

## **Hepatitis C testing among three distinct groups of gay, bisexual and other men who have sex with men: a cross-sectional study in the Celtic nations**

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## TITLE

Hepatitis C testing among three distinct groups of gay, bisexual and other men who have sex with men: A cross-sectional study in the Celtic nations.

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Hepatitis C; Pre-Exposure prophylaxis; Sexual and Gender Minorities; Serologic Tests

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## ABSTRACT

**Objective:** The hepatitis C virus (HCV) epidemic among gay, bisexual and other men who have sex with men (GBMSM) is associated with sexual and drug-related behaviours. To stem the tide of HCV infection in GBMSM, regular testing leading to early diagnosis and treatment as prevention, is vital. This study aims to evaluate the success of current HCV testing guidelines from the perspective of GBMSM in four Celtic nations.

**Methods:** Subpopulation analysis of data from the 2020 cross-sectional online SMMASH3 survey were undertaken to examine HCV testing experiences and sexual behaviours among sexually active GBMSM (n=1886) stratified across three groups: HIV-diagnosed GBMSM (n=124); HIV-negative GBMSM using pre-exposure prophylaxis (PrEP) (n=365); and HIV-negative/untested GBMSM *not* using PrEP (n=1397).

**Results:** Sexual behaviours associated with HCV acquisition were reported by the majority of HIV-diagnosed (76.6%, n=95) and PrEP-using (93.2%, n=340) GBMSM. Reassuringly, recent testing for HCV in these groups was common, with 79.8% (n=99) and 80.5% (n=294) self-reporting HCV screening within the preceding year respectively, mostly within sexual health settings. While 54.5% (n=762) of HIV-negative/untested GBMSM not using PrEP reported sexual behaviours associated with HCV, 52.0% had not been screened for HCV in the last year, despite almost half (48.0%, n=190) of unscreened men being in contact with sexual health services in the same period.

**Conclusions:** Sexual behaviours associated with HCV acquisition among HIV-diagnosed and PrEP-using GBMSM are common but complemented by regular HCV testing within sexual health services. Current testing guidelines for these groups appear to be effective and generally well observed. However, behaviour-based HCV testing for HIV-negative/untested GBMSM *not* using PrEP appears less effective, and may undermine efforts to achieve HCV elimination. Accordingly, we need to increase HCV-testing for these men in clinical settings and explore ways to screen those who are not in touch with sexual health services.

## WHAT IS ALREADY KNOWN ON THIS TOPIC

- Increasing HCV testing and diagnosis among GBMSM is an integral component of HCV elimination.

## WHAT THIS STUDY ADDS

- Current HCV testing guidelines for HIV-diagnosed and PrEP-using GBMSM appear to be effective and generally well observed, even among men who report behaviours associated with HCV acquisition.
- However, over half of HIV-negative/untested GBMSM not using PrEP reported HCV-related behaviours in the last year, and over half of those had not been tested for HCV, despite many being in touch with sexual health services.

## HOW MIGHT THIS STUDY AFFECT RESEARCH, PRACTICE OR POLICY?

- HIV-negative GBMSM who use PrEP have higher rates of screening for HCV than GBMSM who do not. Therefore, expanding access to PrEP for HIV-negative GBMSM has implications for HCV elimination strategies, in addition to its impact on HIV transmission.
- We need to increase HCV-testing in clinical settings among HIV-negative/untested GBMSM who are not using PrEP, and explore ways to identify and screen those who are not in touch with sexual health services.

## INTRODUCTION

The Hepatitis C virus (HCV) is a blood-borne liver infection, and a leading cause of mortality and morbidity worldwide<sup>1</sup>. While iatrogenic infection through invasive medical procedures is a significant route of HCV transmission in low- and middle-income countries, acquisition of HCV in high-income nations is primarily associated with recreational drug injection<sup>1</sup>. These modes of infection are not exhaustive, however, and since the mid-2000s a growing epidemic of HCV among HIV-diagnosed gay, bisexual and other men who have sex with men (GBMSM) has been reported around the globe, linked primarily to sexual behaviours<sup>2</sup>. These include unprotected receptive and/or 'traumatic' anal intercourse, unprotected fisting, chemsex (the sexualised use and injection of drugs), group sex, and the presence of another sexually transmitted infection (STI), notably LGV and syphilis<sup>3-5</sup>.

Recent evidence suggests the HCV epidemic in GBMSM is evolving and expanding. An increased incidence of HCV in HIV-*negative* GBMSM has been reported in a number of studies, with infection centring around HIV-negative GBMSM taking pre-exposure prophylaxis (PrEP)<sup>6-9</sup>. It has been hypothesised that the advent of PrEP has decreased practices such as serosorting, leading to HIV-negative GBMSM having sex within broader sexual networks<sup>7</sup>. Indeed, transmission of HCV between HIV-diagnosed and PrEP-using GBMSM has been repeatedly demonstrated through phylogenetic analyses<sup>10-12</sup>, enabled by shared and ongoing sexual behaviours<sup>13</sup>. However, the extent of this phenomenon is unclear, as contrasting population-level data from Australia demonstrates persistently low HCV incidence among HIV-negative GBMSM over time<sup>14</sup>.

Importantly, *repeated* HCV infection in GBMSM appears common. While estimates vary, rates of HCV reinfection for HIV-positive GBMSM have been reported up to 20 times higher than primary infection<sup>15</sup>, and while fewer studies examined PrEP-using GBMSM, a similar pattern seems to prevail<sup>3,7</sup>. GBMSM who have been diagnosed with HCV once appear much more likely to acquire the infection again.

To stem the tide of HCV infection and *reinfection* among GBMSM, regular testing leading to early diagnosis and treatment as prevention is vital<sup>16</sup>. In the UK and Ireland, HCV testing among GBMSM is encased in a range of national guidelines, which differentiate frequency based on behavioural assessment, PrEP-use and HIV status<sup>4,17-20</sup>. For HIV-diagnosed GBMSM, testing at least annually is recommended in both the UK and Ireland, with more frequent testing indicated if specific behaviours are identified or other STIs diagnosed<sup>17-19</sup>. Three-monthly testing for PrEP-using GBMSM is recommended in the UK<sup>20</sup>, while the HCV screening guidelines for Ireland make no recommendations in relation to PrEP<sup>19</sup>. For HIV-negative/untested GBMSM who do not use PrEP, behaviour-based HCV assessment is encouraged to guide testing frequency in the UK<sup>4</sup>, with recommendations for at least annual HCV testing to be offered in Ireland<sup>19</sup>. This study aims to evaluate the success of these guidelines from the perspective of GBMSM in Scotland, Wales, Northern Ireland, and the Republic of Ireland. These countries are known collectively as the Celtic nations for political, ethnocultural and language-related reasons, and are referred to as such within this paper<sup>21</sup>. Using data from 2020 we examined HCV-associated behaviours, willingness to test and testing experiences among sexually active GBMSM, across the three groups differentiated within national guidelines<sup>4,17-20</sup>: i) HIV-diagnosed GBMSM, ii) HIV-negative GBMSM using PrEP, iii) HIV-negative/untested GBMSM not using PrEP.

## METHODS

The social media, men who have sex with men, sexual and holistic health (SMMASH3) study is the third iteration of a serial, cross-sectional online survey conducted within the Celtic nations<sup>22-24</sup>. The questionnaire (<https://www.smmash2020.org/surveys>) was developed by an interdisciplinary steering group which included community members, and administered via REDCap, an online survey application. A detailed account of the development and administration of SMMASH3 has been described elsewhere<sup>25</sup>. In summary, GBMSM using gay-facing sociosexual websites and apps were

targeted with message ‘blasts’ or banner ads promoting and linking to the survey. In addition, paid advertising was used on Facebook to target men who ‘liked’ a range of LGBTQ+ related social issues, with Twitter accounts from commercial gay venues and support sectors also retweeting invitations to participate. Inclusion criteria were men wishing to or having sex with men and aged  $\geq 16$  if located in Scotland, Wales and Northern Ireland, or  $\geq 17$  if located in the Republic of Ireland, based on the local age of sexual consent. Participants who clicked on adverts were taken to an information sheet outlining the voluntary nature of the study and explaining the confidentiality of any data collected, before linking to the survey itself. Recruitment took place between December 2019 and mid-March 2020 and was completed before the national lockdowns associated with the COVID-19 pandemic.

Subpopulation analysis of SMMASH3 data examined HCV testing experiences among sexually active GBMSM, across three distinct groups differentiated within national HCV testing guidelines: i) HIV-diagnosed GBMSM, ii) HIV-negative GBMSM using PrEP, iii) HIV-negative/untested GBMSM not using PrEP. Sexually active GBMSM were defined as reporting sexual activity with a male partner in the last year (participants reporting only female partners in the preceding year were excluded). The survey measured demographics (location at time of the survey, age, gender, sexual orientation, ethnicity, relationship status), sexual behaviours with regular and/or casual partners, recreational drug use, STI/HIV testing and diagnoses, PrEP use and HCV testing history and willingness. The HCV testing question was worded “*when was your most recent test for hepatitis C?*” and did not differentiate between antibody and RNA testing.

Behavioural variables associated with HCV infection were categorised as i) any STI diagnosis, ii) chlamydia, LGV or gonorrhoea diagnosed rectally, iii) being fisted, iv) group sex, v) chemsex (defined as any sex in the last year after taking crystal methamphetamine, mephedrone, GHB/GBL or ketamine), vi) serosorting (defined as reporting condomless anal intercourse only with partners of the same HIV status, regardless of whether any other biological or behavioural risk reduction strategies were included) and vii) condomless receptive anal intercourse with  $>1$  partner in the last year.

Data were screened to exclude men who were not in the Celtic nations during data collection, who were not sexually active, or did not report their HCV or HIV testing behaviours (see Figure 1). SPSS v.28 was used to calculate descriptive statistics to compare HCV testing, willingness to test, and sexual behaviours across our three distinct groups.

## RESULTS

A total of 1886 sexually active GBMSM located in the Celtic nations who reported their HIV and HCV testing history were included (see Table 1). 233 participants (10.8%) did not report their HCV testing behaviours, and were therefore excluded. Further analysis demonstrated HIV-diagnosed and PrEP-using GBMSM were significantly more likely to report their HCV testing data than GBMSM who were HIV negative/unttested and not using PrEP. This is likely because the men were more invested in the medical management of their sexual health and so more willing to complete our lengthy survey which focused largely on sexual health issues. No other differences in demographic or HCV-associated behaviours were observed between men who did, and did not, report HCV testing data (see Supplementary file S1).

The men included in the analysis comprised 124 HIV-diagnosed GBMSM, 365 PrEP-using GBMSM and 1397 HIV-negative/unttested GBMSM not using PrEP. The majority were from Scotland (n=935, 49.6%) and most were aged  $\geq 46$  years (n=664, 35.2%), with fewer younger men, aged 16-25 (n=263, 13.9%). Nearly all identified as male (97.4%, n=1837), and while most identified as gay (n=1517, 80.4%) a substantial minority reported bisexual, heterosexual or other identities (n=363, 19.2%). Over half (n=1050, 55.7%) were single, and one third reported a regular male partner (including civil partnerships and marriage, n=663, 35.2%). Reported HCV testing, willingness to test and HCV-associated behaviours in i) HIV-diagnosed GBMSM, ii) GBMSM using PrEP and iii) HIV-negative/unttested GBMSM not using PrEP are shown in Table 2. These data are discussed below, by each of our three groups.



Table 1: Demographic characteristics of included GBMSM.

	Total n = 1886	
<b>Country</b>		
Scotland	935	49.6
Wales	251	13.3
Northern Ireland	143	7.6
Republic of Ireland	557	29.5
<b>Age</b>		
16 - 25	263	13.9
26 – 35	500	26.5
36 – 45	459	24.3
≥46	664	35.2
<b>Gender<sup>1</sup></b>		
Male	1837	97.4
Trans/Nonbinary/Female/Other	44	2.3
No response	5	0.3
<b>Sexual Orientation</b>		
Gay	1517	80.4
Bisexual/Straight/Other	363	19.2
No response	6	0.3
<b>Ethnicity</b>		
White	1806	95.8
People of colour	57	3.0
No response	23	1.2
<b>Relationship status<sup>2</sup></b>		
Single	1050	55.7
Regular male partner	663	35.2
Regular female partner	164	8.7
No response	9	0.4
<b>HIV testing Status</b>		
HIV Positive	124	6.6
HIV Negative	1481	78.5
Untested / Don't know	281	14.9
<b>PrEP Use</b>		
On PrEP	365	19.4
Not on PrEP	1397	74.0
HIV Positive	124	6.6

<sup>1</sup> Individuals with one or more missing demographic responses were included in the analysis if inclusion criteria were fulfilled.

<sup>2</sup> A small number of participants reported polyamorous and open relationships, but these all involved at least one male partner and so were coded as having a regular male partner. Men who reported they were widowed or separated were categorised as single.

Table 2: HCV testing, willingness to test, and HCV--associated behaviours in i) HIV-diagnosed GBMSM, ii) GBMSM-using PrEP and iii) HIV negative/unttested GBMSM not using PrEP.

	HIV-diagnosed GBMSM n = 124		GBMSM-using PrEP n = 365		HIV negative/unttested GBMSM not using PrEP n = 1397	
	n	%	n	%	n	%
<b>Last HCV Test</b>						
Past 3 months	56	45.2	201	55.1	191	13.7
Past 3 – 12 months	43	34.6	93	25.5	325	23.2
1-5 years ago	7	5.6	24	6.6	290	20.8
>5 years ago	6	4.8	9	2.5	143	10.2
Never	3	2.4	9	2.5	281	20.1
Unsure	9	7.3	29	7.9	167	12.0
<b>Past year (cumulative)</b>	99	79.8	294	80.5	516	36.9
<b>Where tested for HCV in the last year</b>						
Sexual health clinic for GBMSM	15	15.2	148	50.3	185	35.9
Generic sexual health clinic	31	31.3	147	50.0	210	40.7
HIV Clinic	45	45.5	n/a	n/a	n/a	n/a
Hospital (other than sexual health clinic)	13	13.1	11	3.7	41	7.9
Outreach or community clinic	1	1.0	1	0.3	16	3.1
GP	1	1.0	9	3.1	87	16.9
Home testing	0	0	1	0.3	18	3.5
<b>Ever been diagnosed with HCV?</b>						
Yes	8	6.5	4	1.1	18	1.3
No	104	83.9	322	91.0	921	66.4
Never tested / unsure	12	9.7	28	7.9	448	32.3

Willing to test for HCV...	...as part of your HIV care?		...as part of your PrEP care?		...using a blood sample you gave for an HIV test?	
	n	%	n	%	n	%
3 monthly	33	27.5	275	75.5	381	27.5
6 monthly	70	58.3	62	17.0	353	25.5
Annually	16	13.3	24	6.6	481	34.8
Every 5 years	<i>Option not presented</i>		<i>Option not presented</i>		83	6.0
Never	1	0.8	3	0.8	85	6.1
<b>Past year (cumulative)</b>	119	99.2	361	99.2	1215	87.8
<b>HCV-associated behaviours in the last year</b>						
STI diagnosis	37	30.1	125	34.4	105	7.5
Rectal Chlamydia, LGV or Gonorrhoea	27	21.8	75	20.7	39	2.8
Being fisted	16	12.9	44	12.1	64	4.6
Group sex / sex party	58	46.8	232	63.6	364	26.1
Serosorting <sup>1</sup>	8	6.5	117	32.1	335	24.0
Chemsex	33	31.4	67	19.9	49	4.0
Condomless receptive anal intercourse with >1 partner	83	66.9	273	74.8	340	24.3
<b>Reporting any HCV-associated behaviours in the last year<sup>2</sup></b>	95	76.6	340	93.2	762	54.5
<b>In touch with sexual health clinical services in the last year?</b>						
STI test in the last year	93	85.5	310	85.2	632	45.2
HIV test in the last year	n/a	n/a	357	98.1	779	55.8
On HIV Treatment	121	98.4	n/a	n/a	n/a	n/a
PrEP from a sexual health clinic or trial	n/a	n/a	294	80.8	n/a	n/a
In touch with any sexual health clinical service(s) in the last year?	124	100	361	98.9	813	58.2

<sup>1</sup> Defined as condomless anal sex with men of the same HIV status, regardless of whether any other biological or behavioural risk reduction strategies were included.

<sup>2</sup> Excluding being HIV+ or using PrEP

Table 3: HCV testing and contact with clinical services among men reporting HCV-associated behaviours in the last year

	HIV-diagnosed GBMSM n=95		GBMSM-using PrEP n = 340		HIV negative/untested GBMSM not using PrEP n = 762	
<b>Last HCV test</b>						
Past 3 months	46	48.4	191	56.2	139	17.8
Past 3 – 12 months	29	30.5	87	25.6	236	30.3
1-5 years ago	7	7.4	21	6.2	152	19.5
>5 years ago	4	4.2	8	2.4	61	7.8
Never	3	3.2	9	2.6	101	13.0
Unsure	6	6.3	24	7.1	90	11.6
<b>Past year (cumulative)</b>	<b>75</b>	<b>78.9</b>	<b>278</b>	<b>81.8</b>	<b>366</b>	<b>48.0</b>
<b>In touch with sexual health clinical services in the last year?</b>						
Yes	95	100	337	99.1	552	72.4
No	0	0	3	0.9	210	27.6
<b>Not screened for HCV in the last year</b>						
In touch with clinical services	n/a	n/a	59	95.2	190	48.0
Not in touch with clinical services	n/a	n/a	3	4.8	206	52.0

## HIV-diagnosed GBMSM

Most HIV-diagnosed men reported an HCV test in the previous year (n=99, 79.8%) and most within their HIV clinic. Only 6.5% (n=8) of HIV-diagnosed men in this sample reported ever being diagnosed for HCV in their lifetime, and all only once. Almost all HIV-diagnosed participants (n=119, 99.2%) said they would be willing to be tested annually for HCV as part of regular HIV care, with one quarter (n=33; 27.5%) agreeable to 3 monthly testing. Over three-quarters of HIV-diagnosed participants (n=95, 76.6%) reported one or more HCV-associated behaviours in the last year. Of these men, almost half (n=46, 48.4%) reported an HCV test in the last three months, and one in five (n=20, 21.1%) reported no HCV test in the last year. All HIV-diagnosed men reported being in touch with STI clinical services, suggesting HCV screening was well positioned as part of routine HIV care.

## GBMSM using PrEP

Most men on PrEP reported an HCV test in the previous year (n=294, 80.5%) with most testing in a GBMSM-specific or generic sexual health clinic. Only 1.1% (n=4) of PrEP-using GBMSM reported a HCV diagnosis in their lifetime, and only one participant reported being diagnosed more than once. Our questionnaire did not distinguish between antibody and RNA testing, however, our focus on diagnosis within the question (“have you ever been diagnosed with hepatitis C?”) rather than ‘testing positive’ inferred clinical interpretation of a positive result. Three-quarters (n=275, 75.5%) of PrEP-using GBMSM were willing to test for HCV every three months as part of their regular PrEP care. The vast majority of men on PrEP (n=340, 93.2%) reported at least one HCV-associated behaviour in the last year. Of these men, over half (56.2%, n=191) reported an HCV test in the last three months, and fewer than one in five (18.2%, n=62) reported no test in the last year. Almost all (n=337, 99.1%) PrEP-using GBMSM who reported HCV behaviours were in touch with STI clinical services in the last year, suggesting this is an ideal location to screen this group for HCV.

## HIV-negative/unttested GBMSM not using PrEP

Only around one-third (n=516, 36.9%) of HIV-negative/unttested GBMSM not using PrEP reported an HCV test in the last year, with most testing in either a generic or GBMSM-specific sexual health clinic. Only 1.3% (n=18) of men in this group reported being diagnosed with HCV, and all only once. Although higher than for GBMSM-using PrEP, this may be explained by the older age profile of HIV-negative/unttested men not on PrEP (data not shown). Willingness to test for HCV as part of HIV screening was high with almost nine in ten (n=1215, 87.8%) agreeable to an annual test. Over half (n=762, 54.5%) reported HCV-associated behaviours, but of these only 48.0% (n=366) reported an HCV test in the last year, despite almost three-quarters (n=552, 72.4%) being in touch with sexual health clinical services. This suggests HCV testing for this group is suboptimal, and while further work is required to identify the causes, sexual health clinics provide an ideal opportunity to screen.

## DISCUSSION

In 2016, the World Health Organisation (WHO) published the first Global Health Sector strategy towards eliminating viral hepatitis as a significant threat to public health, with aims including the reduction of HCV incidence by 90% by 2030<sup>1</sup>. Within populations of GBMSM, scaling up HCV testing, diagnosis and treatment is a vital component to achieving that goal<sup>26</sup>, with testing the first crucial step in the care cascade.

Within this Celtic nations cohort, recent testing for HCV in sexually-active HIV-diagnosed and PrEP-using GBMSM was common, with 79.8% and 80.5% respectively self-reporting HCV screening within the preceding year. While encouraging, the vast majority of these men were in routine contact with sexual health and/or HIV clinics, therefore one in five reporting not being tested demands further consideration. While lack of awareness of being tested for HCV may account for some responses, there are also well reported barriers to testing such as perceived stigma, fear of a positive result and perceptions of being 'low-risk' for HCV<sup>27</sup>. Of note, while three-quarters of HIV-diagnosed men

reported at least one HCV-associated behaviour in the last year, this increased to almost 95% for PrEP-using GBMSM. Predominant among those behaviours were high rates of chemsex, participation in group sex, condomless receptive anal sex with more than one partner, and an STI diagnosis in the last year. For GBMSM using PrEP, serosorting was also frequently reported, although given evidence supporting this behaviour is based on pre-PrEP era data, the continued relevance of this is unclear. HCV screening was common among these men; only 21.1% of HIV-diagnosed and 18.2% of PrEP-using GBMSM who reported HCV-associated behaviours in the preceding year had *not* been tested within the same period. Such findings stand in contrast to data from the United States published in 2021, where Li and colleagues<sup>28</sup> reported an average annual HCV testing rate of 30.3% among a large cohort of HIV-diagnosed GBMSM, despite national guidelines recommending *at least* annual testing for this group.

Other real-world data quantifying HCV testing frequency in GBMSM is limited. Crowell and colleagues<sup>29</sup> described a self-report of prior HCV testing among GBMSM who were 'behaviourally vulnerable' to HIV (and therefore similar to our PrEP-using cohort) upon entry to the German BRAHMS study in 2021. They reported 77.4% had ever been tested for HCV, with 50.4% tested within the preceding six months, similar to our Celtic cohort. A much lower lifetime history for HCV testing has been described among 16-30-year old GBMSM in China<sup>30</sup>, although few data on their sexual behaviours were provided. Of course, testing behaviours may be closely related to screening access. Publicly funded sexual health testing is available in all Celtic nations through the National Health Service (Scotland and Wales), Health and Social Care (Northern Ireland) and the Health Service Executive (Republic of Ireland), in addition to private healthcare options. However, the balance of access to publicly funded and private services may vary geographically within and between the Celtic nations.

Reassuringly, willingness to be tested for HCV was extremely high among sexually active HIV-diagnosed and PrEP-using GBMSM. Almost all HIV-diagnosed GBMSM were willing to be screened

annually as part of their HIV care, in line with current guidance<sup>17-19</sup>, and while three quarters of PrEP-using GBMSM were agreeable with recommendations for three monthly testing<sup>20</sup>, almost all were willing to be tested for HCV annually as part of PrEP provision. Such willingness to test is vital, as recent modelling has demonstrated the impact regular screening of HIV-diagnosed and PrEP-using GBMSM can make to the HCV elimination agenda<sup>26</sup>. However, with current PrEP-coverage rates at around 20% of GBMSM in the Celtic nations, this alone is unlikely to achieve WHO elimination targets, meaning a focus on HCV testing among sexually active HIV-negative/untested GBMSM who do *not* use PrEP is also required<sup>26</sup>.

Only 36.9% of HIV-negative/untested GBMSM not using PrEP reported being screened for HCV within the preceding year, and a further third had never received an HCV test, or were unsure whether they had, in their lifetime. However, just over half (54.5%) of these men described at least one HCV-associated behaviour in the preceding year, of whom half (52.0%) had not received an HCV screen in the same period. It may be hypothesised that those not testing had simply not been in touch with services, yet almost half (48.0%) of those reporting HCV behaviours and who had *not* been tested, had been in contact with sexual health services in the preceding year. While current guidelines advocate behaviour-based HCV testing for GBMSM not using PrEP in Scotland, Wales and Northern Ireland<sup>4</sup>, our results suggest this strategy is not yet achieving its goals, while the Republic of Ireland's annual testing policy<sup>19</sup> is only partially successful. Known provider barriers to offering HCV testing include lack of knowledge and discomfort in asking about behaviours<sup>27</sup>, but further exploration with practitioners working in sexual health settings specifically would help contextualise these findings. Moreover, it remains a priority to encourage those HIV-negative/untested GBMSM not using PrEP to disclose behaviours which are associated with HCV infection and for the majority, by extension, HIV and other STIs. Finally, our results clearly demonstrate HIV-negative GBMSM who use PrEP have higher rates of HCV screening than GBMSM who do not. As such, expanding access to PrEP for HIV-negative GBMSM has implications for HCV elimination strategies, in addition to its impact on HIV transmission.



## Strengths and limitations

This study examined a large, well-constructed dataset providing information about HCV behaviours, testing and willingness to test among GBMSM, conceptualising 'risk' in line with current guidelines. While our broad sample across a wide geographic setting strengthens our findings, there are also limitations to this study. Sampling primarily from sociosexual-networking sites risks excluding those unable to access or afford these technologies, and is likely to bias the dataset towards more highly educated men who are more likely to perform HCV-associated behaviours<sup>26</sup>. Survey responses are also subject to self-reporting bias. Although our questions related to HCV behavioural criteria, we did not specifically ask about 'traumatic' anal intercourse nor whether fisting was 'protected'. Scotland was over-represented in our sample and Wales, Northern Ireland and the Republic of Ireland were under-represented based on their population size. This was driven partly by our funding strategy, and the regional nature of the lead institution and key third sector partners. The majority of our sample was white. Although this reflects the demographic ethnicity of the Celtic nations, it limits the transferability of our data to more ethnically diverse cultures. Finally, our recruitment strategy focused on 'men', which likely excluded gender-diverse participants. Moreover, our sexual behaviour questions were poorly designed to capture non-binary and trans sexual experiences and likely impaired accurate recording of these data. As part of the International 21<sup>st</sup> Century Behavioural Surveillance Network we are actively invested in creating and incorporating non-binary and trans-inclusive sexual behaviour questionnaires going forward.

## CONCLUSION

Testing is the vanguard of the HCV care cascade. While our study provides some reassurance that current guidelines for HIV-diagnosed and PrEP-using GBMSM are achieving their aims, and confirms that HIV/PrEP services provide an optimal strategy to reach these men, a revised approach to HCV testing for other GBMSM may be required to realise WHO elimination targets<sup>1</sup>. HIV-negative/untested

GBMSM not using PrEP formed the majority of our participants, but a behaviour-based testing approach for HCV based on HIV-status and PrEP use may often miss key behaviours and restrict HCV screening for GBMSM in the Celtic nations.

## **CONTRIBUTORSHIP STATEMENT**

DW, JF and SB conceptualised this article using data from the SMMASH3 study. DS and PV contributed to the original design of SMMASH3, led by JF. DS and JF collected the data. JF, DW and SB performed this subpopulation analysis and interpreted the data. DW and JF drafted the original manuscript, with all authors contributing to critical review and revision.

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## **COMPETING INTERESTS**

DW has received speaker's honoraria from Gilead and Janssen and funding for attendance at conferences and educational meetings from Janssen, MSD and BMS. The other authors have nothing to declare.

## **ETHICAL APPROVAL**

This study involved human participants. A favourable ethical opinion was sought and given by Glasgow Caledonian University School of Health and Life Sciences Ethics Subcommittee

(HLS/NCH/19/019). Participants gave informed consent to participate in this study before taking part.

All data were treated as confidential and anonymous.

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