbreaks of shigella and syphilis, the launch of new services, recruiting to PrEP clinical studies and referring men to HIV prevention campaigns.

## Outreach on smartphone apps

### *Background*

Online outreach, as differentiated from advertising, is the extension of traditional peer-based outreach from health promotion workers (traditionally carried out in bars, clubs and cruising grounds) in an online setting. Whereas advertising will tend to try and direct groups of MSM towards an activity, online outreach usually involves the use of a profile on the app to engage individual MSM in an intervention with a health promotion worker to provide tailored information and advice.

The development of online outreach began with the advent of the first MSM dating websites, and usually involved particular HIV organisations negotiating with each website to gain access and develop a service which was acceptable to both the website and to their customers. As with most MSM businesses, initial concerns from website owners often centred around a desire not to alienate their customers with invasive HIV prevention work. Effective community-based outreach work, which has a long history of tailoring its services to be culturally appropriate to a wide range of settings, has in most cases been able to provide services online which the majority of users find acceptable and useful, and has resulted in a number of long-standing relationships between HIV prevention organisations and MSM websites.

### **EU respondents**

About a third of activity reported by stakeholders was app-based outreach.

Currently, some apps don't officially permit organisations or community groups to undertake outreach activities. As such, this caused difficulties:

'We tend to play a game of cat and mouse with the moderators. We've had our work profile moderated many times, and blocked entirely a few times too. This was more of a concern before they introduced email-based profiles (as being blocked could effectively prevent the entire device from using the app), so we've been able to be more overt and explicit more recently.'

Despite these restrictions, many organisations have continued to work 'under the radar' on apps successfully, where they would otherwise be prevented from undertaking outreach.

### **Reaching out online**

Reaching out online (ROO) [2] was a research project conducted in the UK between the Terrence Higgins Trust and Sussex University. It aimed to get a better understanding of how online outreach could be used to meet the sexual health needs of MSM online.

Over 1 000 survey participants were asked a number of questions on what they thought of differing approaches to providing sexual health services on a website or app.

When asked to consider a range of ways of engaging with sexual health info, the ability to chat confidentially to a worker was the most popular option. Advertising, in the form of banners or push messages, was only viewed as a 'good' or 'great' idea by 84% of respondents. When asked how they would prefer to access health information, talking to a health promotion worker through smartphones apps and websites was more popular than through traditional outreach settings such as bars and saunas.

### **Stakeholder case studies of EU prevention using smartphone apps**

Stakeholders had undertaken a variety of innovative HIV prevention activities on smartphone apps, covering all areas of work, from outreach to advertising. A selection of small case studies are provided below to give examples of some of the challenges and benefits which stakeholders experience in attempting to utilise smartphone apps more readily in their work.

#### **Case study 1: France**

'We've used apps for outreach. We inform guys nearby that we're currently providing free HIV testing services in their area or that a support group is taking place in the following days. We also use them to provide counselling on sexual health and inform men of existing services in their area.'

We have a proactive position, contacting guys and not just waiting for them to contact us. We've never contacted an app owner. When our profile is deleted, we create another one. Nevertheless there should be a better partnership with app owners in order to have shared rules or even quality criteria in order to prevent just anybody or any organisation from providing sexual health services online.

When apps are used before or during an outreach activity, such as HIV testing, we can have a third more people coming to it and they're more likely to be at higher risk of HIV or sexually transmitted infections. App outreach requires time and regularity. I've noticed my fellow volunteers and I tend to give up after a few months when we've already contacted every profile once or twice. People get tired of it easily. It also requires financial means to invest in quality material and group training on counselling skills, how to use the technology, etc. A quality iPad or touchscreen mobile phone matters as the team is more likely to get bored if there are bugs or slowness.'

### **Case study 2: Croatia**

'Here [in Croatia] we've worked on the most popular apps. We have two main activities. The first is outreach through our profiles. We have a profile on both sites which we use to reach people. The profiles give some information about HIV and people contact us with questions. We don't contact others as that is against the rules. The profiles are not approved by the apps. Sometimes the profile gets deleted, so we need to adjust how much information we give to avoid deletion. For example, on [app name] we basically cannot have anything specific about HIV. The apps don't allow health promotion which can result in our profiles being banned and that limits our reach. Our second activity is advertising on the app. This includes banners and direct messages depending on the app. [App name] has given us free advertising space. We have paid [app name] for advertising.

The reach is good, about 70 people per month. This will translate to about 10% of the target population (MSM) reached per year. One of our targets is that people come for testing. Only 2% report they heard about testing on an app, but we think they are uncomfortable talking about apps with doctors so it doesn't get recorded on the questionnaire. During European HIV Testing Week we paid for advertising. We reached all users in our capital, Zagreb. It was rather expensive for our budget but 12% of all people who tested during European HIV Testing Week heard about it on an app. Other channels were more effective such as a local dating website where we have much more space to publish articles and communicate with people on forums. Advertising on apps gives reasonable results but is expensive. Invest in a good budget for promotion and creative materials (banners, images and text in ads) that will have impact. But more free advertising or discounts would help. If budget is limited, be creative and think outside the box.'

### **Case study 3: Spain**

'We've been using the [app name] and [app name] apps to answer questions about sexual health. We have a profile with information about this service that Stop Sida provides. Although we don't pay the app owners we paid them to make some changes to their apps to make our service more visible. There's also a very popular LGTB website which is working on a new app. Once it's working we'll be the referral point for questions about sexual health. We haven't received many questions this far. That's the reason why we thought of making some changes in the apps to make our profile and invitation to ask questions more visible. These changes are not finished yet.

We believe in peer education so we organised three months of training to have some prepared volunteers who are available for online counselling about sexual health. We also meet once a month to coordinate and support these volunteers. Training and supporting the people who are going to provide any service on the app is also important (it's a lonely activity, with not many chances to share experiences). And it requires knowing what health resources are available and where to refer individuals.

Outreach on apps is a great opportunity to be available for many people. It can be a great tool to promote sexual health.'

### **Case study 4: Serbia**

'We've used an app for two activities: outreach for HIV testing and outreach to people living with HIV in need of support. It was less effective than we anticipated in the sense that we had significantly fewer people responding to our outreach than we expected. We even got reported for spamming when trying to reach people and promote HIV testing. However, we find people working on this app to have an understanding for our work, and they even generously gave us a banner ad position on the website which did help.

Having lived as a gay man in Serbia, as a long-term activist and someone who uses apps for my personal life I have a hypothesis. In Serbia there's a lack of a thriving gay scene, lack of sexual education, a perception that there's a lot of stigma towards gay people and MSM (which might be higher than in reality) and very high self-stigma among MSM. Hence people tend to use apps for cruising, as 'alter ego' fantasy profiles. In that context their focus is significantly narrowed, and they tend to disregard or not even consider anything outside of that. This does not apply to all users. Also, combined with profile alter egos and on-line anonymity, the 'that can't happen to me' syndrome is amplified. So my advice with app outreach is: be persistent! Try to be individual with everyone and get people into a personal conversation in order to reach them. It may take more time, but it will be effective.'

### **Case study 5: England**

'We do most app-based outreach on eleven apps. Before starting this kind of outreach we find it important to become familiar with the app's culture, its users and their way of speaking. Before we create a profile we approach the app's owners first although this doesn't always enable us to work there. On some apps we simply have to work through loopholes in the profile guidelines; many apps don't allow words which describe a 'service' in a profile's headline, so we have to find creative ways to do this around these restrictions. We must be clear that our presence is not advertising; we don't pay the apps.

On app outreach we reach over a hundred men each month. We've also shifted from a passive outreach model (waiting to be contacted) to an active one. However, this was built on a number of years' presence on the app – we wanted to do this carefully so more invasive outreach wouldn't alienate the app users, and so far this has worked well.



Our aim is to supply advice, information and support around any issue that they may have in relation to sexual health. When appropriate we encourage the client to access our office-based services (for a rapid test, STI screen or face-to-face chat) about any topic that needs a more in-depth discussion.'

## Obstacles and solutions to using smartphone apps for prevention

### Financial

Participants were asked what they considered to be the biggest obstacles they faced in conducting HIV prevention on smartphone apps. Financial limitations were said to be the main barriers to conducting HIV prevention work on smartphone apps with 'lack of funding to carry out online prevention work' and 'cost of advertising' being rated the largest barriers. Notably, only 12 participant organisations reported undertaking prevention work via paid advertising.

A number of stakeholders detailed the issues they have with funding bodies, who may not recognise the validity of online or app work. In one example, a funding body required that condoms and lube be distributed physically, even though there were no local MSM venues in which to distribute them. Online work was not permitted, even though this was where the majority of MSM could be found, and it was felt that this could be achieved using smartphone apps.

In other examples, a local commissioner was happy to provide funding for more traditional services – even if the prevention organisation felt that their efforts and resources would be better used reaching MSM in more popular online settings.

### Support

As referred to in the previous case studies, 'a lack of support by app owners' is considered an obstacle and this includes policies which form an impediment to conducting outreach on the apps. Whereas MSM websites often allow forms of community outreach to take place by HIV organisations, some smartphone applications have restrictions against any type of community organisation profile. This has often created a difficult situation where stakeholder organisations conduct outreach on smartphone applications without the company's consent. This may lead to organisations having their unofficial profiles moderated or blocked.

Moderators and rules within the apps have posed challenges in the UK:

'Moderators will block our profile if they think we have broken the app's rules (which in our experience aren't clear or consistently applied). We always send a new profile to the app to make sure the picture and headline are OK instead of them deleting our profile later (then we lose important information like our message history). Some apps don't allow words such as 'sex' or 'sexual' on our profile. Our work is also restricted by the limitations that come with the basic functionality of all apps. Also, we are riding on the back of someone else's website and there may be an uncomfortable 'fit' with what they are and what we want to do. Our work would be easier if there was a clear dialogue between health promoters and the app owners about what we can and cannot do.'

One stakeholder from Sweden also talked about issues with app management when they wanted to do more than purchase advertising:

'We tried to collaborate with a specific app but their interest was in us buying ads, which we do but that means we don't reach premium users. The app doesn't want "fake profiles" and wants to give their users an "authentic experience"'. (Stockholm, Sweden)

Many stakeholders noted they may have had more successful relationships and support from smaller, or more localised websites or apps rather than with (or even contacting) the international apps based outside of Europe.

### Knowledge

Knowledge to undertake effective online outreach on apps was also felt to be an issue for many of the respondents, with 65% feeling that the knowledge or skills required to undertake online outreach apps was either a medium or large barrier to them undertaking this work.

As the UK's *Reaching out online* report [2] highlighted, successful online outreach on apps requires:

- cultural competency in understanding the ways in which MSM use particular apps
- digital competency in using the apps and in translating effective communication skills into an online setting.

## Looking forward

How important do you think smartphone applications could be to the future of your organisation's HIV prevention work?

1. Not important	2.	3.	4.	5. Extremely important	Weighted average
0	1.85% (2)	15.74% (17)	28.70% (31)	52.78% (57)	4.43

The vast majority of respondent stakeholders felt that smartphone apps could be very important to the future of their organisation's HIV prevention work, and this was backed up by a wide range of comments which demonstrated a huge amount of enthusiasm, with a particular focus on the many potential positive outcomes from working on smartphone apps.

'This channel would be beneficial to promote services for MSM from rural areas of the country where stigma is high and MSM prefer not to disclose their sexuality and don't visit MSM venues.' (Estonia)

'Smartphone apps will be an important tool for our work in different areas, not only health, because of their benefits. In fact, we are planning to work with apps in the area of violence/hate crimes. Probably, our work on health will someday go in that way.' (Portugal)

'Smartphone applications have a much greater reach than any organisation in Ireland.' (Ireland)

'As new generations emerge on the gay scene, we have to adapt prevention to their world.' (Antwerp, Belgium)

When asked how useful the following kinds of support from app owners would be in taking this aim forward in their work:

- support for outreach on apps
- HIV prevention/services integrated into the app
- free/lower-cost advertising
- at least 70% of respondents agreed that each of these would be useful.

**On a scale of one to five (with one being 'not useful' and five being 'extremely useful') how useful would the following types of support from the smartphone apps themselves be to your organisation?**

Response	1 (not useful)	2	3	4	5 (extremely useful)	Average	Count
Support for online outreach	2.48% (3)	7.44% (9)	18.18% (22)	29.75% (36)	42.15% (51)	4.02	121
HIV prevention/services information integrated into the app	0.83% (1)	4.13% (5)	15.70% (19)	24.79% (30)	54.55% (66)	4.28	121
Free/lower-cost advertising	0.83% (1)	3.31% (4)	15.70% (19)	28.10% (34)	52.07% (63)	4.27	121

In February 2015, ECDC, in collaboration with THT, hosted an expert meeting with key stakeholders who are involved in HIV prevention work with MSM in the EU/EEA countries<sup>7</sup>. The expert meeting highlighted several key points:

- the need for a coordinated approach to collaboration with app owners (to avoid numerous, conflicting or difficult to validate requests from organisations across the EU)
- the need for a clear approach to using apps for sex and drug-related health promotion and prevention work
- the need to evaluate the effectiveness of ads and provision of information through apps.

Recent work by the American Centers for Disease Control and Prevention (CDC), the San Francisco AIDS Foundation, and the American Foundation for AIDS Research (amfAR) successfully engaged both smartphone app owners in the US and stakeholders alike. As such, aligning this EU workstream undertaken by ECDC with the US equivalent is a key priority.

<sup>7</sup> ECDC workshop. Understanding the impact of smartphone applications on the sexual health of men who have sex with men and HIV prevention in Europe. Stockholm, 4–5 February 2015. See: [http://ecdc.europa.eu/en/press/events/layouts/forms/Event\\_DispForm.aspx?List=a8926334-8425-4aae-be6a-70f89f9d563c&ID=302](http://ecdc.europa.eu/en/press/events/layouts/forms/Event_DispForm.aspx?List=a8926334-8425-4aae-be6a-70f89f9d563c&ID=302)

## Hypotheses

The research carried out to date has been unable to either quantify the impact of smartphone apps on the sexual health of MSM or to show causal links. Seven hypotheses were used to explore the perceived impact of smartphone apps on the sexual health and sex lives of MSM via the stakeholder survey, and in-depth key informant interviews with ten MSM from across the EU.

The results presented below are not intended to prove or disprove the hypothesis, but rather to provide more discussion around these issues which might be used as a starting point for future research, or for consideration by stakeholders.

### Hypothesis 1: 'I believe that smartphone applications have increased partner numbers and frequency of partner change among MSM.'

#### Background

Increased partner numbers and concurrency have long been associated with an increased risk of HIV and other sexually transmitted infection (STI) transmission. One of the principal concerns around smartphone applications for MSM, for those working in HIV prevention, is that the ease of access afforded by the technology is increasing the number and concurrency of sexual partners in MSM.<sup>8</sup>

#### Stakeholders

The majority of participants (65.6%) in all regions agreed or strongly agreed with this hypothesis. A large percentage (29.6%) were unsure and only 4.8% disagreed.

**Please indicate your agreement with the following statement: 'I believe that smartphone applications have increased partner numbers and frequency of partner change among MSM.'**

Answer options	Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Rating average	Response count
	0 (0)	4.80% (6)	29.60% (37)	38.40% (48)	27.20% (34)	3.88	125

Notably, a larger percentage of participants from Western European countries agreed, when compared with both Central and Eastern Europe respectively.

	Western Europe	Central Europe	Eastern Europe
Agree or strongly agree	68.37%	56.52%	44%

In interviews, while stakeholders felt this hypothesis was difficult to prove with hard evidence, some thought that apps provided the perfect tools and opportunities for MSM to increase their number of sexual partners (should they wish):

'I mean, there have always been ways for gay men to have higher partner numbers, like saunas or cruising grounds, but I think the difference with the apps is just how popular they are. I think that a far greater proportion of gay men use apps regularly than ever used saunas or cruising grounds, even at their peak [of popularity].' (Brighton, UK)

At the expert meeting, stakeholders also raised the importance of not phrasing this hypothesis in moral terms, and also felt that anecdotal evidence supported the self-selection theory, that apps were simply being used by MSM with a preference for higher number of partners. However, the lack of real evidence here meant this discussion remained broadly theoretical.

<sup>8</sup> See the literature review in Appendix 1, 'accentuation theory'

## MSM key informants

In interviews with MSM across Europe, the relationship between apps and increased partner numbers was felt to be complex. As a starting point, the view that apps increased men's frequency of access to MSM spaces was widely held:

'I probably checked [app name] in the morning, when I woke up, along with all the other social media. I check my app messages like I check my Facebook or Twitter or texts. So maybe ten times or more [a day]. In the evening I might actually sit on it and proactively talk to people.' (Aged 24, UK)

His MSM app usage had become intertwined with his other social media interactions, which his smartphone facilitated several times per day.

The majority of participants also noted the sexual nature of popular apps.

'Everyone is there for sex – people don't actually make friends I think? Because you say: "I'm only looking for friends". And then people only ever talk to the ones they fancy.' (Aged 24, UK)

A 35-year-old from the UK said: 'Certainly I've had more partner numbers since having the apps.' He went on to describe why he thought this was the case:

'You don't have to rely on being at home – it's much easier to arrange off-the-cuff meetings. Opportunities tend to present themselves easier. You can send someone a message while having lunch with a friend and arrange something without having to go back [home].'

For other men, the geospatial elements in the technology made it easier to meet partners too:

'Basically, the distance feature means you tend to talk to people who are closer to you geographically, and that tends to work because it's convenient. Because of that it's much easier to meet up for a drink or for casual sex.' (Aged 39, Spain)

However, some of the participants, particularly the younger MSM, noted that despite spending significant amounts of time on apps, it didn't necessarily lead to new sexual partners:

'I had [app name] for years and years and I would use it all the time – like every time I would go to a new area I would be like: "Oh let's see who the gays are around here". But like I said, it was unsuccessful. I think maybe I went on one or two dates, and I don't even think I slept with them.' (Aged 24, UK)

For those who had clear views about not being interested in casual sex, their actual usage of apps had stayed within these boundaries, despite the increased access and often sexual nature of other men's app usage.

## Conclusions

Both the MSM participants and stakeholders seemed to agree with the fact that smartphone apps afforded more frequent and easier access to MSM spaces, and that usage of the most popular apps tended to focus on casual sex. However, the participants supported both the conflicting accentuation and self-selection theories when it came to the question of increasing partner numbers.

Age and generational differences may influence men's uses of apps, particularly for casual sex. A better understanding of app usage by different age groups may provide a more nuanced understanding of the use and impact of apps on sexual partners: comparing younger digital 'natives' (who may have grown up with social media) to older 'digital migrants' (who have moved online to websites, then apps, during their sexual lives).

Given their widespread use, a better understanding of how these norms are interpreted, resisted or appropriated by the different generations of men who use them, will be important in understanding the current and future challenges to sexual health for MSM internationally.

## Hypothesis 2: 'I believe that smartphone applications provide new opportunities for MSM to communicate, meet and form non-sexual connections.'

### Background

Communication technologies have always had a particularly significant role for MSM in facilitating the meeting not only of sexual partners, but also friends and the formation of communities of interest or identity. Peer groups and social links have also proven to be powerful tools in HIV prevention over the last 30 years. As such, this hypothesis aimed to explore the perception of the role that smartphone apps may play in facilitating non-sexual networks amongst MSM.

### Stakeholders

Most stakeholders across Europe agreed that apps did offer new opportunities for MSM to form non-sexual social, or other social connections.

**Please indicate your agreement with the following statement: 'I believe that smartphone applications provide new opportunities for MSM to communicate, meet and form non-sexual connections.'**

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Rating average	Response count
0 (0)	3.97% (5)	18.25% (23)	50.00% (63)	27.78% (35)	4.02	126

Respondents from countries in Central and Eastern Europe were most likely to agree, with over 90% agreeing and no disagreement. The greater proportion of uncertainty or disagreement with the statement came from countries in the West region.

**Please indicate your agreement with the following statement: 'I believe that smartphone applications provide new opportunities for MSM to communicate, meet and form non-sexual connections.'**

	Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Rating average	Count
West	0% (0)	5.00% (5)	20.00% (20)	44.00% (44)	31.00% (31)	4.01	100
Central	0% (0)	0% (0)	9.09% (2)	77.27% (17)	13.64% (3)	4.05	22
East	0% (0)	0.00% (0)	11.11% (1)	66.67% (6)	22.22% (2)	4.11	9

As one stakeholder noted:

'Ireland has a large rural community which can now engage in support and socialising. Before smartphones, people were unwilling to use the internet at home in case family members discovered the sites they were accessing.'

However, some tension arose between the potential or theoretical opportunities presented by apps to form non-sexual relationships and the more practical 'reality' of the way in which some stakeholders felt they were currently being used:

'Although they do create more opportunities for meeting up, I believe their main use is for sexual encounters. It would be good if it could be better promoted for friendship, etc.' (UK)

However, one stakeholder noted that the primary focus of sex when using apps can still lead to non-sexual connections:

'Many MSM seek longer-term relationships via sexual encounter forums as these are viewed as a pathway to meet other like-minded individuals for friendship and relationships.' (UK)

A stakeholder from Berlin commented on what he felt was increased antisocial or negative behaviour on the apps – particularly focusing on brief statements on men's profiles which may be racist, misogynistic or rude towards demographics which they weren't sexually interested in. It was felt that the overly visual nature of apps and the subsequent process of picking or blocking profiles (and the ease which this could be done), led to an environment which was less suited to forming friendships. Many of these tensions and concerns were also expressed by MSM themselves in the interviews.

## MSM key informants

An interesting discussion for the interview participants arose around the differing uses of smartphone apps and how the pursuit of casual sex fit alongside other social aims (such as forming friendships).

'[App name] is all about the images. You choose someone based on images – the same as [app name], the same as [app name] with something like Twitter, you might start reading someone's tweets without even knowing what they look like.' (Aged 24, UK)

For this respondent, the image-focused nature of most apps meant that they weren't conducive to forming social connections that weren't sexual, and this was apparent in a comparison to other types of social media which prioritised text above images. For other men, the brief and direct nature of communication on apps also compounded the issue:

'Chats are always the same sort of thing – short and direct – unless you were trying to arrange a date with someone, then it would be a longer type of chat.' (Aged 24, UK)

For another man, the brief communication on smartphone apps, and their focus on image and the relationship to casual sex were connected to larger cultural norms and again cast in a somewhat negative social light:

'One thing, we're talking about sex and hook-ups, we are men and we need it and it is all fine. And maybe this has something to do with our Western culture, but sex tends to be, in my eyes, like a consumer good – which means that we are forgetting, either consciously or unconsciously, the respective person behind it.' (Aged 41, Estonia)

This viewpoint was echoed by some older participants and matched with a sense of nostalgia about the ways in which MSM would have socialised before digital platforms:

'I'm sad in a way, I remember a much better time before the internet. I mean, gays are known for promiscuity and for having sex, random sex. I'm not saying that this did not happen before, but there was a time and a place to do it. People went out, they socialised. You might meet someone, buy them a drink, eventually they end up in bed. There was a process. These days you look at the profile, send them your pics of your endowment and what have you, and bla bla bla, let's meet. That's it.' (Aged 46, Malta)

For other men who used apps extensively, they still reflected on the social limitations of the technology compared to physical settings:

'Meeting them in real life is more important. Meeting guys in the bars is a lot better than the apps. When you're face to face to someone you can really talk. When you're on an app you send a message and hope something will come back, and sometimes you will have to wait 2 to 3 hours and will stop in the middle of a conversation, and that's not OK. You can't do that in real life. It's politeness.' (Aged 21, Netherlands)

However, even for the majority of participants who felt that apps did not readily offer non-sexual social connections, most were able to recall a positive social connection they had made through the apps, and in many cases it an important, lasting impact:

'How did I make friends? Actually this brings apps into it. The biggest revolution in terms of making friends was a boy I met on an app in Rome. Six months later he moved to London. He already knew a load of people and we all went out and then I made loads of friends. It was very rare, but it did come from an app.'

## Conclusions

Stakeholders felt that smartphone applications offer unprecedented opportunities for men to form social connections, particularly in areas without substantial gay infrastructure. Men may form important friendships or relationships through smartphone apps, but these are perceived as being the 'exception, rather than the norm. Peer support, social connections and community have long been important tools in fighting health inequalities for MSM. The role which smartphone apps can play remain an important consideration within sexual health.

## Hypothesis 3: 'I believe that the short nature of conversations on smartphone applications can have an impact on successful negotiation of sex or sexual health practices.'

### Background

The shift to using more smartphone apps resulted in the principle input method for text shifting from the keyboards used for desktop PCs and laptops, to smartphone touch screens. As such, typing longer messages became more laborious. Also, the nature of instant chat-style messaging, compared to a traditional email-style message, tends to be shorter, as the components of the full message can be broken into individual components. As such, this hypothesis attempted to explore what impact this technical shift in communication may have had on platforms used by MSM for sourcing partners.

The majority of participants (58%) agreed with the statement, with 28% being unsure.

Please indicate your agreement with the following statement: 'I believe that the short nature of conversations on smartphone applications can have an impact on successful negotiation of sex or sexual health practices.'

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Rating average	Count
0.79% (1)	11.90% (15)	28.57% (36)	43.65% (55)	15.08% (19)	3.60	126

The idea that apps can help to facilitate successful negotiation of sexual health practices was put forward by a number of stakeholders:

'It can be highly effective too in negotiating sexual health practices, profile information such as HIV status, condom use, safer sex practices, etc. It can act as a base level negotiation of sex without having to have an awkward conversation when drunk or high back at someone's at 4 a.m.' (UK)

Generally it was felt that the ability to include sexual health information briefly within profiles, or via the anonymity of the net, made it easier to have, what could otherwise be awkward conversations. Some stakeholders commented on the fact that:

'The "shorthand" tends to develop codes, which may promote clearer communication – but it may also cause ambiguity and confusion, but it will definitely impact the negotiation.' (UK)

The brief nature of communication via apps was considered to have some impact, but stakeholders could not agree on whether the impact of this would be positive or negative for the individual.

### MSM key informants

Nearly all participants noted that communication on apps felt briefer or were shorter than on websites. The main reasons expressed for this were based around the physicality of using a smartphone:

'I suppose it is a little more cumbersome when you do it on the phone, because you have those small keypads, so it's not as comfortable as using a keyboard on a desktop computer.' (Aged 42, Estonia)

In a number of instances, this led participants to express a preference for non-mobile platforms, where communication was more involved:

'I prefer it on laptop because it's more convenient to type. I don't have a problem responding to people on mobile phone, but if someone writes me like an A4 letter, it's like I don't want to write it on my mobile, I'll wait till I can get home on my laptop and respond to him.' (Aged 24, Slovakia)

For others, the immediacy of apps lent itself to briefer conversations:

'With [app name] and [app name], because you can see who's online, that expectation of getting a message back in a shorter time frame is higher.' (Aged 35, UK)

The impact of this brief style of messaging was interwoven with the pursuit of casual sex on smartphone apps. In terms of how this specifically impacts on successful negotiation of sex and sexual health, interview participants offered a mixed account. For some men, negotiations around sexual health did not feature at all:

'Never, I've never heard of [sexual health coming up in conversation] once. Well I always wear condoms. I've had guys turn up and assume something different. When I turn up and I say I'm wearing it [condoms] that's the end of it.' (Aged 24, Malta)

However, a number of participants agreed with some of the stakeholders that the abrupt and to-the-point nature of information exchange on apps made it easier to make informed choices about partner selection:

'If it's just a one night stand and someone has on their profile, "safer sex: never", then it's goodbye! Really for me if their stance is: "safer sex: never", I won't have anything to do with them or just not have anal.' (Aged 28, Romania)

For one participant, discussions around safer sex were easier on apps than they were on websites:

'I definitely feel that with the apps, the whole safer sex thing and barebacking comes up more in conversation. With the websites, which tended to be longer conversations, it would always be a bit odd how you'd bring that up. With the apps, as it's much more conversational, you start off with a bit of banter, move to what you're into, condom usage, drugs, etc. It flows a lot quicker.' (Aged 35, UK)

For him, discussions around safer sex fit more easily with the briefer, more sex-based conversations on apps than with the longer, more general and extended conversations which may take place via websites.

A similar observation was made by another participant, who noted that on apps:

'With time I notice that more and more people put their HIV status on their profiles, they put they're positive or negative and the date of their last test, and increasingly there are more people who are putting they're on PrEP.' (Aged 39, Spain)

Other respondents were also able to recount positive experiences, where disclosure online had led to more informed and positive sexual experiences:

'I met a guy online and he confessed that he's got HIV, but we clicked, and had sex and protected ourselves. Everything was fine actually. I think maybe being online made it easier for him to have that conversation.' (Aged 42, Estonia)

## Conclusions

Both stakeholders and MSM noted that the brief nature of conversation on apps did have an impact, both positive and negative, on successful negotiation of sex or sexual health practices. Discussion of sexual health (including condom use, testing history and STI status), which is a positive factor for MSM's sexual health, was in some cases facilitated by the brief communication on apps. However, a better understanding of how these negotiations directly relate to sexual practice would be beneficial.

The importance of undiagnosed and acute HIV infection in the ongoing transmission of HIV among MSM is widely accepted. The role of disclosure and negotiation can be seen to be problematic in this context, if the men who are most infectious are unaware of their status. A greater understanding of how men practically use negotiation, profile information and discussion around safer sex to actively inform their own harm-reduction strategies, would be useful before making recommendations on how these can be best incorporated or their usage encouraged on apps.

## Hypothesis 4: 'I believe that smartphone applications facilitate the mixing of sexual networks which may have previously been separated by age, identity or sexual practices.'

### Background

Historically, MSM sexual networks were based around specific communities, sexual interests, demographics or spaces they use to meet (bars, clubs, saunas, online spaces). Smartphone apps have restructured the way in which most might find each other. While apps have added in search criteria based on demographics or community, the default of most MSM smartphone apps is to filter men based on proximity. Ironically, this shift back to the most basic of criteria, location, may bring together local sexual networks of interest which may have otherwise be separated, and this formed the basis of this hypothesis.

The majority of stakeholders (over 60%) agreed with this hypothesis with an additional 24% being unsure.

<b>'I believe that smartphone applications facilitate the mixing of sexual networks which may have previously been separated by age, identity, or sexual practices.'</b>						
Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Rating average	Count
0.79% (1)	13.49% (17)	24.60% (31)	46.03% (58)	15.08% (19)	3.61	126



For one stakeholder, the mixing of sexual networks was nothing new:

'I cannot see a relationship. There will always be that "mixing". I never believed in the tightness knot around ages, identity, or sexual practices.' (Portugal)

For another, the internet had already facilitated the mixing of these networks, with apps offering no significant change:

'Already the web communities have had that potential to change sexual networks, so not sure why apps would make much difference when it comes to mixing.' (Greece)

Another went further, as they theorised that smartphone apps would keep sexual networks separate:

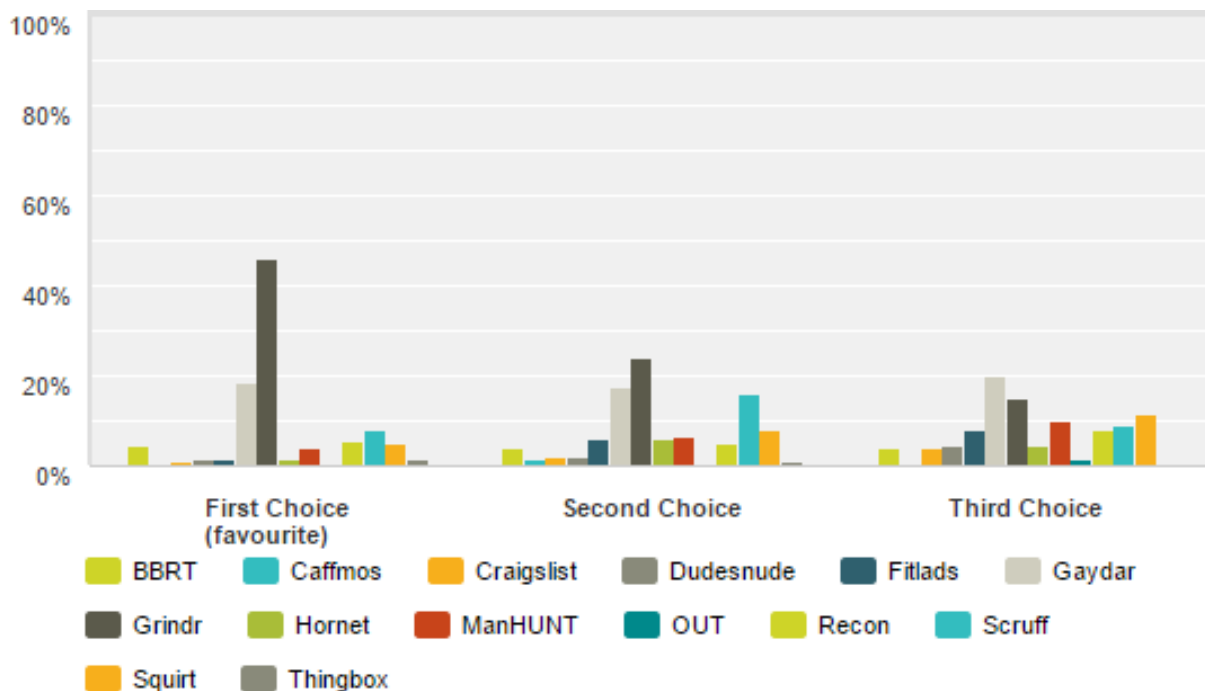
'Maybe for some it is, but I also think that the characteristics shown in the profile can be a barrier for this mixing.' (Belgium)

Functionality of the apps to filter and define interests and sub-groups allowed for more targeted selection. Similarly the availability of different apps was also felt to keep networks separate:

'I think MSM use the applications which they feel best meet their requirements, using different ones depending on their mood at the time of use.' (UK)

However, data from the UK study *Reaching out online* (ROO) [2] showed that despite a wide number of apps and websites being available, there were clear preferences for certain apps (such as Grindr), with large disparities in popularity between the market leaders, and the competition, as can be seen in the below graph.

**Figure 2. Websites and apps: differences in popularity between the market leaders and the competition**



Source: *Reaching Out Online* [2]

Among the app-only platforms, there was more diversity in popularity than with the websites. Notably, the next popular online platforms behind the main market leaders tended to be niche or catered towards specific communities of interest. The popularity of these apps does initially seem to support the idea that specific sexual networks of interest may remain separate online. However, the ROO data showed that most MSM use more than one platform.

Looking at those whose first choice is a special interest platform such as BBRT (HIV+/UAI) and Recon (fetish), Grindr is the most popular second choice for both groups. Grindr is not just the most popular online network, but also features as the overarching network shared with other sexual networks of interest.

Very different sexual networks may occupy shared online spaces through the dominance and popularity of smartphone applications.

However, occupying the same space is not the same as sexual networks actually mixing, as one stakeholder noted:

'Whilst apps can expose users to a wider variety of ages, special interest groups and practices, I feel that users tend, nevertheless, to stay with the networks they identify with.' (UK)

The effect of smartphone apps on the mixing of sexual networks has not been determined. This was also echoed in the expert meeting, where no consensus on the issue was reached. It was felt that local context was vital here in determining the impact of apps on sexual and would benefit from future research.

## MSM key informants

For some participants, the dominance of a certain app in an area provided a melting pot for the different sexual networks:

'All the different sub genres are closer to each other than they used to be. Previously you'd go to a specific sub-genre website, whereas now everyone uses Grindr – so the rubber people, the twinkies, everyone.' (Aged 35, UK)

Many participants commented on being approached by, or aware of, men who had different preferences sexually and how they used the app:

'You send a picture of yourself, then you get a whole influx of pics, you know with erect penises, fetishes and... Let's not go there. That's an instant turn off.' (Aged 42, Malta)

'In terms of what's been offered me, which isn't to say I accepted it, I've certainly been offered far more, from being shit on, to wanting to be fisted. Obviously I knew those practices were out there, and it doesn't bother me, but no one ever came up to me and said that, because I wasn't in a fisting club.' (Aged 35, UK)

For most participants, this was a simple case of rejecting or ignoring such offers, and many participants suggested easy strategies they had for these situations:

'I chat with everybody, and if it goes in the direction that they want to see my naked pictures, then I just say no – somebody was inviting me immediately to the hotel, and I say not with me actually, and just laugh.' (Aged 24, Slovakia)

However, some participants suggested that coming into contact with apps may change their own behaviour or expectations over time:

'When you were first on there, and some old guy sent you a picture of his arsehole, you were like: "Aghhhhh". But you get used to it, and now it's like: "Meh, close, next". The worst experience is the constant searching and the sense of shallowness you just get from the app itself. The problem with the app is they promote having more guys and even gravitating towards it. I mean, I get to the point when I think: "I'm not that shallow, why am I there?"' (Aged 24, UK)

'It's way too easy to set up no-strings-attached sex dates, you do end up getting a bit more shallow unless you check yourself.' (Aged 28, Romania)

Despite these challenges and potential clashes, most men commented favourably on this greater mixing of different networks when asked to reflect upon it:

'Yeah apps have had a positive effect on my sex life, because it helps. It opens you up to meeting or seeing more people, more potential. Even if I hadn't had any sex, I've had more potential.' (Aged 24, UK)

## Conclusions

Smartphone applications, through their popular adoption, increased ease of access, use of GPS technology and suitability for facilitating casual sex, seem to set the stage for a change in the mixing of sexual networks. MSM may have very different ideas about what they want from apps and how they intend to use them. However, the default criteria for how men locate other men (based on immediate location, the 'load it up and see who's around' factor) differs from previous web-based platforms. Given the wide range, and often conflicting uses and aims, of MSM smartphone apps, a better understanding of how men negotiate different networks which they encounter, would be beneficial. Again, it would be particularly useful to look at different sub groups or communities. In particular, understanding how norms are established and maintained within particular apps and how users, who may have different aims or are part of different networks, either change based upon this exposure or maintain resilience.

A better understanding of the practical mapping of sexual networks, and their relationship to virtual and physical spaces, would be instrumental in understanding the chains of transmission for STIs and how prevention interventions could interrupt these pathways or exploit them to reduce the burden of undiagnosed infections.

## Hypothesis 5: 'I believe smartphone applications facilitate the organisation of private sex parties involving recreational drug use.'

### Background

Within some areas of the EU, recreational drug use by certain MSM has recently caused increasing concern because of shifting patterns in terms of the types and context in which drug use takes place. There is a rise in popularity of newer substances, such as mephedrone and GHB/GBL, alongside methamphetamine. These are used in private home settings in connection with group sex sessions for extended periods of time. In some areas, this specific relationship has been coined 'chemsex'. STI concerns centre around the increased duration of sex, increased number of sexual partners, compounded by lowered inhibitions and possibly poorer judgement. Subsequent concerns also focus on the significant impact of sustained drug use on mental health, and wider wellbeing indicators.

It has been observed that users are using smartphone apps to source people for the group sex events. As such, some question if smartphone apps are an enabling factor this activity.

Over 60% of participants agreed with the statement that apps 'facilitate the organisation of private sex parties involving recreational drug use.' But there was also a large proportion (34%) who were unsure.

'I believe smartphone applications facilitate the organisation of private sex parties involving recreational drug use.'						
Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Rating average	Response count
0% (0)	4.76% (6)	34.13% (43)	39.68% (50)	21.43% (27)	3.78	126

While there are many commonalities for the MSM community internationally (of which smartphone apps are one), previous data from The Chemsex Study [10] has shown that patterns of recreational drug use can vary hugely. This is not only within countries but even within different areas of large cities themselves.

This influenced the responses on the relation of smartphone applications to recreational drug use, where stakeholders' views on this issue varied greatly in the different regions of Europe. Participants from Eastern Europe were least likely to agree with the statement at 22.22%. Participants from Western Europe were most like to agree with 66% agreeing with the statement.

'I believe smartphone applications facilitate the organisation of private sex parties involving recreational drug use.'						
	Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Weighted average
Eastern Europe	0.00% (0)	22.22% (2)	55.56% (5)	22.22% (2)	0.00% (0)	3.00
Central Europe	0.00% (0)	9.09% (2)	50.00% (11)	18.18% (4)	22.73% (5)	3.55
Western Europe	0.00% (0)	4.00% (4)	30.00% (30)	44.00% (44)	22.00% (22)	3.84

For a number of stakeholders, apps were simply an extension of existing web-based platforms as a tool to facilitate any type of sex party:

'I do not think this is the effect of smartphone apps. Such parties are usually advertised via pre-existing online services and communication via mobile phones.' (Belgrade, Serbia)

However for another stakeholder, even though they acknowledge some similarities, they also highlighted some potential differences which apps may bring to the situation:

'Even if this activity happens on apps, it has been organised in a similar way via web communities also. This is just a new, and maybe quicker, arena for such activities.' (Stockholm, Sweden)

For other stakeholders, anecdotally they had not observed any change in frequency in their area of Europe:

'These have always existed in high numbers and frequency. They don't seem to be increased or decreased in our area.' (Limerick, Ireland)

However, for other stakeholders, the use of apps in relation to private sex parties involving recreational drugs was something which they could strongly relate to from their work experience with MSM:

'We hear more and more about that.' (Liege, Belgium)

'The growth in chemsex parties and ease with which to contact others anonymously to organise them is evident from MSM feedback.' (Woking, UK)

The geographical relationship between smartphone applications and recreational drugs was again apparent, even in the differing uses of language used to describe the activity on a local basis.

In the Chemsex Study [10], which looked at recreational drug use within specific boroughs of London in the UK, the researchers noted an association between smartphone apps and recreational drug use, stating:

'For those we interviewed, smartphone apps were often a first-port-of call for men seeking sex, drugs or chemsex away from the commercial gay scene. In addition to their use for meeting a single partner (for chemsex or just sex) the smartphone apps were also a primary means of organising and advertising sex parties.'

Other stakeholders expanded on this relationship between smartphone apps and recreational drugs and reported that there was clear differences between particular subgroups within their local MSM population:

'From interviews conducted about shigella [a bacterial infection passed on sexually], this was true for HIV positive MSM using BarebackRT, but not for HIV-negative men using other apps.' (London, UK) [11]

The expert meeting covered more general information about recreational drug use and MSM, including regional information and associations, which can be found in Appendix 2.

## MSM key informants

Similar regional differences were seen in the interviews with MSM as in the stakeholder survey. Many users recounted that they had been approached for a wide variety of types of sex, many of these participants had never been approached or seen any reference to recreational drug use online:

'Online I can't say, I really don't know if I've seen any drugs for gay men. No, I haven't seen any of that.' (Aged 42, Estonia)

'I haven't come upon it online, but I have seen it in the club, and I have dated a couple of pot heads. But online I haven't seen discussion of it, but to be honest I haven't searched for it either. I think I've seen one that was advertising bareback parties and I was curious about that, and it had some reference to drug use too, but that's the only one I randomly found.' (Aged 28, Romania)

However, for other participants, (mostly from large cities in Western Europe), it was something they had encountered:

'In Spanish there are code words, like slang words for having drugs. These kind of people tend to be very direct, so when you talk about what you're into the first thing they ask if you have anything; drugs available. Then people also use the English term in Spanish, 'chem friendly'. I'd say like 20% of the people put it in their profiles on the apps.' (Aged 39, Spain)

'Yeah I've seen the guys on there, who try and put [drug usage] on the apps in a clever way. Like they will say that they're a drug dealer, or they want to have sex on drugs, but they'll use the lingo, or whatever it is.' (Aged 24, UK)

'It's definitely out there and quite prominent. People are very happy to advertise chemsex parties or being on chems, and they're quite open about saying that.' (Aged 35, UK)

For participants who had seen references to recreational drug, the experience seemed to be a fairly frequent occurrence in their area, and they all commented on the use of code words or slang to circumnavigate the moderation on apps, which may otherwise block drug references.

For a 24-year-old from the UK, this was simply part of the background wallpaper of other activities which he had seen on smartphone apps, but which he had not taken part in himself. For a 35-year-old, however, who had occasionally taken part in sex parties involving recreational drugs, he described a more complex situation:

'I definitely think [apps are] a key thing. Whether it's a sex or chemparty, you do see lots of guys sat around on their phones trying to find who's about, rather than necessarily engaging with people in the room. It's so much easier now than it was before the apps. Even with websites you could invite people, but before it was like you were in the club and decided who was going to go home, so it was fairly set. Whereas the apps enable a constant flow, which keep the party going for longer, because you've got constant access to people who are out there.'

For the 24-year-old, the online component added an element of opportunism and spontaneity to the setting, while the convenience and ease of access to apps lends itself better to the party situation. Multiple men can be looking for new guys on their smartphones whereas, with the previous platforms, all the men present would not have bought their own laptops for this purpose.

As the 35-year-old noted though, the use of smartphone apps in these settings is not just down to the efficiency. He recalls men sitting around at a sex party, high and ignoring each other because they are focusing on their smartphones:

'Partly when you're high, you can fixate on things and go on tangents. So partly with Grindr, it's like: "Next [profile], next, next." So you fixate on that and it's quite simple to digest, with what a high mind can keep occupied. And you might find someone fit to talk to, but the likelihood is they're just as fucked at another chill out and as reluctant to move as you are.'

A better understanding of the relationship between smartphone apps and the specific activity of men who use them while attending sex parties involving recreational drugs would be useful.

## Conclusions

Gay men have always been disproportionately impacted by higher rates of alcohol and recreational drug use, but recent shifts in both the types of drugs being used, the setting, and the technology utilised all have the potential for changing the harms and impacts of drug use on their health.

While app use may be popular and widespread across Europe among MSM, its relationship to drug use may be entirely dependent on other factors. These include the availability and usage of drugs, the size of the local MSM population and potential other issues around availability of gay infrastructure. As such, the relationship between drug use and smartphone apps appears to vary widely based on location across Europe.

Where it is an issue, a better understanding of why smartphone app use fits so well within the setting of sex parties using recreational drugs would be useful, especially for any services which may be supporting MSM in harm reduction or abstinence with their drug use. These issues are already being explored in therapeutic interventions around these issues, and a wider understanding of how apps can be used to reach men in these settings, or afterwards, would be useful.

While this current challenge to sexual health does seem to remain localised, the popularity of smartphone apps in tourism and travel (see Hypothesis 6) offers a potential for such practices to change and expand across Europe. Keeping abreast of any changes, and sharing best practice from countries that are currently engaging with the issue, should remain a priority for supporting the sexual health of European MSM.

## Hypothesis 6: 'I believe that smartphone applications influence MSM tourism within Europe, functioning as a common way for MSM travelling to a new country to meet other MSM in that location.'

### Background

The popularity of MSM smartphone applications has seen a significant shift in terms of the number and use of different MSM platforms. Previous MSM web based platforms tended to be more national or regional in scope, but the rise of a handful of apps internationally has seen a narrowing of the types of online platforms used by MSM globally. This shift may have reduced barriers for MSM who may be travelling to meet other MSM while abroad, and may now form an important factor in MSM tourism.

This hypothesis was the second most strongly supported in the stakeholder survey, with 81% of respondents agreeing or strongly agreeing with the statement.

#### 'I believe that smartphone applications influence MSM tourism within Europe, functioning as a common way for MSM travelling to a new country to meet other MSM in that location.'

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Rating average	Response count
0% (0)	4.76% (6)	13.49% (17)	51.59% (65)	30.16% (38)	4.07	126

A number of stakeholders commented on the existing impact which the internet had already had on MSM tourism:

'In the same way like web communities like Gaydar and GayRomeo have done.' (Stockholm, Sweden)

'No doubt; when abroad, less likely to have knowledge of local physical locations and activities.' (Dublin, Ireland)

However, other stakeholders took this further and focused on the specific benefits of using smartphone apps while travelling:

'I think this is true. It's easy (phone data-plan allowing!) to pull out your phone in a new city and see "what's around". I think this is good, though obviously in terms of STIs including HIV this has its downsides.' (Manchester, UK)

As some noted, as technology improves and continues to lower barriers to online access, this will become even more common in the future:

'If the price for digital traffic [data roaming] is harmonised across the European countries the influence will be much stronger.' (Copenhagen, Denmark)

At the expert meeting, some stakeholders also raised the issue of commercial sex work taking place on smartphone apps, and also noted the suitability of smartphone apps for heterosexual identified MSM who may be travelling, particularly for business.

## MSM key informants

The strong support for this hypothesis by stakeholders was matched by the accounts of MSM in Europe, with the majority of those who had travelled using apps in some capacity. For some men, this was simply part of the pleasurable experience of travelling:

'I had a quick trip around Europe and chatted to guys [on apps] in Amsterdam, London, etc. I was only there briefly so nothing really materialised, but it was definitely more vibrant and more used and happening, just because there's more people [in those cities].' (Aged 28, Romania)

Generally, most men commented favourably about the use of smartphone apps in these situations:

'[A smartphone app] was really useful [when travelling] as I knew I was coming back, and could use it to keep chatting to new guys. Grindr was also useful, as when I was in a new city I could use it for chatting to new people – going to a bar by yourself is never fun – then things like Grindr are really useful. Sometimes [when travelling] you rely on [the apps] completely, as there might be no gay clubs at all.' (Aged 24, UK)

Many men focused on the positive enabling factors of smartphone apps for making connections with other MSM in countries which they might be visiting, and which they felt would otherwise have been difficult:

'Definitely used apps on holiday. It was probably mostly apps, as I took my phone with me, rather than a laptop. Sometimes there was a language barrier, because sometimes you're in a foreign-speaking country, but most of the European countries they're fairly good at English. And there is time to go online and Google Translate missing bits of a conversation.' (Aged 35, UK)

The same MSM highlighted that travelling with your phone presents a much lower barrier to accessing MSM online spaces, compared to carrying a laptop or finding a computer when abroad in order to use a website. Also, the nature of communication on these apps provides a way around some language barriers through the use of digital translation tools. This is not to say that MSM did not notice cultural differences or experience some difficulties:

'They have their own gay slang and lingo, which of course they would, but it never really occurred to me before! It was really difficult, because I'm trying to Google Translate gay slang abbreviations, which doesn't work.' (Aged 24, UK)

For most interviewees the cultural similarities in using apps far outweighed the differences. For some, phone apps are their preferred means of communicating with other gay men while travelling. One interviewee described how this extended to the choice of which app to use.

'[A smartphone app] is a very good place to meet the tourists, I actually befriended a couple of those, it's a very good place just to get to know people from abroad. They've come from the big towns, or outside Europe, and they log into Grindr and you find them there. Lots of times they think that the gay scene here is completely empty, because they log onto Grindr and there isn't anyone there.' (Aged 28, Romania)

For this participant, while a specific app was not popular in his own city, his understanding of the popularity of that app internationally influenced his choice to use it locally to find men who were visiting Romania. Interestingly, he noted that the tourist's lack of knowledge of what apps were used locally rendered the local gay scene invisible to them. In this way, that app functioned as a common language which men would default to in lieu of local knowledge.

## Conclusions

The mainstream popularity of apps across Europe, and their more international user base, provides the perfect tool for MSM who are travelling and looking to make connections with other MSM. While the majority of the interview participants' reports, and indeed those of the stakeholders, were positive, it is worth considering how this hypothesis might interact with some of the other hypotheses considered in this report. Through the establishment of easier-to-access international connections, sexual networks may become increasingly complicated through the use of smartphone apps. Furthermore, while apps aid communication between people speaking different primary languages, it would be useful to explore what impact this has on successful negotiation of sex and sexual health.

The widespread use of phone apps by MSM across Europe does provide a unique opportunity to engage MSM internationally in HIV prevention and sexual health. Phone apps offer health promotion potential which has yet to be fully realised on an international scale. While the monopoly of a small number of MSM smartphone apps has posed significant challenges to individual organisations across the EU, finding manageable ways to form partnerships with those apps would reach an unprecedented number of MSM.

## Hypothesis 7: 'I believe that online platforms, and increasingly smartphone applications, will often be the first point of contact for young MSM with other MSM or MSM culture.'

### Background

Young people are often early adopters of new technologies, thus the recent shifts into mobile technology with social media is perceived to have a greater impact on younger MSM. Against this general statement, the ease and anonymity with which contact can be made with other MSM via phone apps suggests it may be a logical starting place for young gay men to explore their sexuality.

This was the strongest supported hypothesis, with more than three-quarters (80.15%) of the respondents to the survey either agreed or strongly agreed with the statement – and in Central Europe, over 95% agreed.

#### 'I believe that online platforms, and increasingly smartphone applications, will often be the first point of contact for young MSM with other MSM or MSM culture.'

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Rating average	Count
0	2.38% (3)	17.46% (22)	44.44% (56)	35.71% (45)	4.13	126

As one stakeholder from Dublin, Ireland simply emphasised, 'apps are so convenient'. However, it was not just the ease of use and accessibility which stakeholders felt were the main reasons for young MSM's early adoption of smartphone apps. Other cultural issues, such as homophobia, were suggested by one respondent as another important factor as to why MSM may choose to first connect with other MSM via smartphone apps:

'This is especially true within the cultural context of Albania where MSM relationships are a strong taboo surrounded with stigma and discrimination.' (Tirana, Albania)

Similarly, the lack of MSM physical infrastructure in an area may also provide a problem which smartphone apps are able to overcome:

'This is particularly true in areas where MSM venues are limited or non-existent or where youth culture is not reflected in local venue offerings.' (Woking, UK)

This move away from physical spaces was cited as a cause for concern for one stakeholder:

'I have concerns that if MSM are now not meeting in gay bars, etc., where there would be leaflets and posters to guide, or where informal conversations can be had about Post-exposure prophylaxis (PEP), Pre-exposure prophylaxis (PrEP) and other subjects – and if smartphone app owners do not want health info on their apps – where do people access this info or have these conversations?' (London, UK)

But even if there has been a shift to using apps by younger MSM, some stakeholders believed physical spaces still play an important role:

'Surely a lot of young or old people prefer real places to meet.' (Liege, Belgium)

'There's no longer a need to go out 'on the scene' as a way of meeting guys. Even though the apps require that you be over 18, it's only an "agree" button in most cases, so I think it's definitely something young MSM are doing. Physical spaces are not being eradicated by virtual spaces, but they're being complimented by them.' (Manchester, UK)

## MSM key informants

For some of the younger MSM who took part in the interviews, apps were their first point of contact with other MSM. For this 18-year-old from Malta, initial forays into gay bars or websites had been negative experiences:

'I have been [to a nearby gay bar and club in a city] once. I didn't like it. It was so boring because it was all over-age people, I mean seriously. I wasn't a fan. I used to have [a profile on a gay website]. I just quit it and I no longer use any website. They're kinda boring. There are many horny people out there, they're all: "Hey I wanna do this, hey what you up for." Seriously I'm not into it. I'm not into sex, being honest with you.'

This early experience of being propositioned for sex online was something which another participant recalled also:

'For me, online communication is a bit weird, because I was a bit traumatised by the net. In the early days of the internet when I was just discovering myself, you'd get like a dozen guys just hitting on you and wanting to know your sexual preferences, asking you for sex with no conversation about anything. A few hundred of those tried and I kind of gave up on online communication.' (Aged 28, Romania)

However, despite the similarities in the sexual content, the young man from Malta still felt that smartphone apps were an improvement over the websites he had tried:

'They're quite good, I quite like it, but I don't like people who want all the sex all the time. [App name] is faster, I can text quicker, the other one you needed to sign in at the computer all the time. This one it's on my phone, so if I want to go to a restaurant I can go there and talk to people while I'm eating.'

A similar view was expressed by this 24-year-old from the UK, who felt that apps were more socially acceptable than the websites they had preceded:

'With [app name], even though everyone knows it's seedy, it's bright orange, it's kind of cute – even if you're doing something seedy. Like everyone talks about Grindr, but I don't think everyone would have spoken about being on [website name] or [website name] – I wouldn't have told anyone I was on [website name].'

For other younger participants, they had skipped out the websites entirely:

'I use [app name] and [app name] – I've never used gay websites previously. A friend of mine told me about the apps – that was about a year ago. I find them interesting because sometimes I get a nice talk and sometimes I get a date out of it.' (Aged 21, Netherlands)

When asked how they learnt about HIV or sexual health, only a few participants had said they had seen any information on a phone app. A Dutch participant said that he had excellent sex education at school (which included information for gay men), while others had to look for other sources:

'I like reading Queerty and Towleroad – the blogs – and Facebook, so seeing a few campaigns and reading more about safer sex. So I've been reading things about PrEP as well, which is really interesting, but I'm not sure that doctors around here would know what it is, let alone provide it, because it's expensive.' (Aged 28, Romania)

For this participant, wider social media including gay-themed Facebook pages and blogs, are where they most encountered sexual health information. It is worth noting that nearly all participants thought that more sexual health information should be provided on the smartphone apps.

## Conclusions

For many younger MSM, apps for MSM may be one of the first places where they look to explore their sexuality and make contact with other MSM. Often physical spaces remain important, but many younger men may spend a far greater amount of time using gay smartphone apps. Websites, which may have older demographics or seem quite dated structurally compared to their app equivalents, were generally perceived to be less acceptable to younger MSM who took part in the interviews.

It is encouraging to see the ways in which wider social media has been successfully utilised for sexual health work. However phone apps, which for many younger men were but one of a range of platforms, remain a key under-utilised site of intervention for HIV prevention. The acceptability of smartphone apps to younger MSM present an important opportunity for meeting the wide-ranging sexual health education needs of this target group.



## Conclusions

At the expert meeting, the project findings were discussed and recommendations of possible subsequent actions were made, which form the basis of this section of the final report.

### Smartphone apps and HIV prevention

There is evidence that use of apps by MSM is widespread and has increased significantly in recent years. There are many factors that are common across EU countries and internationally, such as the use of certain popular apps, and smartphone apps of particular importance to young MSM and MSM tourism. However, against these larger trends, there remain equally important local variations in usage and popularity of smartphone apps which needs to be considered.

Smartphone apps have significant reach and offer considerable potential for public health, in terms of health promotion and data generation. Organisations in some countries are already using online and mobile platforms for STI/HIV prevention, although there are questions about how to do this most effectively. Experience suggests that when used effectively, apps can help promote the uptake of HIV testing and other services when linked to specific events (such as testing week), utilise advertising to promote services, and provide an effective platform for community outreach.

### Key actions to be considered

- EU organisations working in MSM HIV prevention should get together to inform best practice and innovation to serve as a guide for future work in this area.
- The creation of guidelines and toolkits on effective HIV prevention on smartphone apps should be considered.
- Co-ordinated engagement, on behalf of EU stakeholders, between app owners and MSM/HIV organisations, including those operating in other areas of the world, will help develop beneficial partnerships and may improve the utilisation of smartphone apps in HIV prevention.
- This co-ordinated engagement should also strive to develop an EU-wide initiative utilising smartphone apps to support HIV prevention with coordinated advertising to promote such important initiatives as the European HIV Testing Week across multiple countries.
- Encourage researchers to incorporate studies of smartphone apps and other important digital technologies into their future surveys and projects.

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# Appendix 1. Literature review

## Introduction

The use of the technology by gay and bisexual men, and other men who have sex with men (MSM) has frequently been the subject of research over the last few decades. As technology has changed and developed over time, so men have adapted their use of this medium for socialising, sharing information and forming communities. Previous research has focused on the progressive technical iterations of different internet or online platforms (from early online bulletin boards, chat rooms, to profile based websites) and the varying uses of these platforms by MSM [1]. Smartphone apps (which are programs used on mobile smartphones or tablets) can thus be situated as the latest iteration in this lineage.

Despite this technical evolution, much of the literature has continued to focus on the core theme of men's use of the internet to seek sexual partners and develop sexual networks online. Researchers have, for the most part, been concerned with the impact that the internet has had on the sex lives of men who have sex with men, and on their sexual health [2]. Variations in use based on the technical specifics of each platform, identity of the MSM or intended use provided consistent themes in research [1].

Smartphone apps designed for MSM to meet each other have been in existence since around 2009. The most popular one so far is Grindr, which currently has over 10 million users worldwide<sup>9</sup>, and is available on Apple and Android devices. Geosocial networking (GSN) apps like Grindr mostly work in the same way: users can update their own profiles and pictures via their smartphones and allow others to see their location in real time and then receive messages, chat and agree to meet. The main differences from previous MSM dating websites are 1) the easier and more frequent access afforded by mobile technology (compared to desktop computers), and the use of GPS (global positioning system) technology to more precisely locate other users.

While technically, smartphone apps are smartphone or tablet applications downloaded onto the device, in terms of usage they are closely related to mobile-optimised versions of previously existing websites (such as dating or specific interest websites). Both apps and mobile optimised websites will be tailored for use on smartphones (with touch screen controls), and will often make use of the inherent phone GPS technology. Smartphone apps have some content restrictions from the platform's respective app stores (particularly Apple), whereas mobile-optimised websites function via the web and are thus less regulated in terms of nudity and language, for example.

There are currently a host of apps to reflect subcultures and aesthetics, and each app is geared more or less towards 'hooking up', romance, or forming more general social groups or connections.

Public health concerns have been raised, similarly to those raised about the internet and other new technologies before – that the current use of apps on smartphones could be contributing to an even greater extent to increasing STI rates, as it can facilitate more frequent partner exchange amongst MSM.

This review covers the available evidence on the impact of smartphone apps on the sexual health of MSM and sexual cultures. It has been undertaken to inform a larger, ECDC-funded, project to explore the impact of smartphone apps on the sexual health of MSM in Europe. The review was therefore initially geared mainly towards Europe, but as (global) available evidence on these technology is still scarce, it still relies heavily on predominantly US-based research instead. In order to account for potential geographic differences in use and outcomes, some recent and large-scale European research on the use of the Internet for sex by MSM has been included.

## MSM, sex and the internet in context

Research on the use of the internet for sex follows research on the sexual lives of gay men more broadly, which has included studies on gay bars, clubs, bookstores, sex-on-premises venues, telephone chat rooms, classified ads in magazines, public sex environments (PSEs) and cruising grounds more generally [2-5].

Nonetheless, research has over the years established that the internet presents significant features for the formation of social and sexual networks that differentiate it from other spaces in which men may be seeking other men for sex [1,5]. In broad terms, amongst the key characteristics of the use of the internet for sexual purposes are:

- it provides safety from the threat of physical violence and homophobia
- it increases chances of meeting other eligible men thanks to the large numbers of members online, and to pre-selection using individual profiles and images
- it offers more anonymity for men who are not 'out' about their sexuality.

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<sup>9</sup> See: <http://grindr.com/learn-more>

Due to the above factors, plus the convenience of online access, the act of sourcing sexual partners may be made easier.

Broadly, some of the negative aspects that have been suggested have included:

- the shrinking of 'off-line' gay communities or spaces as a result of increased online networking
- the hypothesis that men are having a higher number of partners, or more 'risky sex' via partners sourced online and thus increasing their likelihood of acquiring STIs, including HIV
- the mental health impact of excessive use of the internet for sexual purposes<sup>10</sup>.

Overall, research in this area is focused on core public health issues such as the transmission of STIs, particularly HIV. A primary focus on sexual health in this population is partly explained by the elevated risks and prevalence of all STIs amongst men who have sex with men in most countries of the world where data about same-sex relationships is available [6]. For example, increases in STIs have been observed in European (and American) MSM in the mid-2000s which some researchers have linked to increased sexual risk behaviours [7], while others have highlighted the importance in improved testing and reporting. Research has chiefly sought to establish whether the internet was a contributing factor in these epidemics of STIs as it presented a much greater chance of exposure to sexual health-related risks, and harms, by facilitating sexual networking amongst men who have sex with men [2, 5, 8-10].

Nonetheless, to date the scientific literature appears largely unable to show direct causality between internet use and STI trends. Indeed, even within similar kinds of studies there are inconsistencies and contradictions due to methodology that make it difficult to conclude anything. Furthermore, there is some evidence that suggests that internet-based networks may provide protective elements (rather than more risk exposure), particularly as HIV status disclosure online is easier than in person [11].

In addition, some have noted that more web use also allows men to socialise and form relationships in what may otherwise be perceived as isolated or hostile circumstances and that this can help with identity, belonging, improved mental health and community engagement [2]. Most of the available research on the online sexual behaviour of MSM can therefore only show associations and relationships between the use of the internet for sex, sexual risk and individual STI histories, rather than provide conclusive causation evidence for the STI trends.

## The 'accentuation' and 'self-election' hypotheses: some issues with methodologies

In broad terms, the literature has focused more on supporting or discounting what may be seen as two main hypotheses with regards to the impact of the use of the internet by MSM on their sexual health and behaviours.

### 1. The accentuation hypothesis

Internet use increasing sexual risk and consequently contributing to rises in STIs amongst MSM populations;

### 2. The self-selection hypothesis

Internet use for casual and/or high-risk sex is undertaken by men who would engage in sexual risk anyway, and who do so 'offline' as well [13].

These two perspectives are of course relevant also to an understanding of the impact of the use of smartphone apps on the sexual health of MSM. Particularly of interest are the weightings which the technical specifics and actual usage of smartphone apps may lend to both hypothesis (potentially differing from previous online platforms, such as websites or chat rooms).

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<sup>10</sup> For example, for internet use and sexual compulsivity see Schnarrs [12].

The two hypotheses, however, are largely informed by methodological choices made in research studies. This is also often noted in the limitations that scholars provide with regards to the interpretation of their research findings. Some of the key methodological issues that can constrain our current understanding include:

- online sample bias – samples of MSM recruited online on websites (and apps) that are used to seek sexual partners are more likely to report use of the internet for sex than samples recruited offline (in clinics, gay venues, etc.). Online samples might thus overestimate online sexual partner-seeking in relation to offline samples, and vice versa;
- crude measurements – sexual risk is often measured via very few variables, usually limited to unprotected anal intercourse (UAI) with at least one partner in the previous 12 months, or similar. This measurement alone does not allow us to find out frequency of UAI, number of partners for UAI, whether it is UAI with stable and/or casual partners, serodiscordance, viral load, use of PEP/PrEP, etc.;
- stratification issues – there is a general lack of data stratified by characteristics that can guide interpretation of findings, including: HIV status; viremia (in the context of transmission of HIV); key demographics such as ethnicity or socioeconomic status; HIV status of partners; HIV testing history; health behaviours other than sex behaviours (although drug-related behaviours are often analysed);
- concurrency of behaviours – data usually relies on snapshot reports of online sex behaviours, or online vs. offline sex behaviours. This does not allow for a longitudinal understanding of behaviour over time nor for an understanding of concurrent online and offline behaviours;
- internet as a generic space – there is so far a lack of understanding of the ways in which the different types of online space, such as desktop websites, mobile websites, applications and social media, may all serve differing yet complimentary functions for MSM;
- self-reporting issues – the majority of studies rely on self-reported sexual behaviours, HIV status, HIV/STI testing and history of STIs.

These common limitations, alongside others specific to each research project, hamper the possibility to confirm or discount either the accentuation or self-selection hypotheses. Clearly evidence on the impact that smartphone apps may be having on the sexual behaviour and sexual health of MSM presented below should be interpreted with further caution, also as the body of research is still considerably small.

## Smartphone apps: an extension of the internet or a new landscape for sexual networks?

Before turning to the main findings from behavioural research on MSM's use of smartphone apps, it is worth considering whether apps should be seen as a new social space for men looking for sexual partners or as an evolution of existing web platforms. Smartphone apps principally differ from the first generation of websites in that they are optimised for use on mobile smartphones or tablets, and utilise more precise GPS technology to determine other user's geographical locations<sup>11</sup>.

As many people keep their phones (and tablets) on their person and switched on most of the time, the possibility of contacting and being contacted by others via smartphone apps is arguably greater than via the use of websites that usually need to be accessed on desk-based computers. Indeed, studies report a high-frequency of usage of these apps by MSM, with men checking their profiles at repeated points during the day, every day (more details in the following sections). Smartphone apps thus present different opportunities for sexual practices from those hitherto offered by the internet and all 'offline' sexual spaces.

However, the only qualitative study found in this review cautions against an understanding of smartphone apps as separate and discrete entities, but instead suggests that apps should be seen alongside a continuum of networking which takes place in person, on the internet, on different kinds of websites and social networking sites and, also, on different types of smartphone apps [14].

Study participants generally report that smartphone apps are their main source of sexual partners and, simultaneously, that the main use they make of apps is seeking sexual partners [11, 15-17]. Nonetheless, men make other uses of these apps too, for example to meet friends, socialise and organise activities.

Furthermore, different apps cater for different needs and preferences: while some apps and mobile-optimised websites are predominantly and explicitly geared towards finding sexual partners, such as BarebackRT, they are also used for connecting men with similar identities and community affiliation (i.e. HIV+ MSM). Therefore the uses

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<sup>11</sup> Subsequent website evolution means that most popular websites now have mobile optimised versions which allow parity with apps, so the distinction is arguably less important. The important shifts from previous internet technology remain centred on 1) increased and easier access to the app/site via mobile technology, and 2) the use of GSN technology to facilitate physical meetings.

that MSM make of the variety of apps available should not be generalised, and the observer should allow for nuances in behaviours and in the consequent interpretation of survey data.

## Main findings

### 1. Demographic characteristics of MSM using smartphone apps to seek sexual partners

In general, participants in research studies were more likely to be white, be in their 20s, have completed secondary education, and be in employment. Also, the majority of men surveyed identified for the most part as gay or bisexual, whilst fewer men chose other terms to describe themselves.

Studies were concentrated in US urban centres thus drawing mostly, though not exclusively, on samples of urban MSM. Lack of breakdown by geographic location in most of the articles does not allow an assessment of whether urban men use apps more than, or differently from, men living in rural or isolated areas.

Some studies reported on data from sensation-seeking scales to explore the psychological profiles of app users. The first of these studies compared men who used the web for sex with men who used both web and apps for sex and found no difference in sensation seeking measures [11]. The other study also found no difference in sensation seeking reporting between men using apps for sex and men who did not use apps [18].

A number of studies reported on drug and alcohol use, using a range of measurements and more or less detailed information on different substances with varying and, at times, opposite results [17, 19-21]. For example, in a large clinic-based sample of over 7 000 MSM in Los Angeles (US), men who used apps for sex were more likely to use drugs than men who used gay venues or men who used only websites to seek sexual partners [19]. In another US study of Grindr users in New York City, however, most respondents (83%) reported not having recently used drugs [20].

A UK study [22] found that the age of users who preferred apps over traditionally web-based sites was significantly lower. This would be consistent with more general observations on uptake of technology, which have noted the early adoption of mobile technology by young people (touch screen, GSN), and increased importance of mobile access to the internet on a year-on-year basis<sup>12</sup>.

### 2. Characteristics of the use of smartphone apps in relation to sexual networking by MSM

As previously mentioned, the majority of respondents, when asked, reported that they used smartphone apps to seek sexual partners. This finding was consistent across studies that analysed data from larger samples as well as studies that sampled specifically MSM that used apps for sex.

In those studies that included more detailed questions about app usage, respondents often reported multiple daily use of smartphone apps [11, 18]. Respondents also reported smartphone apps as their primary medium for sourcing sexual partners in comparison with dating websites, social networks such as Facebook, venues such as bars, clubs and saunas, or meeting men through friends [14].

Some studies asked questions as to whether men who had actually had sex with men met via smartphone apps. Responses ranged from 96.5% [11] to 56% [17] to 23.5% [16]. However, fewer studies asked about the different kinds of sex men had with men met via apps aside from UAI. In the studies that did, men reported around similar amounts of anal and manual/oral sex [11, 16, 17].

No studies could be found that asked whether men who have sex with men met via apps at their first, or possibly subsequent encounters, nor whether men were still having sex with the same partners. It is therefore not currently possible to explore whether men are having sex with men they meet via the apps immediately, or whether sexual activities and relationships develop over time.

### 3. Numbers of sexual partners and smartphone apps

One study reported that an increase in numbers of partners was significantly associated with the length of time since participants had joined Grindr [21]. Another study reports that men who met partners via smartphone apps had more partners than non-app users [18]. Another found that men who only used mobile platforms reported a higher number of partners than those who only used web-based platforms [22].

<sup>12</sup> For UK data, see: [http://stakeholders.ofcom.org.uk/binaries/research/media-literacy/adults-2014/2014\\_Adults\\_report.pdf](http://stakeholders.ofcom.org.uk/binaries/research/media-literacy/adults-2014/2014_Adults_report.pdf)

Many studies, however, did not compare numbers of sexual partners. There was only one French study, analysing web use (but not smartphone app use) over different kinds of platforms, which reported data on group sex for 52.5% of participants [23].

## 4. Prevalence of UAI amongst men seeking men online and via smartphone apps

One earlier [13] and two recent [9, 24] meta-analyses of observational studies on the sexual behaviour of MSM online show that, overall, there was an elevated odds ratio (OR) for UAI amongst online users versus men who met sexual partners 'offline'. However, there was no breakdown between smartphone apps and websites in terms of online spaces.

A large French study, however, reports a wide variation in the range of responses from men recruited via different kinds of gay websites. The authors discuss how the mean ranges of prevalence of HIV, UAI and a number of other measurements, are more informative when looked at within each sample from the different websites rather than across the overall sample in the study. For instance, the overall mean of prevalence of UAI with a casual partner in the previous 12 months in the French sample was around 34%, but men recruited from a bareback website showed a 77.3% prevalence of UAI, whilst men recruited from gay general interest sites had a prevalence of UAI around 30% [23].

Another study from the UK also found significant variation in UAI reported within the categories of mobile or web-based platforms, dependant on the communities and usage of those particular platforms. The study also highlighted the interlinked nature of many of the sites, noting the varied combinations in which people used a combination of different mobile and web based platforms together [22].

Individual studies of smartphone app users report slightly lesser variations in rates of UAI, although measurements, time periods and methods for reporting differ. One study found high rates (around 58%) of UAI in the previous three months amongst MSM using the internet and smartphone apps to find sexual partners. The study however found only slightly higher odds ratio of UAI in men using websites and apps to look for sexual partners versus men only using the web [11].

A US study of young MSM aged 18-24 years old found around 20% of men had anal sex without a condom with the last partner met via Grindr. In this sample, odds ratio of UAI increased with the length of time men are registered on Grindr and for men who post naked pictures of themselves on the app [21].

In another US study of Grindr users in Los Angeles, 46% reported UAI and 39% unprotected receptive anal intercourse (URAI) in the previous 3 months and a mean of 10 anal sex partners in the previous year [17]. Yet in a small US survey sample comparing app users versus non-app users, no difference in UAI reporting was found [18].

## 5. HIV status, HIV/STI prevalence and HIV/STI testing

Although few studies stratified data by HIV status, the prevalence of HIV in the sample demographics of the studies included in this review appeared similar to the prevalence of HIV amongst MSM using websites to meet other partners, and the wider MSM populations in most European countries. Overall, apps users do not seem to show any increased likelihood of being, or testing, HIV positive.

Nonetheless, a substantial proportion of respondents in various studies declared unknown HIV status, or that they had never tested, or had been tested longer than the 12 months previous to recruitment in the studies. Published research therefore does not currently seem to support the notion that the use of smartphone apps is driving HIV rates in these populations but it does reflect that there still are considerable amounts of undiagnosed HIV.

For example, a US study based in Washington, recruited men in gay venues and administered participants with a survey questionnaire and a rapid HIV test. Of the 379 MSM who took part in the study, around 13% tested positive for HIV and 23% of these did not know their status prior to the study [16].

In another US study based in Los Angeles, around 83% of the 375 MSM who took part reported having had an HIV test in the previous 12 months, but a further 4.3% reported never having tested for HIV. Of those tested, 4.5% reported being HIV positive [17]. Another US survey conducted with 1 351 MSM who use Grindr in New York City, and who reported being HIV negative at the time of the study, found that 1/10 of the men had never tested for HIV before (though 30% of these men reported being negative) [20].

In another US study in Los Angeles County, MSM were interviewed and tested when attending a sexual health clinic. Overall, 7 184 men were surveyed – one of the largest samples in the literature reviewed here. For data analysis, men were divided into three groups: a) MSM who only sought sexual partners in person; b) men who sought partners in person or on websites; and c) men sought partners using at least one smartphone app (regardless of other methods). There was no significant difference in HIV prevalence amongst the three groups of MSM, although app users did show higher rates of gonorrhoea and chlamydia compared to men in the other groups. This result was similar to a small US survey of MSM recruited via university student listservs, Facebook and

Twitter, where app-users did not differ from non app-users in relation to HIV status but reported more STIs aside from HIV [19].

In the UK study, men who had sourced sexual partners online were more likely to have had an HIV test in the previous 6 months than those who had sourced their partners offline. Users who preferred mobile platforms were also more likely to have tested more recently for HIV (within the last 3 and 6 months) than those who only used website platforms [22].

## 6. Seroadaptive behaviours and 'barebacking'

Concerns have been raised that smartphone app use is facilitating increases in behaviours that carry a higher risk of HIV when compared to those using 'offline' networks or websites. However, due to the scarcity of available research, it is not currently possible to establish whether app users engage in more risk behaviours than internet users or men who meet other men via other methods. As detailed previously, often app and internet use will be combined in studies under a broader term, such as 'social media networking sites' [15], so it can be difficult to ascertain the impact of particular types of platforms. Furthermore, as noted before, it is not often possible to ascertain a reliable estimate of the proportion of men who might be seeking sexual partners by more than one method.

To the contrary, meta-analyses show that use of online web platforms to find sexual partners is associated with more reporting of practices that carry some HIV (and more STIs) risk, such as serosorting [25], barebacking [26], systematic UAI [15, 23] and strategic positioning [9] whilst use of smartphone apps often is not. Indeed, studies report both increased and decreased UAI by men who use apps compared to other groups [11].

In a study of 1 351 Grindr users who reported being HIV negative, around half of participants reported UAI in the previous three months, including a third of MSM who stated they had never had an HIV test [20]. In another US study based in Washington, of the 241 MSM who met someone met via a smartphone app, and 23.5% had sex with that person. Of these around 57% had anal intercourse, for the most part (72.5%) without a condom and around half with partners of a known HIV status [16].

Of the 375 participants in a Los Angeles-based study, just under 2% had had anal intercourse with someone met on Grindr in the previous month. In the same study 46% reported UAI and 39% URAI with a men they met via Grindr. Of those who reported UAI, 70% thought it unlikely that they could acquire HIV in this way. This was the only study to report on PEP use as 3.7% of their participants had used this treatment [17].

## 7. Sexual networks, clusters and geographical locations – analysis on social networks

If smartphone apps have become an important setting for MSM's partner acquisition, then they may also influence the creation of sexual networks and, subsequently, transmission routes of STIs. Furthermore, the use of digital platforms may provide theoretical opportunities to map sexual networks and intervene in chains of STI transmission in ways which would have been much more difficult in the more traditional, anonymous, physical settings.

Older studies (Klausner, 2000) have focused on the role that early online spaces (in this case, a chat room) have played in both tracing an STI outbreak and online partner notification attempts. While there are commonalities which can be drawn on here in terms of an online space's role in forming a sexual network, the significant differences between a single chat room and a smartphone application with millions of users limits the study's utility for the purposes of this review. The impact of an online platform on the formation of sexual networks, how they can be used for the broad STI outbreak response, or in more sophisticated partner notification systems, all depend on the technical specifics and usage of that particular platform (Mowlabocus, 2014).

A UK study [15] investigating an outbreak of *Shigella flexneri* 3a in predominantly HIV+ MSM, did identify the use of social media (of which smartphone apps and mobile optimised sites were the main components) as the most common way in which men sourced new partners. Other factors such as HIV status, group sex, drug use (including injecting) and fisting were also strongly associated with this outbreak, so it's important to view the app use with that particular group of MSM within this wider context. While causality remains difficult to prove in this context, what this study does suggest is that higher risk sexual networks do use smartphone apps and that this common ground might provide a setting where the hard-to-reach or high-risk MSM can be realistically reached.

While online networks may have appeared to pose solutions to issues such as partner notification, it is also true that currently this potential has yet to be fully realised [27-28]. That said, as technology and usage of online spaces continue to change, opportunities for more successful partner notification may yet be realised.



## 8. Sexualised drug use amongst MSM and its relation to smartphone apps

While LGBT people are often associated with a disproportionately high use of certain recreational drugs, particularly amongst HIV positive MSM [29], recent shifts in both the types of drugs used and the context in which drugs are taken amongst MSM in some countries are causing concern[30].

'Chemsex' is a term used to refer to drug use by MSM in predominantly sexualised settings. The London-based study [31] found that the drugs associated with sexualised use to be mephedrone and GHB (or GBL), methamphetamine (known as a crystal meth), but may also include 'legal highs' ('legal' chemicals which tend to be similar variants to existing drugs), or more rarely MDMA or ketamine. More recently, reports have shifted their focus on to the harms associated with injecting crystal meth, but also mephedrone [29].

Whereas previously, recreational drug would have often been centred around clubbing (and this is obviously still a big component of certain aspects of the gay scene) the 'Chemsex' trend sees this form of drug use moving away from public venues into private settings which often include multiple sexual partners [31].

As the research has also found [15, 31, 32], the organisation of these sessions is often facilitated by the use of smartphone apps. In a private domestic setting, people are often invited to participate via messaging on smart phone platforms [15]. While online platforms have been around for many years for MSM [1], applications allow individual men to look for other potential sexual partners much more easily through their smartphones [31].

This has posed a number of concerns for HIV prevention and sexual health [15, 30-32]. Firstly, increasing partner numbers and concurrency will increase an individual's risk of STI transmission, regardless of condom use. Secondly, increased duration of sexual encounters may result in damage to skin and mucous membranes which will make men more susceptible to STI or HIV transmission. Thirdly, reduced inhibitions from drug use may make safer sex practices harder to adhere to. There are associated risks too that result from sharing injecting equipment, apart from the broader impact on mental health and sexual wellbeing from dependency on drugs.

It should be noted though that this problem is largely a regional one for MSM, being tied to particular countries, cities and even areas within cities. In the UK for example, the European MSM Internet Survey (EMIS) reported an overall proportion of 1.6% of MSM using GBL, but it rose to 5.5% within London, and 10.5% within a specific area of that city [31]. EMIS reported similar differences between European countries.

There may be other issues which arise for MSM experiencing problems with sexualised drug use, such as finding appropriate support services. Traditional drug services, that may historically mostly serve opiate-based drug users, may not have sufficient cultural knowledge around the specifics of sexualised drug use to meet the needs of MSM [31, 32].

### In summary

Overall, the available evidence on the impact of smartphone apps is limited in scope and in geographic location. The extent to which US-based study findings can be extrapolated to apply to MSM networks in Europe is uncertain. In addition, even within the US, published research is for the most part observational, rather than explanatory, and constrained by important methodological issues, particularly related to sample bias and the limitations of measurements in survey questionnaires.

An additional challenge arises from trying to make assumptions about smartphone-app use using the findings of previous research on internet use for sex by MSM. Although apps can, and possibly should, be seen as an extension of the internet, they also present novel features that may potentially contribute to the creation of specific sexual networks in which both sexual risk-taking and STI prevalence could be high. Nonetheless, the data available is currently unable to support or discount presuppositions regarding these fundamental differences between the Internet and smartphone apps.

In relation to HIV, the current evidence does not indicate a higher prevalence of HIV in MSM using smartphone apps (as it does, for example, in relation to specific websites geared towards 'barebacking', but this is likely to be more of an identity issue rather than the impact of the technology). However, available literature seems to reflect issues of undiagnosed HIV amongst what is predominantly a younger subsection of the MSM population in the US. As undiagnosed HIV is responsible for the majority of onward HIV transmission amongst MSM, the data that shows the high levels of unknown HIV status amongst men seeking men for sex via smartphone apps represents more arguments of the need for more prevention and testing amongst MSM in Europe.

Nonetheless, the relationship between risk-taking and HIV transmission is a complex one with regards to smartphone app users. Although app users would appear to engage in the same levels of condom-less anal sex as men who use websites to seek sexual partners, it is not currently clear what levels of seroadaptive behaviours are involved, nor the role that undetectable viral load might play in decisions about condom use, particularly as it appears that men are more likely to disclose their HIV status online.

Clearly there is scope for further research to engage with, and hopefully resolve, some of the data limitations and gaps outlined in this review. More longitudinal and in-depth research would be particularly useful in assessing men's behaviours across different settings where they may meet other men, considering apps usage over time, and eliciting more detailed data surrounding the actual sexual and intimate relationships that are developed via smartphone apps (with the risk-related choices involved) above and beyond records of single episodes of UAI.

Furthermore, while evidence as to the popularity of smartphone apps alone may justify the investment of HIV prevention within these platforms, a greater understanding of how HIV prevention interventions may be situated within smartphone applications to achieve the best health promotion outcomes may provide key guidance for stakeholders attempting to utilise this new technology.

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## Appendix 2. Popularity of MSM spaces by country

On a scale of 1 to 5 (with 1 being 'not popular' and 5 being 'extremely popular'), in your opinion, how popular are these spaces to MSM in your area?

	Austria	Belgium	Bulgaria	Croatia	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland
MSM websites	4.75	4.29	5.00	2.00	4.17	5.00	4.60	4.33	4.33	4.36	4.08	5.00	5.00	4.10
Smartphone applications (i.e. Grindr, Scruff, etc.)	3.50	4.29	4.00	2.00	2.83	4.50	3.40	4.00	4.67	4.50	3.91	4.00	5.00	4.10
Gay clubs or discos	4.25	4.14	2.83	2.50	3.67	3.50	3.40	4.33	4.50	4.20	4.08	4.00	5.00	4.10
Gay bars	4.00	4.29	4.17	0.00	3.50	4.00	3.40	4.33	4.33	4.09	4.25	3.00	5.00	4.00
Gay saunas or bath houses	3.75	3.71	2.83	1.00	3.00	4.00	3.00	4.00	4.67	4.10	3.75	3.00	0.00	2.60
Gay cruising grounds (public sex environments)	3.00	2.86	1.00	1.00	2.00	3.50	1.80	3.67	4.17	3.82	3.17	2.00	0.00	2.40
Gay community groups	2.75	2.57	3.50	2.00	3.00	2.00	2.00	1.33	3.50	3.18	3.00	1.00	5.00	2.90
Gay sex clubs (sex on premises venues)	4.25	3.57	0.17	1.00	3.17	3.50	2.80	4.00	4.50	4.10	3.00	3.00	0.00	1.40

	Italy	Latvia	Lithuania	Luxembourg	Malta	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	Netherlands	UK	EU
MSM websites	5.00	4.50	3.75	2.50	3.00	4.00	4.50	4.07	4.00	5.00	5.00	4.56	4.33	5.00	4.21	4.29
Smartphone applications (i.e. Grindr, Scruff, etc.)	5.00	4.00	3.75	2.00	5.00	4.00	4.00	3.92	3.80	4.00	5.00	4.47	4.33	4.50	4.61	4.04
Gay clubs or discos	4.25	2.50	3.00	5.00	4.00	4.00	4.29	2.00	4.67	4.50	4.75	4.33	4.50	3.18	3.91	
Gay bars	4.25	2.50	2.75	3.50	3.00	3.67	4.50	4.36	2.60	4.00	1.50	4.44	3.67	4.50	3.43	3.62
Gay saunas or bath houses	4.00	2.00	2.75	3.00	0.00	3.33	4.00	3.50	0.60	3.67	3.50	4.25	1.67	4.50	3.25	3.01
Gay cruising grounds (public sex environments)	3.25	1.00	1.50	1.00	5.00	3.00	2.50	3.29	3.20	2.67	4.00	3.63	2.33	3.00	3.36	2.66
Gay community groups	2.75	2.50	2.00	1.00	2.00	3.33	2.00	2.50	3.20	3.00	2.50	2.75	1.67	2.50	2.75	2.56
Gay sex clubs (sex on premises venues)	3.75	0.50	2.00	2.50	0.00	3.00	3.50	2.08	1.00	1.00	0.00	3.50	2.00	3.50	2.54	2.39

## Appendix 3. Importance of MSM spaces for HIV prevention by country

On a scale of 1 to 5 (with 1 being 'not important' and 5 being 'extremely important'), please rate the importance of these spaces for your current HIV prevention work with MSM.

	Austria	Belgium	Bulgaria	Croatia	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg
Gay community groups	2.00	3.60	4.40	4.00	4.40	3.00	2.50	1.67	2.67	2.78	3.70	1.00	4.00	3.89	4.25	3.00	3.50	4.00
Gay bars	4.50	4.60	4.60	0.00	3.00	4.00	4.00	4.00	4.00	3.67	3.80	3.00	2.00	4.11	4.00	3.00	3.50	4.00
Gay clubs or discos	4.50	4.60	2.60	2.00	3.20	4.00	3.50	4.00	3.67	3.67	3.20	3.00	2.00	4.00	4.25	4.00	4.00	4.00
Gay saunas or bathhouses	4.00	5.00	2.60	2.50	3.40	4.00	3.75	4.67	4.00	3.56	4.30	4.00	0.00	3.22	3.75	2.50	2.25	4.00
Gay cruising grounds (public sex environments)	3.75	3.20	0.60	2.50	2.60	4.00	2.25	4.33	3.67	3.11	3.70	2.00	0.00	2.56	3.00	1.00	1.75	4.00
Gay sex clubs (sex on premises venues)	3.25	5.00	0.40	2.50	3.20	4.00	3.50	4.33	4.00	3.67	2.90	2.00	0.00	2.44	3.75	0.00	2.25	0.00
Sexual health clinics	1.75	3.60	2.60	2.00	2.40	3.00	2.25	3.00	3.67	2.22	3.30	1.00	5.00	4.56	3.00	1.00	2.50	0.00
Other medical settings	1.25	3.60	3.60	2.00	1.20	3.00	2.25	3.00	3.00	1.89	3.10	1.00	5.00	3.67	2.50	1.50	2.25	4.00
MSM websites	4.00	4.60	4.80	2.50	3.60	5.00	4.75	4.00	4.33	3.67	4.00	5.00	0.00	4.67	3.25	3.00	3.00	5.00
Smartphone applications (Grindr, Scruff, etc.)	4.00	2.60	3.80	2.50	2.40	3.00	3.50	4.00	3.67	2.56	3.20	4.00	0.00	4.11	3.00	1.50	2.75	5.00
Social media (Facebook, Twitter, etc.)	3.75	3.40	4.40	2.00	3.60	4.00	3.00	3.33	3.67	3.11	3.80	5.00	5.00	3.67	4.00	3.00	3.25	5.00

	Malta	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	Netherlands	UK	EU
Gay community groups	1.00	3.33	2.00	3.77	4.00	5.00	4.50	3.07	3.00	1.00	2.83	3.17
Gay bars	3.00	4.33	5.00	3.46	2.00	4.00	1.00	3.64	3.33	3.00	3.57	3.45
Gay clubs or discos	5.00	4.00	5.00	3.31	3.67	4.00	4.50	3.43	4.00	3.00	2.87	3.69
Gay saunas or bathhouses	0.00	5.00	5.00	3.92	1.33	5.00	4.00	4.21	3.00	3.00	3.09	3.42
Gay cruising grounds (public sex environments)	3.00	4.67	4.00	3.08	4.00	4.00	3.50	3.79	4.33	3.00	3.65	3.07
Gay sex clubs (sex on premises venues)	0.00	4.67	5.00	3.08	1.00	0.00	0.00	3.93	3.33	3.00	2.91	2.56
Sexual health clinics	5.00	4.33	5.00	3.54	4.00	4.00	4.00	3.79	4.00	4.00	4.61	3.21
Other medical settings	2.00	3.67	5.00	3.00	3.00	4.00	4.50	3.38	3.00	4.00	3.78	3.00
MSM websites	5.00	5.00	5.00	3.62	4.67	5.00	4.50	4.07	5.00	4.00	3.91	4.10
Smartphone applications (Grindr, Scruff, etc.)	5.00	5.00	5.00	2.85	3.33	3.00	4.50	3.71	4.00	5.00	4.26	3.49
Social media (Facebook, Twitter, etc.)	5.00	4.33	5.00	3.62	3.67	4.00	4.50	4.14	3.67	4.00	3.26	3.87

## Appendix 4. Popularity of online spaces by country

Thinking about MSM websites and smart phone applications used to meet sexual partners, in your opinion, which are the most popular with MSM in your area?

	EU	Austria	Belgium	Bulgaria	Croatia	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania
Grindr	4.34	4	4.5	5	4	3.8	4.5	4.5	4.33	3.8	3.6	3.18	4		4.8	5	5	3.33
GayRomeo	3.49	5	4.33	0.8	5	3.6	1.5	3.75	4.66	3.8	5	4.72	5		0.1	3.6	4	4
Scruff	1.41	1.25	1.16	0	2	0	3	1.75	0.66	2	1.2	2	2		1.2	1	0	0
National	0.88	1.25	0	0	3	3	2.5	0	1.66	1	0	0	0		0	0	0	1.66
Gaydar	0.85	0.75	0.66	0	0	1	0	1.25	0.66	0.6	0.6	2.18	0		2.9	0.6	0	1.33
Hornet	0.69	0	0.5	0	0	0.6	1	1.75	0	2.6	0.1	0	0		0.8	1	3	1.33
Tinder	0.39	0.5	0.16	0	0	0	1.5	0	1.33	0.4	0	0	0		0	0.8	0	1
Manhunt	0.33	0.25	0.16	0	0	0	0	0.75	0.33	0.2	0.4	0.09	0		0.9	0.2	0	0
Recon	0.30	0	1	0	1	0	0.5	0	1	0.2	0.5	0	3		0	0	0	0
Growlr	0.29	0	0.5	0	0	0.4	0	0	0	0	0.4	0.54	0		1.1	0.6	0	0
BarebackRT	0.10	0	0	0	0	0	0	0	0	0.8	0.1	0.27	1		0	0	0	0
Squirt	0.09	0	0	0	0	0	0	0	0	0.2	0	0.27	0		1	0	0	0
Fitlads	0.05	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0
Dudesnude	0.04	0	0	0	0	0	0	0	0	0	0.3	0.27	0		0.3	0	0	0
Jack'd	0.02	0.25	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0
Adam4Adam	0.01	0	0	0	0	0	0	0.25	0	0	0	0	0		0	0	0	0
Guyspy	0.00	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0

	Luxembourg	Malta	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	Netherlands	UK
Grindr	4	5	5	5	3.64	4.25	4.66	4	4.28	4.66	5	4.88
GayRomeo	5	3	3.33	4	2.42	4.75	4.33	5	2.92	3	1	0.22
Scruff	0	0	2	3	1.35	0.25	0	3	1.28	3.33	4	2.11
National	0	0	1.66	0	0	0	1.66	2.5	1.42	3.33	0	0
Gaydar	0	4	1.66	1	0.85	0	0	0	1.57	0.33	0	2.07
Hornet	0	0	0	0	0.35	1.25	0	1	0	0.66	3	0.55
Tinder	0	0	1.33	2	0.92	0	0	0	0.71	0	0	0.44
Manhunt	0	0	0	0	3.14	0.75	0	1	0.71	0	0	0.37
Recon	0	0	0	0	0.07	0	0	0	0	0.66	0	0.48
Growlr	0	0	0	0	0	0	0	1	1.21	0	2	0.44
BarebackRT	0	0	0	0	0	0	0	0	0	0	0	0.66
Squirt	0	0	0	0	0	0	0	0	0	0	0	1.25
Fitlads	0	1	0	0	0	0	0	0	0	0	0	0.51
Dudesnude	0	0	0.33	0	0.14	0	0	0	0	0	0	0
Jack'd	0	0	0.33	0	0	0	0	0	0	0	0	0.22
Adam4Adam	0	0	0	0	0	0	0	0	0	0	0	0.22
Guyspy	0	0	0	0	0	0	0	0	0	0	0	0.03

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