



OPEN ACCESS

Impact of national commissioning of pre-exposure prophylaxis (PrEP) on equity of access in England: a PrEP-to-need ratio investigation

Flavien Coukan ^{1,2} Ann Sullivan,^{3,4} Holly Mitchell,⁵ Sajjida Jaffer,⁶ Andy Williams,⁷ John Saunders,^{5,8} Christina Atchison,^{2,9} Helen Ward^{1,2,9}

► Additional supplemental material is published online only. To view, please visit the journal online (<https://doi.org/10.1136/sextrans-2023-055989>).

For numbered affiliations see end of article.

Correspondence to

Mr Flavien Coukan, National Institute for Health Research Applied Research Collaboration North West London, Chelsea and Westminster Hospital, London, UK; flavien.coukan15@imperial.ac.uk

Received 12 September 2023
Accepted 13 January 2024
Published Online First
20 March 2024

ABSTRACT

Objectives HIV pre-exposure prophylaxis (PrEP) is highly effective in preventing HIV acquisition. In England, NHS availability was limited to participants of the PrEP Impact Trial until late 2020. Some key populations at greater risk of HIV were under-represented in the trial suggesting inequities in trial PrEP access. We used the PrEP-to-need ratio (PnR; number of PrEP users divided by new HIV diagnoses) to investigate whether PrEP access improved following routine commissioning in October 2020 and identify populations most underserved by PrEP.

Methods Aggregated numbers of people receiving ≥ 1 PrEP prescription and non-late new HIV diagnoses (epidemiological proxy for PrEP need) were taken from national surveillance data sets. We calculated the PnR across socio-demographics during Impact (October 2017 to February 2020; pre-COVID-19 pandemic) and post-commissioning PrEP era (2021) in England.

Results PnR increased >11 fold, from 4.2 precommissioning to 48.9 in 2021, due to a fourfold reduction in non-late new HIV diagnoses and near threefold increase in PrEP users. PnR increased across genders, however, the men's PnR increased 12-fold (from 5.4 precommissioning to 63.9 postcommissioning) while the women's increased sevenfold (0.5 to 3.5). This increasing gender-based inequity was observed across age, ethnicity and region of residence: white men had the highest PnR, increasing >13 fold (7.1 to 96.0), while Black African women consistently had the lowest PnR, only increasing slightly (0.1 to 0.3) postcommissioning, suggesting they were the most underserved group. Precommissioning, the PnR was 78-fold higher among white men than Black women, increasing to 278-fold postcommissioning.

Conclusions Despite the overall increase in PrEP use, substantial PrEP Impact trial inequities widened postcommissioning in England, particularly across gender, ethnicity and region of residence. This study emphasises the need to guide HIV combination prevention based on equity metrics relative to the HIV epidemic. The PnR could support the optimisation of combination prevention to achieve zero new HIV infections in England by 2030.

INTRODUCTION

The HIV epidemic has evolved substantially in the United Kingdom (UK) over the last two decades. The number of new HIV diagnoses peaked at just under 8000 in 2005, falling to 2955 in 2021, a 64% reduction.¹ In England, this reduction was largely

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ In the United Kingdom (UK), men who have sex with men have championed HIV pre-exposure prophylaxis (PrEP) as part of comprehensive HIV combination prevention and are the majority of PrEP users across nations following its commissioning.

WHAT THIS STUDY ADDS

⇒ This study shows that following PrEP commissioning in late 2020 in England, equity gaps across gender, age, ethnicity and region of residence widened significantly, as demonstrated by the PrEP-to-need ratio (PnR) equity metric; although this rose across all groups.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The PnR is a pragmatic standardised metric to identify those most underserved by PrEP relative to the HIV epidemic. These populations will require specific attention via involvement and engagement to end HIV transmission by 2030 as they are also underserved by other HIV preventions and treatments.

driven by a threefold drop in new HIV diagnoses among men who have sex with men (MSM) since mid-2010.¹ This decline has not been as marked in other key populations such as Black women, people of Asian ethnicity, injecting drug users and those residing outside of London, partially explained by a differential uptake of HIV testing.¹

HIV pre-exposure prophylaxis (PrEP) involves HIV-negative people taking antiretrovirals to prevent HIV acquisition and is highly effective in preventing infection.^{2–4} Wales and Scotland commissioned PrEP programmes in 2017, and Northern Ireland provided an extended pilot from 2018.⁵ However, in England, PrEP was initially only accessible via the Impact trial, which was limited to 26 000 places from 2017 until July 2020, when the Department of Health and Social Care announced routine PrEP commissioning. This commissioning was restricted to specialist sexual health services (SSHS); open access services which anyone can attend for free regardless of residency status.⁶ Findings from the PrEP Impact trial, delivered in SSHS, showed that 96% of participants were MSM,



© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY. Published by BMJ.

To cite: Coukan F, Sullivan A, Mitchell H, et al. *Sex Transm Infect* 2024;**100**:166–172.

a population that accounted for <40% of all new HIV diagnoses in 2020.¹⁷ The Welsh and Scottish PrEP programmes have shown similar under-representation of non-MSM populations.^{8,9}

A recent systematic review found many factors hindering access to PrEP in the UK, including lack of PrEP knowledge, lack of self-perception of HIV risk, HIV stigma and lack of access to a PrEP provider.¹⁰ It also highlighted MSM as the most studied population, reflecting the under-representation of other populations at high risk of HIV acquisition in PrEP use research.

The delivery of PrEP in England, therefore, needs to be more equitable, in line with the UK Government's 2022 HIV Action Plan¹¹: doing so requires a better understanding of which populations are most underserved by PrEP delivery. This will support further research into the specific barriers faced by these populations to identify potential ways to increase PrEP access.

Objective

This study aimed to investigate whether equity of access to PrEP (as estimated by PrEP-to-need ratio (PnR)) improved following its commissioning at the end of the PrEP Impact trial. We hypothesised that the unlimited supply following PrEP commissioning would lead to an increase in equity of access across populations at risk.

METHODS

We performed a cross-sectional analysis of population-level data on PrEP use and non-late new HIV diagnoses to describe the distribution of the PnR during the precommissioning and post-commissioning era of PrEP.

Data sources and definitions

Precommissioning versus postcommissioning era

The precommissioning era is defined as the first 29 months of the PrEP Impact trial (total 34 months), from October 2017 to end of February 2020. This represents the trial period prior to the COVID-19 pandemic, as the ensuing lockdowns resulted in a reduction in the provision of SSHS in the UK,¹² which caused many individuals to pause or discontinue PrEP use.¹³ Meanwhile, the postcommissioning era was defined as the whole of 2021, the first full calendar year for which data were available following the commissioning of PrEP in October 2020.

PrEP use data

Aggregated data regarding the number of PrEP Impact trial participants up to February 2020 who received at least one PrEP prescription were provided by the UK Health Security Agency (UKHSA). This population was identified via linkage of the Impact trial electronic case report forms,¹⁴ and the GUMCAD STI surveillance system.¹⁵ GUMCAD is the English pseudoanonymised surveillance system that collects data on sexually transmitted infections (STI) tests, diagnoses and treatments, sexual behaviours, partner notification outcomes and PrEP provision.¹⁵

Aggregated data of the number of SSHS attendees who obtained PrEP on the NHS in 2021 were identified in the GUMCAD dataset (UKHSA), where clinic attendees with any of the following surveillance codes were included: PrEP uptake/continuation, PrEP regimen (daily or event-based) and/or PrEP prescription (30/60/90/180 tablets or other).¹⁵

New HIV diagnoses data

The aggregated numbers of new HIV diagnoses made between October 2017 and February 2020 and in 2021 were identified via the HIV and AIDS Reporting System (HARS; UKHSA) and

restricted to residents in England.¹⁶ This was the best indicator of the epidemiological need for PrEP as the real-time incidence of HIV data is not available. HARS collects data on all new HIV diagnoses, first AIDS diagnoses and deaths from sexual health and HIV clinics, laboratories and other healthcare and community settings.¹⁶

As our interest was in acquisitions, which could reasonably have been expected to be prevented by PrEP, we excluded people who were diagnosed late based on an AIDS-defining illness at diagnosis, and the UK definition of a late diagnosis (a CD4 count of fewer than 350 cells/mm³ within 91 days of diagnosis, and no evidence of recent seroconversion).¹⁶ Those newly diagnosed in England with a prior diagnosis abroad were also excluded.

PrEP-to-need ratio

The PnR follows the methods developed by Siegler *et al*¹⁷ and was calculated to investigate the population levels of PrEP use compared with the underlying epidemiological need for PrEP (via the non-late new HIV diagnosis proxy): we define it as the ratio of the number of PrEP users accessing SSHS to the number of non-late new HIV diagnoses for a given population. PnRs were calculated overall, by gender, by age and gender, by ethnicity and gender and by Index of Multiple Deprivation¹⁸ and gender at the national level; and by gender and ethnicity at the regional level. Gender was categorised into men and women, which included transgender men and women, respectively. Of note, the sexual orientation for men was only requested for the national gender breakdown to avoid small number masking for heterosexual men precommissioning, as required by the UKHSA data request policy.¹⁹ Due to UKHSA's policy of small number masking, it was not possible to avoid the masking of aggregated numbers for certain sub-populations: in those instances, we used the highest number possible that could fit within the masking e.g. if the number of new HIV diagnoses was masked as '<5', we used the number '4' in the PnR calculations. Following evidence that people from Latin America have high HIV prevalence, a Latin American flag was derived from the country of birth of the attendees to investigate equity issues in that population, as this ethnic category is not available in the UK.²⁰ Finally, Lorenz curves were used to display the disparities in PrEP uptake across ethnicity and gender nationally and by gender at the regional level: these graphical representations illustrate the distribution of PrEP users as a function of the cumulative percentage of HIV diagnoses. Data analysis was conducted in Stata V.17.0.

Significance testing

The equity gap was defined as the relative difference (ie, comparative ratio) between the PnR of the group of interest and the PnR of the baseline group. The relative differences and their respective p values and 95% CI were calculated via univariate logistic regression for the gender-only breakdown and bivariate logistic regressions for the others.

Sensitivity analyses

Sensitivity analyses were performed for the PnR approach, first replacing the denominator of the PnR with the number of SSHS attendees with a PrEP need identified.²¹ This was done only for the postcommissioning year of PrEP, as these data were not available in the GUMCAD data set for the Impact trial period. Second, we replaced the denominator with the number of new HIV diagnoses deemed recent by the Recent Infection Testing Algorithm (RITA), where small number masking allowed. RITA combines serological recency test results with clinical data to

Table 1 Distribution of the number of PrEP users and PrEP need in England during the precommissioning (PrEP Impact Trial—October 2017–February 2020) and postcommissioning (2021) period of PrEP by age and gender (including gender and sexual orientation minorities)

Age	Gender	Precommissioning (October 2017–February 2020)			Postcommissioning (2021)		
		PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PrEP users N (%)	Non-late new HIV dx N (%)	PnR
Overall	Total	21 292 (100.0%)	5019 (100.0%)	4.2	60 384 (100.0%)	1234 (100.0%)	48.9
	Men, of which:	20 626 (96.9%)	3797 (75.7%)	5.4	57 169 (94.7%)	895 (72.5%)	63.9
	MSM	20 349 (95.6%)	2423 (48.3%)	8.4	49 543 (82.0%)	483 (39.1%)	102.6
	Heterosexual men	277 (1.3%)	1374 (27.4%)	0.2	7626 (12.6%)	412 (33.4%)	18.5
	Women	623 (2.9%)	1219 (24.3%)	0.5	1198 (2.0%)	338 (27.4%)	3.5
	Transgender people*	456 (2.1%)	9 (0.2%)	50.7	527 (0.9%)	4 (0.3%)	131.6
16–24	Men	2973 (14.0%)	538 (10.7%)	5.5	8691 (14.4%)	104 (8.4%)	83.6
	Women	115 (0.5%)	146 (2.9%)	0.8	261 (0.4%)	27 (2.2%)	9.7
	Subtotal	3104 (14.6%)	686 (13.7%)	4.5	9313 (15.4%)	132 (10.7%)	70.6
25–34	Men	8348 (39.2%)	1338 (26.7%)	6.2	23 603 (39.1%)	327 (26.5%)	72.2
	Women	251 (1.2%)	325 (6.5%)	0.8	492 (0.8%)	85 (6.9%)	5.8
	Subtotal	8617 (40.5%)	1664 (33.2%)	5.2	24 830 (41.1%)	412 (33.4%)	60.3
35–49	Men	6832 (32.1%)	1231 (24.5%)	5.5	17 972 (29.8%)	314 (25.4%)	57.2
	Women	182 (0.9%)	474 (9.4%)	0.4	348 (0.6%)	154 (12.5%)	2.3
	Subtotal	7021 (33.0%)	1705 (34.0%)	4.1	18 889 (31.3%)	468 (37.9%)	40.4
50–64	Men	2202 (10.3%)	579 (11.5%)	3.8	6184 (10.2%)	119 (9.6%)	52.0
	Women	64 (0.3%)	226 (4.5%)	0.3	88 (0.1%)	65 (5.3%)	1.4
	Subtotal	2267 (10.6%)	805 (16.0%)	2.8	6583 (10.9%)	184 (14.9%)	35.8
65 and over	Men	271 (1.3%)	111 (2.2%)	2.4	718 (1.2%)	31 (2.5%)	23.2
	Women	11 (0.1%)	48 (1.0%)	0.2	7 (0.0%)	7 (0.6%)	1.0
	Subtotal	283 (1.3%)	159 (3.2%)	1.8	766 (1.3%)	38 (3.1%)	20.2

* Transgender people include transgender men, transgender women and those who identified as non-binary and were only available for the national gender breakdown to avoid small number masking, as required by UKHSA data request policy.

MSM, men who have sex with men; PnR, PrEP-to-need ratio; PrEP, pre-exposure prophylaxis; UKHSA, UK Health Security Agency.

determine whether the diagnosis was of an HIV acquisition within 6 months.¹⁶

RESULTS

Between October 2017 and February 2020, 21 292 participants were recruited into the PrEP Impact Trial, and there were 5019 non-late new HIV diagnoses among England residents (table 1), which represented a PnR of 4.2; that is, there were just over four PrEP users for each non-late new HIV diagnosis. In 2021, there were nearly three times as many PrEP users ($n=60\,384$), and a fourfold decrease in non-late new HIV diagnoses ($n=1234$), increasing the overall PnR to 48.9, an 11-fold increase from the precommissioning level (table 1).

Almost all PrEP Impact Trial participants were men (96.9%), of whom most were MSM (98.7%). The overall proportion of PrEP users who were MSM declined from 95.6% to 82.0% from pre to postcommissioning (table 1). This was due to an increase in the proportion of heterosexual men PrEP users (it increased from 1.3% to 12.6%). This contrasts with women accounting for a lower share of PrEP users (from 2.9% to 2.0%) despite accounting for a higher proportion of non-late new HIV diagnoses in 2021 ($n=338$, 27.4%) than previous ($n=1219$, 24.3%). This resulted in the equity gap between women and men widening by nearly 70% as the men's PnR was 11 times greater than women's during the Impact Trial but increased to 16 times greater postcommissioning (online supplemental material 1). The widening inequity between men and women was found across all age categories, ethnicities and regions of residence.

White men had the highest PnR both pre and postcommissioning at 7.1 and 96.0, respectively (table 2), while Black African women had the lowest at 0.1 and 0.3, making them the

most underserved group in relation to PrEP in England both pre and postcommissioning. The equity gap between these groups increased from a 78-fold difference precommissioning to a 278-fold difference postcommissioning (online supplemental material 1), a 3.6-fold increase in the equity gap between white men and Black African women across time periods (relative difference=0.28 (95% CI 0.17 to 0.46)). This racial divide held true across regions of residence, whereby Black Africans consistently had the lowest PnR, and those of white ethnicity consistently had the highest (online supplemental material 1). People of Black Caribbean and 'Black other' ethnicity also consistently had the second and third-lowest PnR.

The Lorenz curves, figure 1A, highlight the widening inequity: precommissioning, low PnR ethnicity and gender groupings, who made up 20% of PrEP users, accounted for 50% of non-late new HIV diagnoses, which increased to nearly 60% postcommissioning.

Precommissioning, while men from London accounted for one-third of all non-late new HIV diagnoses, they made up over half all PrEP users (table 3, figure 1B), which changed to 55.2% of all PrEP users and a quarter of HIV diagnoses in 2021. This represents a 16-fold increase in the PnR among men resident in London pre to postcommissioning (relative difference=16.06 (95% CI 14.22 to 18.14)), the highest across regions of residence and gender groupings (online supplemental material 1). In comparison, residents in the Midlands and East of England have the lowest PnR across time periods, and the lowest PnR increase: the equity gap compared with men residing in London increased twofold (relative difference=0.49 (95% CI 0.40 to 0.59)) and nearly threefold (relative difference=0.36 (95% CI 0.25 to 0.52)) for the men and

Table 2 Distribution of the number of PrEP users and PrEP need in England during the precommissioning (PrEP Impact Trial—October 2017–February 2020) and postcommissioning (2021) period of PrEP by ethnicity and gender

Ethnicity	Gender	Precommissioning (October 2017–February 2020)			Postcommissioning (2021)		
		PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PrEP users N (%)	Non-late new HIV dx N (%)	PnR
White	Men	15 669 (73.6%)	2196 (43.8%)	7.1	41 765 (69.2%)	435 (35.3%)	96.0
	Women	367 (1.7%)	367 (7.3%)	1.0	714 (1.2%)	90 (7.3%)	7.9
	Subtotal	16 061 (75.4%)	2564 (51.1%)	6.3	44 106 (73.0%)	526 (42.6%)	83.9
Black African	Men	339 (1.6%)	293 (5.8%)	1.2	1050 (1.7%)	79 (6.4%)	13.3
	Women	36 (0.2%)	395 (7.9%)	0.1	42 (0.1%)	122 (9.9%)	0.3
	Subtotal	376 (1.8%)	688 (13.7%)	0.5	1131 (1.9%)	201 (16.3%)	5.6
Black Caribbean	Men	341 (1.6%)	86 (1.7%)	4.0	964 (1.6%)	28 (2.3%)	34.4
	Women	9 (0.0%)	38 (0.8%)	0.2	19 (0.0%)	15 (1.2%)	1.3
	Subtotal	350 (1.6%)	124 (2.5%)	2.8	996 (1.6%)	43 (3.5%)	23.2
Black Other	Men	128 (0.6%)	66 (1.3%)	1.9	336 (0.6%)	22 (1.8%)	15.3
	Women	6 (0.0%)	43 (0.9%)	0.1	13 (0.0%)	7 (0.6%)	1.9
	Subtotal	134 (0.6%)	109 (2.2%)	1.2	358 (0.6%)	29 (2.4%)	12.3
Asian	Men	1041 (4.9%)	240 (4.8%)	4.3	4413 (7.3%)	69 (5.6%)	64.0
	Women	46 (0.2%)	51 (1.0%)	0.9	86 (0.1%)	13 (1.1%)	6.6
	Subtotal	1092 (5.1%)	292 (5.8%)	3.7	4616 (7.6%)	82 (6.6%)	56.3
Mixed/other	Men	1646 (7.7%)	411 (8.2%)	4.0	4675 (7.7%)	76 (6.2%)	61.5
	Women	87 (0.4%)	85 (1.7%)	1.0	175 (0.3%)	25 (2.0%)	7.0
	Subtotal	1740 (8.2%)	497 (9.9%)	3.5	4960 (8.2%)	101 (8.2%)	49.1
Not stated	Men	1462 (6.9%)	505 (10.1%)	2.9	3966 (6.6%)	186 (15.1%)	21.3
	Women	72 (0.3%)	240 (4.8%)	0.3	149 (0.2%)	66 (5.3%)	2.3
	Subtotal	1539 (7.2%)	745 (14.8%)	2.1	4217 (7.0%)	252 (20.4%)	16.7
Latin American*	Men	714 (3.4%)	216 (4.3%)	3.3	2459 (4.1%)	49 (4.0%)	50.2
	Women	81 (0.4%)	21 (0.4%)	3.9	218 (0.4%)	4 (0.3%)	54.5
	Subtotal	796 (3.7%)	238 (4.7%)	3.3	2702 (4.5%)	52 (4.2%)	52.0

*Latin American is not an ethnicity readily available in the GUMCAD STI surveillance system and HARS datasets and was derived from the attendee's country of birth (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Argentina, Bolivia, Bouvet, Brazil, Chile, Colombia, Ecuador, Falkland Islands, French Guiana, Guyana, Paraguay, Peru, South Georgia and the South Sandwich Islands, Suriname, Uruguay, Venezuela).
HARS, HIV and AIDS Reporting System; PnR, PrEP-to-need ratio; PrEP, pre-exposure prophylaxis.

women residing in that region, respectively (online supplemental material 1).

DISCUSSION

This is the first study to investigate inequity in PrEP use in England by comparing the number of PrEP users to the number of individuals who may have benefited from PrEP (using non-late new HIV diagnosis proxy) to identify the populations most underserved in relation to PrEP. We measured how PrEP inequity changed following the roll-out of a nationally commissioned routine PrEP service.

This ecological analysis highlighted large inequities across gender, age, ethnicity and region of residence. The PnR was significantly higher in men than women, in younger men than older men and women, in white men than minority ethnicity men and women and in London than in other parts of England. Additionally, these equity gaps widened significantly following PrEP commissioning: the PnR difference between men and women increased from an 11-fold to a 16-fold difference. This held true across age, ethnicity and region.

However, the most substantial equity gaps were at the intersection between ethnicity and gender. Black African women represented <1% all PrEP users before and after commissioning. However, they made up an increasing share of non-late new HIV diagnoses postcommissioning (from 7.9% to 9.9%). In contrast, while the proportion of white men among all PrEP users decreased slightly from 73.6% to 69.2%, the proportion

of non-late new HIV diagnoses attributed to them reduced by 20%. This resulted in an equity gap widening substantially from a 78-fold difference precommissioning to a 278-fold difference postcommissioning. Furthermore, the under-representation of people of Black ethnicity was seen across all English regions.

Limitations

This analysis has several limitations. First, missing data on ethnicity remained stable at 7% of the number of PrEP users but reached 20.4% of the number of non-late new HIV diagnoses postcommissioning from 14.8% precommissioning, that is, the proportion of missingness in the denominator was two times to three times that of the numerator. This could be due to differential missingness bias, overestimating the PnR estimates for some ethnicities while underestimating the estimates for others. The lack of more granular ethnicity categories could mask additional inequities among populations whose ethnicity identity is not available in the UK census; hence the interest to flag those born in Latin America, who have a PnR much lower than their white counterparts despite known high HIV prevalence in England.²⁰

Second, this ecological study uses non-late new HIV diagnoses as a proxy for PrEP need. Those new diagnoses do not necessarily represent individuals with the highest risk for HIV acquisition, hence why our approach aimed to remove those diagnosed late in their HIV progression. We explored the use of new HIV diagnoses deemed recent by the RITA algorithm in the denominator of the PnR calculations as a sensitivity analysis (online

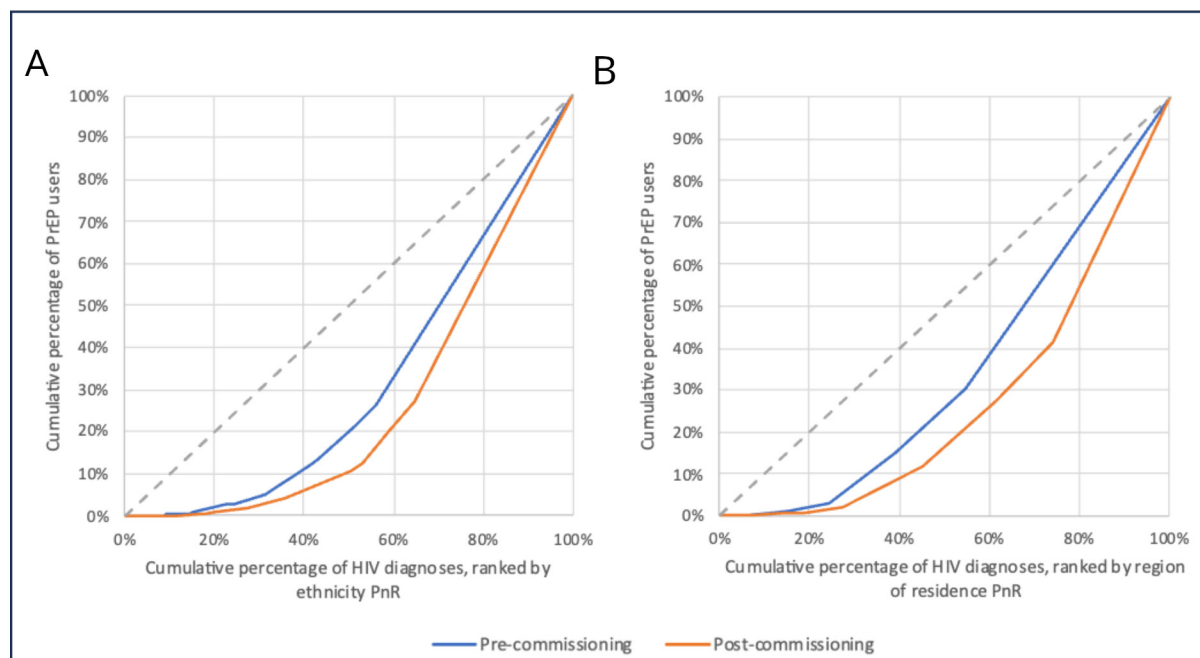


Figure 1 Lorenz curve (Latin American is not an ethnicity readily available in the GUMCAD STI surveillance system and HARS datasets and was derived from the attendee's country of birth (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Argentina, Bolivia, Bouvet, Brazil, Chile, Colombia, Ecuador, Falkland Islands, French Guiana, Guyana, Paraguay, Peru, South Georgia and the South Sandwich Islands, Suriname, Uruguay, Venezuela)) of the cumulative proportion of PrEP users by the cumulative proportion of non-late new HIV diagnoses by (A) ethnicity and gender grouping and (B) region of residence and gender grouping in England precommissioning (blue curve) and postcommissioning (orange curve). HARS, HIV and AIDS Reporting System; PrEP, pre-exposure prophylaxis.

supplemental material 2), but this is an inaccurate measure as RITA results are available for <50% of new diagnoses.

We also performed a sensitivity analysis using GUMCAD PrEP need data, which confirmed the major equity gaps described here (online supplemental material 3). However, this was only available for 2021. Additionally, while the current methodology is imperfect in identifying those in need of PrEP,^{22 23} it remains the best proxy available: the third national Survey of Sexual attitudes and lifestyles showed that most people having condomless sex with new partner(s) do not attend SSHS²⁴ and would, therefore, not be captured within the GUMCAD PrEP need data.

Another limitation is that PrEP Impact trial data underestimate PrEP use (and, therefore, an underestimate of the PnR) over the duration of the trial. This is because demand from attendees outpaced the number of Impact places available, resulting in private purchase of PrEP,²⁵ and, therefore, would not be included in the precommissioning numbers presented here. This is a problem most likely affecting MSM estimates, as they made the bulk of self-sourcing PrEP users,²⁶ which would imply an underestimation of the equity gaps with other populations during Impact. However, our results showed equity issues similar

Table 3 Distribution of the number of PrEP users and PrEP need in England during the precommissioning (PrEP Impact Trial—October 2017–February 2020) and postcommissioning (2021) period of PrEP by region of residence and gender

Region	Gender	Precommissioning (October 2017–February 2020)			Postcommissioning (2021)		
		PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PrEP users N (%)	Non-late new HIV dx N (%)	PnR
London	Men	10 927 (52.1%)	1706 (34.0%)	6.4	32 708 (55.2%)	318 (25.8%)	102.9
	Women	330 (1.6%)	454 (9.0%)	0.7	668 (1.1%)	108 (8.8%)	6.2
	Subtotal	11 275 (53.8%)	2161 (43.1%)	5.2	33 569 (56.6%)	426 (34.5%)	78.8
Midlands & East of England	Men	2518 (12.0%)	737 (14.7%)	3.4	5816 (9.8%)	218 (17.7%)	26.7
	Women	92 (0.4%)	334 (6.7%)	0.3	152 (0.3%)	96 (7.8%)	1.6
	Subtotal	2615 (12.5%)	1072 (21.4%)	2.4	6726 (11.3%)	314 (25.4%)	21.4
North of England	Men	3274 (15.6%)	783 (15.6%)	4.2	9231 (15.6%)	207 (16.8%)	44.6
	Women	84 (0.4%)	233 (4.6%)	0.4	180 (0.3%)	78 (6.3%)	2.3
	Subtotal	3366 (16.1%)	1016 (20.2%)	3.3	9858 (16.6%)	285 (23.1%)	34.6
South of England	Men	3595 (17.2%)	571 (11.4%)	6.3	8454 (14.3%)	152 (12.3%)	55.6
	Women	94 (0.4%)	198 (3.9%)	0.5	179 (0.3%)	56 (4.5%)	3.2
	Subtotal	3700 (17.7%)	770 (15.3%)	4.8	9147 (15.4%)	209 (16.9%)	43.8

PnR, PrEP-to-need ratio; PrEP, pre-exposure prophylaxis.

to those reported in the Scottish and Welsh commissioned PrEP programmes.^{8,9}

Implications

By highlighting equity gaps in SSHS PrEP delivery, this study is particularly timely as it provides data to inform the UK Government aims to end new HIV transmission by the end of the decade in England.¹¹

This equity analysis is helpful in identifying where equity gaps are to support those most underserved. The PnR methodology is a pragmatic standardised method that can be used to compare equity across UK nations and across other countries worldwide.²⁷ While few other studies have used this method to date, they all showed the practicality of PnR calculations to highlight PrEP equity gaps; in fact, these studies (done in the USA) showed similar sociodemographics PrEP equity patterns to this analysis.^{17,28} They found that women, Black and older people, along with those from historically disadvantaged backgrounds, were the most underserved populations.

It is also important to note that while PrEP is not the only prevention available in England (PrEP is part of the wider HIV combination prevention package), the inequities highlighted in this paper mirror those affecting other HIV preventions: we know that women and people of Black African ethnicity have yet to recover pre-COVID-19 levels of HIV testing.¹ This lower-than-expected HIV testing implies that these populations' PnR was overestimated compared with other populations for whom HIV testing recovered to pre-COVID-19 levels, that is, the true equity gap with white men could be bigger than estimated here. Additionally, Black women and those residing outside of London living with HIV from the same populations are also known to experience unequal linkage to care and treatment and worse outcomes than their white cisgender counterparts.^{1,29}

It is important to emphasise that PnR is an equity measure only as an ecological construct, that is, it explores disparities in PrEP access across sociodemographic variables at population level.¹⁷ In the future, it will be key to look at MSM and non-MSM populations separately when updating this analysis to better understand who within the MSM population requires more support. Similar analyses should be done for the other underserved populations highlighted in this paper (women and ethnic minorities), ideally at attendee level, to investigate why PrEP assessments and use were so low in these populations.¹

Finally, addressing these equity gaps will also require all relevant stakeholders involved in the delivery of PrEP in England (Local Authority commissioners, clinicians and other health-care workers, as well as those from the populations this analysis highlighted as underserved) to come together to decide on the best way forward to address these equity issues. Such work will be reliant on a better understanding of the various behavioural factors involved along that PrEP care continuum³⁰ across the various underserved populations as different populations may struggle with different parts of care continuum engagement.

CONCLUSIONS

PrEP delivery should be guided based on equity metrics (PrEP use relative to HIV epidemic), not PrEP equality (equal across groups, regardless of the proportion of HIV diagnoses). On this basis, the PrEP Impact trial and subsequent PrEP commissioned service demonstrate large and widening equity gaps by gender, ethnicity and geography, especially those of older age, women of Black ethnicity and those outside of London.

The PnR proved its efficacy in identifying the populations most underserved by the current PrEP service in England. To reach the UK Government's aim to stop HIV transmissions by 2030,¹¹ it will be key to address the barriers to PrEP access and other HIV preventions faced by these underserved populations.

Author affiliations

¹National Institute for Health Research Applied Research Collaboration North West London, Chelsea and Westminster Hospital, London, UK

²Patient Experience Research Centre, School of Public Health, Imperial College London, London, UK

³Chelsea and Westminster Hospital NHS Foundation Trust, London, UK

⁴Imperial College London, London, UK

⁵Blood Safety, Hepatitis, Sexually Transmitted Infections (STI) and HIV Division, UK Health Security Agency, London, UK

⁶The Royal Marsden Hospital, London, UK

⁷The Royal London Hospital, London, UK

⁸UCL Centre for Clinical Research in Infection and Sexual Health, Institute for Global Health, University College London, London, UK

⁹National Institute for Health Research Imperial Biomedical Research Centre, London, UK

Handling editor Miłosz Parczewski

X Flavien Coukan @flvckn

Acknowledgements We thank the PrEP Impact trial participants and participating sites. We thank the GUMCAD and HARS teams at the UKHSA for providing the data needed for this analysis through its several iterations. We also thank Dr Ross Harris for his statistical advice regarding this analysis.

Contributors All authors contributed to the critical review of this analysis. Additionally, SJ, HM and AW contributed to study planning, coordination, and review of results from the analysis. AS, CA, JS and HW contributed to study planning, acquisition of data, interpretation of data and review of results from analysis. FC, the corresponding author, was the submitting author and contributed to each phase of study and manuscript development. FC acted as a guarantor.

Funding This study/project is funded by the NIHR Applied Research Collaboration Northwest London.

Disclaimer The views expressed are those of the authors and not necessarily those of the NIHR or the Department of Health and Social Care. HW is a National Institute for Health Research (NIHR) Senior Investigator and acknowledges support from NIHR Biomedical Research Centre of Imperial College NHS Trust, and NIHR Applied Research Collaborative North West London.

Competing interests Flavien Coukan has received funding from the BHIVA/Viiv Implementation Science Scholarship to investigate the barriers and facilitators to PrEP access faced by Black women.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer-reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution 4.0 Unported (CC BY 4.0) license, which permits others to copy, redistribute, remix, transform and build upon this work for any purpose, provided the original work is properly cited, a link to the licence is given, and indication of whether changes were made. See: <https://creativecommons.org/licenses/by/4.0/>.

ORCID iD

Flavien Coukan <http://orcid.org/0000-0002-2666-0125>

REFERENCES

- Lester J, Martin V, Shah A, et al. HIV testing, PrEP, new HIV diagnoses, and care outcomes for people accessing HIV services: 2022 report. *The annual official statistics data release (data to end of December 2021)*. London, 2022.
- Grant RM, Lama JR, Anderson PL, et al. Preexposure Chemoprophylaxis for HIV prevention in men who have sex with men. *N Engl J Med* 2010;363:2587–99.
- Molina J-M, Capitant C, Spire B, et al. On-demand Preexposure prophylaxis in men at high risk for HIV-1 infection. *N Engl J Med* 2015;373:2237–46.
- McCormack S, Dunn DT, Desai M, et al. Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): effectiveness results from the pilot phase of a pragmatic open-label randomised trial. *The Lancet* 2016;387:53–60.
- National AIDS Trust. *Not PrEPared: Barriers to accessing HIV prevention drugs in England*. London, 2022.
- Department of Health and Social Care. HIV drug prep to be available across England. 2020. Available: <https://www.gov.uk/government/news/hiv-drug-prep-to-be-available-across-england>
- Sullivan A, Desai M, Saunders J, et al. The HIV pre-exposure prophylaxis (prep) impact trial: baseline demographics, coverage and first regimen choice. 5th Joint Conference of the British HIV Association (BHIVA) with the British Association for Sexual Health and HIV (BASHH); 2021
- Health Protection Scotland. *Implementation of HIV PrEP in Scotland: Second Year Report*. 2019.
- Fina L, Phillips AL, Jones AT, et al. Early experience of implementing a national HIV pre-exposure prophylaxis service in Wales, United Kingdom 2017. *Sex Health* 2019;16:56–62.
- Coukan F, Murray K-K, Papageorgiou V, et al. Barriers and Facilitators to HIV pre-exposure prophylaxis (prep) in specialist sexual health services in the United kingdom: A systematic review using the prep care continuum. *HIV Med* 2023;24:893–913.
- Department of Health and Social Care. *Towards zero - an action plan towards ending HIV transmission, AIDS and HIV-related deaths in England - 2022 to 2025*. London, 2021.
- Faculty of Sexual Reproductive Healthcare. *FSRH COVID-19 SRH service survey: interim results*. 2020.
- Howarth AR, Saunders J, Reid D, et al. Stay at home...': exploring the impact of the COVID-19 public health response on sexual behaviour and health service use among men who have sex with men: findings from a large online survey in the UK. *Sex Transm Infect* 2022;98:346–52.
- Chelsea and Westminster Hospital NHS Foundation Trust. Prep impact trial: a pragmatic health technology assessment of prep and implementation [protocol]. 2020. Available: <https://www.prepimpacttrial.org.uk/protocol>
- UKHSA. *GUMCAD STI Surveillance System: Data specification and technical guidance*. London, 2021.
- Public Health England. *HIV and AIDS Reporting System: Requirement Specification*. London, 2016.
- Siegler AJ, Mouhanna F, Giler RM, et al. The prevalence of pre-exposure prophylaxis use and the pre-exposure prophylaxis-to-need ratio in the fourth quarter of 2017, United States. *Ann Epidemiol* 2018;28:841–9.
- Ministry of Housing, Communities & Local Government. *English indices of deprivation*. London, 2019.
- Public Health England. *PHE HIV and STI data sharing policy*. London, 2015.
- de Carvalho Peres JE, Carvalho TS, Hunt D-W, et al. O31 A demographic analysis of latin american sexual and reproductive health service users. Oral Presentations 2023. BASHH 2023 Abstracts; June 2023:A17.
- UKHSA. *Routine commissioning of HIV pre-exposure prophylaxis (PrEP) in England: Monitoring and evaluation framework*. London, 2022.
- Kassanjee R, Pilcher CD, Busch MP, et al. Viral load criteria and threshold optimization to improve HIV incidence assay characteristics. *AIDS* 2016;30:2361–71.
- Kirwan PD, Croxford S, Aghaizu A, et al. Re-assessing the late HIV diagnosis surveillance definition in the era of increased and frequent testing. *HIV Med* 2022;23:1127–42.
- Tanton C, Geary RS, Clifton S, et al. Sexual health clinic attendance and non-attendance in Britain: findings from the third national survey of sexual attitudes and lifestyles (Natsal-3). *Sex Transm Infect* 2018;94:268–76.
- Ogaz D, Logan L, Curtis TJ, et al. Prep use and unmet prep-need among men who have sex with men in London prior to the implementation of a national prep programme, a cross-sectional study from June to August 2019. *BMC Public Health* 2022;22:1105.
- O'Halloran C, Owen G, Croxford S, et al. Current experiences of Accessing and using HIV pre-exposure prophylaxis (prep) in the United kingdom: a cross-sectional online survey. *Euro Surveill* 2019;24:1900693.
- Vanhamel J, Laga M. Measuring progress in the roll-out of pre-exposure prophylaxis: from counting what we know, to knowing what to count. *AIDS* 2021;35:2389–90.
- Doherty R, Walsh JL, Quinn KG, et al. Association of race and other social determinants of health with HIV pre-exposure prophylaxis use: a county-level analysis using the prep-to-need ratio. *AIDS Educ Prev* 2022;34:183–94.
- Dhairyan R, Okhai H, Hill T, et al. Differences in HIV clinical outcomes amongst heterosexuals in the United kingdom by Ethnicity. *AIDS* 2021;35:1813–21.
- Parsons JT, Rendina HJ, Lassiter JM, et al. Uptake of HIV pre-exposure prophylaxis (prep) in a national cohort of gay and bisexual men in the United States. *J Acquir Immune Defic Syndr* 2017;74:285–92.

Supplementary material 1**Table 1.** Distribution of the number of PrEP users and PrEP need in England during the pre- (PrEP Impact Trial – October 2017 to February 2020) and post-commissioning (2021) period of PrEP by age and gender (including transgender and sexual orientation minorities)

Age	Gender	Pre-commissioning (Oct 2017 – Feb 2020)				Post-commissioning (2021)				Pre- to post-commissioning comparisons within groups	Pre- to post-commissioning comparisons across groups
		PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PnR relative difference (95% CI)	PnR relative difference (95% CI)
Overall	Total	21,292 (100.0%)	5,019 (100.0%)	4.2	N/A	60,384 (100.0%)	1,234 (100.0%)	48.9	N/A	11.53* (10.82-12.30)	N/A
	Men, of which:	20,626 (96.9%)	3,797 (75.7%)	5.4	Baseline group	57,169 (94.7%)	895 (72.5%)	63.9	Baseline group	11.76* (10.91-12.67)	Baseline group
	<i>MSM</i>	20,349 (95.6%)	2,423 (48.3%)	8.4	N/A	49,543 (82.0%)	483 (39.1%)	102.6	N/A	12.21* (11.06-13.48)	N/A
	<i>Heterosexual men</i>	277 (1.3%)	1,374 (27.4%)	0.2	N/A	7,626 (12.6%)	412 (33.4%)	18.5	N/A	91.81* (78.02-108.04)	N/A
	Women	623 (2.9%)	1,219 (24.3%)	0.5	0.09* (0.08-0.10)	1,198 (2.0%)	338 (27.4%)	3.5	0.06* (0.05-0.06)	6.94* (5.94-8.09)	0.59* (0.50-0.70)
	Transgender people ¹	456 (2.1%)	9 (0.2%)	50.7	N/A	527 (0.9%)	4 (0.3%)	131.6	N/A	2.60 (0.80-8.50)	N/A
16 to 24	Men	2,973 (14.0%)	538 (10.7%)	5.5	Baseline group	8,691 (14.4%)	104 (8.4%)	83.6	Baseline group	15.12* (12.21-18.73)	Baseline group
	Women	115 (0.5%)	146 (2.9%)	0.8	0.14* (0.11-0.19)	261 (0.4%)	27 (2.2%)	9.7	0.12* (0.07-0.18)	12.27* (7.70-19.55)	0.81 (0.49-1.35)
	Subtotal	3,104 (14.6%)	686 (13.7%)	4.5	N/A	9,313 (15.4%)	132 (10.7%)	70.6	N/A	15.59* (12.89-18.87)	N/A
25 to 34	Men	8,348 (39.2%)	1,338 (26.7%)	6.2	1.13** (1.01-1.26)	23,603 (39.1%)	327 (26.5%)	72.2	0.86 (0.69-1.08)	11.57* (10.23-13.09)	0.77** (0.60-0.98)
	Women	251 (1.2%)	325 (6.5%)	0.8	0.14* (0.12-0.17)	492 (0.8%)	85 (6.9%)	5.8	0.07* (0.05-0.09)	7.49* (5.65-9.95)	0.50* (0.35-0.71)
	Subtotal	8,617 (40.5%)	1,664 (33.2%)	5.2	N/A	24,830 (41.1%)	412 (33.4%)	60.3	N/A	11.64* (10.42-13.00)	N/A
35 to 49	Men	6,832 (32.1%)	1,231 (24.5%)	5.5	1.00 (0.90-1.12)	17,972 (29.8%)	314 (25.4%)	57.2	0.68* (0.55-0.86)	10.31* (9.08-11.71)	0.68* (0.53-0.87)
	Women	182 (0.9%)	474 (9.4%)	0.4	0.07* (0.06-0.08)	348 (0.6%)	154 (12.5%)	2.3	0.03* (0.02-0.04)	5.89* (4.56-7.60)	0.39* (0.28-0.54)
	Subtotal	7,021 (33.0%)	1,705 (34.0%)	4.1	N/A	18,889 (31.3%)	468 (37.9%)	40.4	N/A	9.80* (8.82-10.90)	N/A
50 to 64	Men	2,202 (10.3%)	579 (11.5%)	3.8	0.69* (0.60-0.78)	6,184 (10.2%)	119 (9.6%)	52.0	0.62* (0.48-0.81)	13.66* (11.15-16.74)	0.90 (0.67-1.21)
	Women	64 (0.3%)	226 (4.5%)	0.3	0.05* (0.04-0.07)	88 (0.1%)	65 (5.3%)	1.4	0.02* (0.01-0.02)	4.78* (3.13-7.31)	0.32* (0.20-0.51)
	Subtotal	2,267 (10.6%)	805 (16.0%)	2.8	N/A	6,583 (10.9%)	184 (14.9%)	35.8	N/A	12.70* (10.75-15.02)	N/A
65 and over	Men	271 (1.3%)	111 (2.2%)	2.4	0.44* (0.35-0.56)	718 (1.2%)	31 (2.5%)	23.2	0.28* (0.18-0.42)	9.49* (6.22-14.47)	0.63** (0.39-1.01)
	Women	11 (0.1%)	48 (1.0%)	0.2	0.04* (0.02-0.08)	7 (0.0%)	7 (0.6%)	1.0	0.01* (0.00-0.03)	4.36** (1.27-15.01)	0.29** (0.08-1.01)
	Subtotal	283 (1.3%)	159 (3.2%)	1.8	N/A	766 (1.3%)	38 (3.1%)	20.2	N/A	11.33* (7.75-16.55)	N/A

¹ Transgender people includes transgender men, transgender women and those who identified as non-binary and was only available for the national gender breakdown to avoid small number masking, as required by UKHSA data request policy.

* p-value<0.01

**p-value<0.1

Table 2. Distribution of the number of PrEP users and PrEP need in England during the pre- (PrEP Impact Trial – October 2017 to February 2020) and post-commissioning (2021) period of PrEP by ethnicity and gender

Ethnicity	Gender	Pre-commissioning (Oct 2017 – Feb 2020)				Post-commissioning (2021)				Pre- to post-commissioning comparisons within groups	Pre- to post-commissioning comparisons across groups
		PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PnR relative difference (95% CI)	PnR relative difference (95% CI)
White	Men	15,669 (73.6%)	2,196 (43.8%)	7.1	Baseline group	41,765 (69.2%)	435 (35.3%)	96.0	Baseline group	13.46* (12.12-14.94)	Baseline group
	Women	367 (1.7%)	367 (7.3%)	1.0	0.14* (0.12-0.16)	714 (1.2%)	90 (7.3%)	7.9	0.08* (0.07-0.10)	7.93* (6.10-10.32)	0.59* (0.44-0.78)
	Subtotal	16,061 (75.4%)	2,564 (51.1%)	6.3	N/A	44,106 (73.0%)	526 (42.6%)	83.9	N/A	13.39* (12.17-14.73)	N/A
Black African	Men	339 (1.6%)	293 (5.8%)	1.2	0.16* (0.14-0.19)	1,050 (1.7%)	79 (6.4%)	13.3	0.14* (0.11-0.18)	11.49* (8.71-15.15)	0.85 (0.63-1.15)
	Women	36 (0.2%)	395 (7.9%)	0.1	0.01* (0.01-0.02)	42 (0.1%)	122 (9.9%)	0.3	0.00* (0.00-0.01)	3.78* (2.32-6.16)	0.28* (0.17-0.46)
	Subtotal	376 (1.8%)	688 (13.7%)	0.5	N/A	1,131 (1.9%)	201 (16.3%)	5.6	N/A	10.30* (8.47-12.52)	N/A
Black Caribbean	Men	341 (1.6%)	86 (1.7%)	4.0	0.56* (0.44-0.71)	964 (1.6%)	28 (2.3%)	34.4	0.36* (0.24-0.53)	8.68* (5.57-13.54)	0.65** (0.41-1.02)
	Women	9 (0.0%)	38 (0.8%)	0.2	0.03* (0.02-0.07)	19 (0.0%)	15 (1.2%)	1.3	0.01* (0.01-0.03)	5.35* (1.98-14.44)	0.40** (0.15-1.08)
	Subtotal	350 (1.6%)	124 (2.5%)	2.8	N/A	996 (1.6%)	43 (3.5%)	23.2	N/A	8.21* (5.68-11.85)	N/A
Black Other	Men	128 (0.6%)	66 (1.3%)	1.9	0.27* (0.20-0.37)	336 (0.6%)	22 (1.8%)	15.3	0.16* (0.10-0.25)	7.88* (4.66-13.30)	0.59** (0.34-1.00)
	Women	6 (0.0%)	43 (0.9%)	0.1	0.02* (0.01-0.05)	13 (0.0%)	7 (0.6%)	1.9	0.02* (0.01-0.05)	13.31* (3.80-46.67)	0.99 (0.28-3.48)
	Subtotal	134 (0.6%)	109 (2.2%)	1.2	N/A	358 (0.6%)	29 (2.4%)	12.3	N/A	10.04* (6.37-15.83)	N/A
Asian	Men	1,041 (4.9%)	240 (4.8%)	4.3	0.61* (0.52-0.70)	4,413 (7.3%)	69 (5.6%)	64.0	0.67* (0.52-0.86)	14.75* (11.19-19.43)	1.10 (0.82-1.47)
	Women	46 (0.2%)	51 (1.0%)	0.9	0.13* (0.08-0.19)	86 (0.1%)	13 (1.1%)	6.6	0.07* (0.04-0.12)	7.33* (3.62-14.86)	0.55** (0.27-1.11)
	Subtotal	1,092 (5.1%)	292 (5.8%)	3.7	N/A	4,616 (7.6%)	82 (6.6%)	56.3	N/A	15.05* (11.68-19.40)	N/A
Mixed/ other	Men	1,646 (7.7%)	411 (8.2%)	4.0	0.56* (0.50-0.63)	4,675 (7.7%)	76 (6.2%)	61.5	0.64* (0.50-0.82)	15.36* (11.95-19.74)	1.14 (0.87-1.50)
	Women	87 (0.4%)	85 (1.7%)	1.0	0.14* (0.11-0.19)	175 (0.3%)	25 (2.0%)	7.0	0.07* (0.05-0.11)	6.84* (4.09-11.44)	0.51** (0.30-0.86)
	Subtotal	1,740 (8.2%)	497 (9.9%)	3.5	N/A	4,960 (8.2%)	101 (8.2%)	49.1	N/A	14.03* (11.25-17.49)	N/A
Not stated	Men	1,462 (6.9%)	505 (10.1%)	2.9	0.41* (0.36-0.45)	3,966 (6.6%)	186 (15.1%)	21.3	0.22* (0.19-0.26)	7.37* (6.16-8.80)	0.55* (0.45-0.67)
	Women	72 (0.3%)	240 (4.8%)	0.3	0.04* (0.03-0.05)	149 (0.2%)	66 (5.3%)	2.3	0.02* (0.02-0.03)	7.53* (5.09-11.13)	0.56* (0.37-0.84)
	Subtotal	1,539 (7.2%)	745 (14.8%)	2.1	N/A	4,217 (7.0%)	252 (20.4%)	16.7	N/A	8.10* (6.94-9.45)	N/A
Latin American ²	Men	714 (3.4%)	216 (4.3%)	3.3	0.46* (0.40-0.54)	2,459 (4.1%)	49 (4.0%)	50.2	0.52* (0.39-0.70)	15.18* (11.01-20.93)	1.13 (0.80-1.58)
	Women	81 (0.4%)	21 (0.4%)	3.9	0.54** (0.33-0.88)	218 (0.4%)	4 (0.3%)	54.5	0.57 (0.21-1.53)	14.13* (4.71-42.42)	1.05 (0.35-3.17)
	Subtotal	796 (3.7%)	238 (4.7%)	3.3	N/A	2,702 (4.5%)	52 (4.2%)	52.0	N/A	15.54* (11.39-21.19)	N/A

² Latin American is not an ethnicity readily available in the GUMCAD and HARS datasets and was derived from the attendee's country of birth (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Argentina, Bolivia, Bouvet, Brazil, Chile, Colombia, Ecuador, Falkland Islands, French Guiana, Guyana, Paraguay, Peru, South Georgia and the South Sandwich Islands, Suriname, Uruguay, Venezuela)

* p-value<0.01

** p-value<0.1

Table 3. Distribution of the number of PrEP users and PrEP need in England during the pre- (PrEP Impact Trial – October 2017 to February 2020) and post-commissioning (2021) period of PrEP by region of residence and gender.

Region	Gender	Pre-commissioning (Oct 2017 – Feb 2020)				Post-commissioning (2021)				Pre- to post-commissioning comparisons within groups	Pre- to post-commissioning comparisons across groups
		PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PnR relative difference (95% CI)	PnR relative difference (95% CI)
London	Men	10,927 (52.1%)	1,706 (34.0%)	6.4	Baseline group	32,708 (55.2%)	318 (25.8%)	102.9	Baseline group	16.06* (14.22-18.14)	Baseline group
	Women	330 (1.6%)	454 (9.0%)	0.7	0.11* (0.10-0.13)	668 (1.1%)	108 (8.8%)	6.2	0.06* (0.05-0.08)	8.51* (6.64-10.90)	0.53* (0.40-0.70)
	Subtotal	11,275 (53.8%)	2,161 (43.1%)	5.2	N/A	33,569 (56.6%)	426 (34.5%)	78.8	N/A	15.10* (13.58-16.79)	N/A
Midlands & East of England	Men	2,518 (12.0%)	737 (14.7%)	3.4	0.53* (0.48-0.59)	5,816 (9.8%)	218 (17.7%)	26.7	0.26* (0.22-0.31)	7.81* (6.67-9.15)	0.49* (0.40-0.59)
	Women	92 (0.4%)	334 (6.7%)	0.3	0.04* (0.03-0.05)	152 (0.3%)	96 (7.8%)	1.6	0.02* (0.01-0.02)	5.75* (4.07-8.11)	0.36* (0.25-0.52)
	Subtotal	2,615 (12.5%)	1,072 (21.4%)	2.4	N/A	6,726 (11.3%)	314 (25.4%)	21.4	N/A	8.78* (7.68-10.04)	N/A
North of England	Men	3,274 (15.6%)	783 (15.6%)	4.2	0.65* (0.59-0.72)	9,231 (15.6%)	207 (16.8%)	44.6	0.43* (0.36-0.52)	10.67* (9.10-12.49)	0.66* (0.54-0.81)
	Women	84 (0.4%)	233 (4.6%)	0.4	0.06* (0.04-0.07)	180 (0.3%)	78 (6.3%)	2.3	0.02* (0.02-0.03)	6.40* (4.45-9.22)	0.40* (0.27-0.59)
	Subtotal	3,366 (16.1%)	1,016 (20.2%)	3.3	N/A	9,858 (16.6%)	285 (23.1%)	34.6	N/A	10.44* (9.10-11.97)	N/A
South of England	Men	3,595 (17.2%)	571 (11.4%)	6.3	0.98 (0.89-1.09)	8,454 (14.3%)	152 (12.3%)	55.6	0.54* (0.45-0.66)	8.83* (7.36-10.61)	0.55* (0.44-0.69)
	Women	94 (0.4%)	198 (3.9%)	0.5	0.07* (0.06-0.10)	179 (0.3%)	56 (4.5%)	3.2	0.03* (0.02-0.04)	6.73* (4.57-9.92)	0.42* (0.28-0.63)
	Subtotal	3,700 (17.7%)	770 (15.3%)	4.8	N/A	9,147 (15.4%)	209 (16.9%)	43.8	N/A	9.11* (7.78-10.66)	N/A

*p-value<0.01

Table 4. Distribution of the number of PrEP users and PrEP need in England during the pre- (PrEP Impact Trial – October 2017 to February 2020) and post-commissioning (2021) period of PrEP by region of residence and ethnicity.

Region	Ethnicity	Pre-commissioning (Oct 2017 - Feb 2020)				Post-commissioning (2021)				Pre- to post-commissioning comparisons within groups	Pre- to post-commissioning comparisons across groups
		PrEP users (%)	Non-late new HIV diagnoses (%)	PnR	PnR ratio (95% CI)	PrEP users (%)	Non-late new HIV diagnoses (%)	PnR	PnR ratio (95% CI)	PnR ratio (95% CI)	PnR ratio (95% CI)
London	White	7,655 (36.5%)	883 (17.6%)	8.67	Baseline group	22,371 (37.7%)	134 (10.9%)	166.95	Baseline group	19.26* (16.03-23.14)	Baseline group
	Black African	261 (1.2%)	282 (5.6%)	0.93	0.11* (0.09-0.13)	843 (1.4%)	64 (5.2%)	13.17	0.08* (0.06-0.11)	14.23 (10.49-19.30)	0.74** (0.52-1.05)
	Black other ³	385 (1.8%)	138 (2.7%)	2.79	0.32* (0.26-0.40)	1,032 (1.7%)	36 (2.9%)	28.67	0.17* (0.12-0.25)	10.28* (6.99-15.10)	0.53* (0.35-0.82)
	Asian	702 (3.3%)	138 (2.7%)	5.09	0.59* (0.48-0.71)	3,145 (5.3%)	33 (2.7%)	95.30	0.57* (0.39-0.84)	18.73* (12.70-27.63)	0.97 (0.63-1.50)
	Mixed/other	1,253 (6.0%)	311 (6.2%)	4.03	0.46* (0.40-0.54)	3,594 (6.1%)	43 (3.5%)	83.58	0.50* (0.35-0.71)	20.75* (14.98-28.72)	1.08 (0.74-1.57)
	Not stated	1,019 (4.9%)	409 (8.1%)	2.49	0.29* (0.25-0.33)	2,584 (4.4%)	116 (9.4%)	22.28	0.13* (0.10-0.17)	8.94* (7.19-11.12)	0.46* (0.35-0.62)
	Subtotal	11,275 (53.8%)	2,161 (43.1%)	5.22	N/A	33,569 (56.6%)	426 (34.5%)	78.80	N/A	15.10* (13.58-16.79)	N/A
Midlands & East of England	White	2,138 (10.2%)	554 (11.0%)	3.86	0.45* (0.40-0.50)	5,285 (8.9%)	132 (10.7%)	40.04	0.24* (0.19-0.31)	10.37* (8.52-12.63)	0.54* (0.41-0.70)
	Black African	37 (0.2%)	194 (3.9%)	0.19	0.02* (0.02-0.03)	99 (0.2%)	63 (5.1%)	1.57	0.01* (0.01-0.01)	8.24* (5.14-13.22)	0.43* (0.26-0.71)
	Black other	35 (0.2%)	48 (1.0%)	0.73	0.08* (0.05-0.13)	119 (0.2%)	18 (1.5%)	6.61	0.04* (0.02-0.07)	9.07* (4.69-17.54)	0.47** (0.24-0.93)
	Asian	154 (0.7%)	73 (1.5%)	2.11	0.24* (0.18-0.32)	478 (0.8%)	26 (2.1%)	18.38	0.11* (0.07-0.17)	8.71* (5.38-14.13)	0.45* (0.27-0.76)
	Mixed/other	130 (0.6%)	59 (1.2%)	2.20	0.25* (0.19-0.35)	316 (0.5%)	19 (1.5%)	16.63	0.10* (0.06-0.16)	7.55* (4.33-13.16)	0.39* (0.22-0.70)
	Not stated	121 (0.6%)	144 (2.9%)	0.84	0.10* (0.08-0.12)	429 (0.7%)	56 (4.5%)	7.66	0.05* (0.03-0.06)	9.12* (6.31-13.18)	0.47* (0.31-0.71)
	Subtotal	2,615 (12.5%)	1,072 (21.4%)	2.44	N/A	6,726 (11.3%)	314 (25.4%)	21.42	N/A	8.78* (7.68-10.04)	N/A
North of England	White	2,958 (14.1%)	645 (12.9%)	4.59	0.53* (0.47-0.59)	8,034 (13.5%)	149 (12.1%)	53.92	0.32* (0.26-0.41)	11.76* (9.79-14.12)	0.61* (0.47-0.79)
	Black African	34 (0.2%)	125 (2.5%)	0.27	0.03* (0.02-0.05)	102 (0.2%)	40 (3.2%)	2.55	0.02* (0.01-0.02)	9.38* (5.54-15.88)	0.49** (0.28-0.85)
	Black other	24 (0.1%)	24 (0.5%)	1.00	0.12* (0.07-0.20)	107 (0.2%)	7 (0.6%)	15.29	0.09* (0.04-0.20)	15.29* (5.90-39.57)	0.79 (0.30-2.09)
	Asian	108 (0.5%)	40 (0.8%)	2.70	0.31* (0.22-0.45)	502 (0.8%)	11 (0.9%)	45.64	0.27* (0.15-0.51)	16.90* (8.40-34.00)	0.88 (0.43-1.81)
	Mixed/other	164 (0.8%)	72 (1.4%)	2.28	0.26* (0.20-0.35)	503 (0.8%)	27 (2.2%)	18.63	0.11* (0.07-0.17)	8.18* (5.08-13.17)	0.42* (0.25-0.71)
	Not stated	78 (0.4%)	110 (2.2%)	0.71	0.08* (0.06-0.11)	610 (1.0%)	51 (4.1%)	11.96	0.07* (0.05-0.10)	16.87* (11.23-25.34)	0.88 (0.56-1.37)
	Subtotal	3,366 (16.1%)	1,016 (20.2%)	3.31	N/A	9,858 (16.6%)	285 (23.1%)	34.59	N/A	10.44* (9.10-11.97)	N/A
South of England	White	3,138 (15.0%)	482 (9.6%)	6.51	0.75* (0.67-0.85)	7,646 (12.9%)	111 (9.0%)	68.88	0.41* (0.32-0.53)	10.58* (8.57-13.06)	0.55* (0.42-0.73)
	Black African	42 (0.2%)	87 (1.7%)	0.48	0.06* (0.04-0.08)	69 (0.1%)	34 (2.8%)	2.03	0.01* (0.01-0.02)	4.20* (2.42-7.30)	0.22* (0.10-0.39)
	Black other	37 (0.2%)	23 (0.5%)	1.61	0.19* (0.11-0.31)	80 (0.1%)	11 (0.9%)	7.27	0.04* (0.02-0.08)	4.52* (2.00-10.24)	0.23* (0.10-0.54)
	Asian	118 (0.6%)	41 (0.8%)	2.88	0.33* (0.23-0.48)	403 (0.7%)	12 (1.0%)	33.58	0.20* (0.11-0.37)	11.67* (5.94-22.92)	0.61 (0.30-1.22)
	Mixed/other	173 (0.8%)	55 (1.1%)	3.15	0.36* (0.27-0.50)	463 (0.8%)	12 (1.0%)	38.58	0.23* (0.13-0.42)	12.27* (6.41-23.46)	0.64 (0.32-1.25)
	Not stated	192 (0.9%)	82 (1.6%)	2.34	0.27* (0.21-0.35)	486 (0.8%)	29 (2.4%)	16.76	0.10* (0.07-0.15)	7.16* (4.54-11.28)	0.37* (0.23-0.61)
	Subtotal	3,700 (17.7%)	770 (15.3%)	4.81	N/A	9,147 (15.4%)	209 (16.9%)	43.77	N/A	9.11* (7.78-10.66)	N/A

³ Here Black other includes people of Black Caribbean ethnicity.

* p-value<0.01

** p-value<0.1

Table 5. Distribution of the number of PrEP users and PrEP need in England during the pre- (PrEP Impact Trial – October 2017 to February 2020) and post-commissioning (2021) period of PrEP by Index of Multiple Deprivation (IMD) and gender

IMD	Gender	Pre-commissioning (Oct 2017 – Feb 2020)				Pre-commissioning (Oct 2017 – Feb 2020)				Pre- to post-commissioning comparisons within groups	Pre- to post-commissioning comparisons across groups
		PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PrEP users N (%)	Non-late new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PnR relative difference (95% CI)	PnR relative difference (95% CI)
5th Quintile - least deprived	Men	1,973 (9.3%)	294 (5.9%)	6.71	Baseline group	5,254 (8.7%)	50 (4.1%)	105.08	Baseline group	15.66* (11.55-21.23)	Baseline group
	Women	60 (0.3%)	72 (1.4%)	0.83	0.12* (0.09-0.18)	92 (0.2%)	20 (1.6%)	4.60	0.04* (0.03-0.08)	5.52* (3.05-9.98)	0.35* (0.18-0.69)
	Subtotal	2,035 (9.6%)	367 (7.3%)	5.54	N/A	5,624 (9.3%)	71 (5.8%)	79.21	N/A	14.29* (11.02-18.51)	N/A
4th Quintile	Men	2,960 (13.9%)	473 (9.4%)	6.26	0.93 (0.80-1.09)	8,354 (13.8%)	107 (8.7%)	78.07	0.74** (0.53-1.04)	12.48* (10.07-15.45)	0.80 (0.55-1.16)
	Women	85 (0.4%)	94 (1.9%)	0.90	0.13* (0.10-0.19)	204 (0.3%)	37 (3.0%)	5.51	0.05* (0.03-0.08)	6.10* (3.86-9.63)	0.39* (0.22-0.67)
	Subtotal	3,051 (14.3%)	567 (11.3%)	5.38	N/A	8,925 (14.8%)	144 (11.7%)	61.98	N/A	11.52* (9.55-13.89)	N/A
3rd Quintile	Men	4,443 (20.9%)	687 (13.7%)	6.47	0.96 (0.83-1.12)	12,302 (20.4%)	154 (12.5%)	79.88	0.76** (0.55-1.05)	12.35* (10.34-14.76)	0.79 (0.55-1.12)
	Women	126 (0.6%)	180 (3.6%)	0.70	0.10* (0.08-0.14)	219 (0.4%)	58 (4.7%)	3.78	0.04* (0.02-0.05)	5.39* (3.73-7.80)	0.34* (0.21-0.56)
	Subtotal	4,576 (21.5%)	868 (17.3%)	5.27	N/A	12,917 (21.4%)	212 (17.2%)	60.93	N/A	11.56* (9.91-13.48)	N/A
2nd Quintile	Men	6,690 (31.4%)	1,112 (22.2%)	6.02	0.90 (0.78-1.03)	18,768 (31.1%)	225 (18.2%)	83.41	0.79 (0.58-1.08)	13.86* (11.98-16.04)	0.89 (0.63-1.24)
	Women	169 (0.8%)	322 (6.4%)	0.52	0.08* (0.06-0.10)	369 (0.6%)	82 (6.6%)	4.50	0.04* (0.03-0.06)	8.57* (6.33-11.61)	0.55* (0.36-0.84)
	Subtotal	6,876 (32.3%)	1,434 (28.6%)	4.79	N/A	19,628 (32.5%)	307 (24.9%)	63.93	N/A	13.33* (11.75-15.13)	N/A
1st Quintile - most deprived	Men	4,248 (20.0%)	933 (18.6%)	4.55	0.68* (0.59-0.78)	11,512 (19.1%)	273 (22.1%)	42.17	0.40* (0.30-0.54)	9.26* (8.06-10.65)	0.59* (0.42-0.83)
	Women	160 (0.8%)	363 (7.2%)	0.44	0.07* (0.05-0.08)	295 (0.5%)	110 (8.9%)	2.68	0.03* (0.02-0.04)	6.08* (4.57-8.11)	0.39* (0.26-0.59)
	Subtotal	4,418 (20.7%)	1,296 (25.8%)	3.41	N/A	12,187 (20.2%)	383 (31.0%)	31.82	N/A	9.33* (8.29-10.51)	N/A
Not reported	Men	312 (1.5%)	298 (5.9%)	1.05	0.16* (0.13-0.19)	979 (1.6%)	86 (7.0%)	11.38	0.11* (0.08-0.15)	10.87* (8.29-14.27)	0.69** (0.46-1.04)
	Women	23 (0.1%)	188 (3.7%)	0.12	0.02* (0.01-0.03)	019 (0.0%)	31 (2.5%)	0.61	0.01* (0.00-0.01)	5.01* (2.45-10.26)	0.32* (0.15-0.70)
	Subtotal	336 (1.6%)	487 (9.7%)	0.69	N/A	1,103 (1.8%)	117 (9.5%)	9.43	N/A	13.66* (10.79-17.30)	N/A

* p-value<0.01

** p-value<0.1

Supplementary material 2

Table 1. Distribution of the number of PrEP users and PrEP need (via the recent new HIV diagnosis proxy) in England during the pre- (PrEP Impact Trial – October 2017 to February 2020) and post-commissioning (2021) period of PrEP by age and gender (including gender and sexual orientation minorities)

Age	Gender	Pre-commissioning (Oct 2017 – Feb 2020)				Post-commissioning (2021)				Pre- to post-commissioning comparisons within groups	Pre- to post-commissioning comparisons across groups
		PrEP users N (%)	Recent new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PrEP users N (%)	Recent new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PnR relative difference (95% CI)	PnR relative difference (95% CI)
Overall	Total	21,292 (100.0%)	703 (100.0%)	30.29	N/A	60,384 (100.0%)	148 (100.0%)	408.00	N/A	13.47* (11.28-16.09)	N/A
	Men, of which:	20,626 (96.9%)	601 (85.5%)	34.32	Baseline group	57,169 (94.7%)	122 (82.4%)	468.60	Baseline group	13.65* (11.23-16.60)	Baseline group
	MSM	20,349 (95.6%)	474 (67.4%)	42.93	N/A	49,543 (82.0%)	74 (50.0%)	669.50	N/A	15.60* (12.20-19.93)	N/A
	Heterosexual men	277 (1.3%)	127 (18.1%)	2.18	N/A	7,626 (12.6%)	48 (32.4%)	158.88	N/A	72.84* (51.17-103.68)	N/A
	Women	623 (2.9%)	102 (14.5%)	6.11	0.18* (0.14-0.22)	1,198 (2.0%)	25 (16.9%)	47.92	0.10* (0.07-0.16)	7.85* (5.01-12.28)	0.57** (0.35-0.94)
	Transgender people ¹	456 (2.1%)	9 (1.3%)	50.67	N/A	527 (0.9%)	0 (0.0%)	N/A	N/A	N/A	N/A
16 to 24	Men	2,973 (14.0%)	107 (15.2%)	27.79	Baseline group	8,691 (14.4%)	19 (12.8%)	457.42	Baseline group	16.46* (10.09-26.86)	Baseline group
	Women	115 (0.5%)	22 (3.1%)	5.23	0.19* (0.11-0.31)	261 (0.4%)	8 (5.4%)	32.63	0.07* (0.03-0.16)	6.24* (2.70-14.43)	0.38** (0.14-1.00)
	Subtotal	3,104 (14.6%)	129 (18.3%)	24.06	N/A	9,313 (15.4%)	28 (18.9%)	332.61	N/A	13.82* (9.17-20.84)	N/A
25 to 34	Men	8,348 (39.2%)	241 (34.3%)	34.64	1.25** (0.99-1.57)	23,603 (39.1%)	52 (35.1%)	453.90	0.99 (0.59-1.68)	13.10* (9.70-17.70)	0.80 (0.45-1.41)
	Women	251 (1.2%)	26 (3.7%)	9.65	0.35* (0.22-0.54)	492 (0.8%)	6 (4.1%)	82.00	0.18* (0.07-0.45)	8.49* (3.45-20.91)	0.52 (0.19-1.44)
	Subtotal	8,617 (40.5%)	267 (38.0%)	32.27	N/A	24,830 (41.1%)	58 (39.2%)	428.10	N/A	13.26* (9.98-17.64)	N/A
35 to 49	Men	6,832 (32.1%)	181 (25.7%)	37.75	1.36** (1.07-1.73)	17,972 (29.8%)	34 (23.0%)	528.59	1.16 (0.66-2.03)	14.00* (9.70-20.22)	0.85 (0.46-1.57)
	Women	182 (0.9%)	31 (4.4%)	5.87	0.21* (0.14-0.32)	348 (0.6%)	5 (3.4%)	69.60	0.15* (0.06-0.41)	11.86* (4.53-31.01)	0.72 (0.24-2.12)
	Subtotal	7,021 (33.0%)	212 (30.2%)	33.12	N/A	18,889 (31.3%)	39 (26.4%)	484.33	N/A	14.62* (10.38-20.60)	N/A
50 to 64	Men	2,202 (10.3%)	61 (8.7%)	36.10	1.30 (0.94-1.79)	6,184 (10.2%)	13 (8.8%)	475.69	1.04 (0.51-2.11)	13.18* (7.23-24.03)	0.80 (0.37-1.74)
	Women	64 (0.3%)	18 (2.6%)	3.56	0.13* (0.07-0.22)	88 (0.1%)	9 (6.1%)	9.78	0.02* (0.01-0.05)	2.75** (1.16-6.52)	0.17* (0.06-0.45)
	Subtotal	2,267 (10.6%)	79 (11.2%)	28.70	N/A	6,583 (10.9%)	19 (12.8%)	346.47	N/A	12.07* (7.30-19.97)	N/A
65 and over	Men	271 (1.3%)	11 (1.6%)	24.64	0.89 (0.47-1.67)	718 (1.2%)	4 (2.7%)	179.50	0.39** (0.13-1.16)	7.29* (2.30-23.08)	0.44 (0.13-1.55)
	Women	11 (0.1%)	5 (0.7%)	2.20	0.08* (0.03-0.23)	7 (0.0%)	0 (0.0%)	N/A	N/A	N/A	N/A
	Subtotal	283 (1.3%)	16 (2.3%)	17.69	N/A	766 (1.3%)	4 (2.7%)	191.50	N/A	10.83* (3.59-32.67)	N/A

¹ Transgender people includes transgender men, transgender women and those who identified as non-binary and was only available for the national gender breakdown to avoid small number masking, as required by UKHSA data request policy.

* p-value<0.01

**p-value<0.1

Table 2. Distribution of the number of PrEP users and PrEP need (via the recent new HIV diagnosis proxy) in England during the pre- (PrEP Impact Trial – October 2017 to February 2020) and post-commissioning (2021) period of PrEP by ethnicity and gender

Ethnicity	Gender	Pre-commissioning (Oct 2017 – Feb 2020)				Post-commissioning (2021)				Pre- to post-commissioning comparisons within groups	Pre- to post-commissioning comparisons across groups
		PrEP users N (%)	Recent new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PrEP users N (%)	Recent new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PnR relative difference (95% CI)	PnR relative difference (95% CI)
White	Men	15,669 (73.6%)	397 (56.5%)	39.47	Baseline group	41,765 (69.2%)	68 (45.9%)	614.19	Baseline group	15.56* (12.02-20.14)	Baseline group
	Women	367 (1.7%)	58 (8.3%)	6.33	0.16* (0.12-0.22)	714 (1.2%)	9 (6.1%)	79.33	0.13* (0.06-0.26)	12.54* (6.14-25.59)	0.81 (0.38-1.72)
	Subtotal	16,061 (75.4%)	455 (64.7%)	35.30	N/A	44,106 (73.0%)	78 (52.7%)	565.46	N/A	16.02* (12.59-20.38)	N/A
Black African	Men	339 (1.6%)	27 (3.8%)	12.56	0.32* (0.21-0.48)	1,050 (1.7%)	8 (5.4%)	131.25	0.21* (0.10-0.45)	10.45* (4.70-23.23)	0.67 (0.29-1.55)
	Women	36 (0.2%)	18 (2.6%)	2.00	0.05* (0.03-0.09)	42 (0.1%)	8 (5.4%)	5.25	0.01* (0.00-0.02)	2.63** (1.02-6.75)	0.17* (0.06-0.45)
	Subtotal	376 (1.8%)	45 (6.4%)	8.36	N/A	1,131 (1.9%)	16 (10.8%)	70.69	N/A	8.46* (4.73-15.14)	N/A
Black Caribbean	Men	341 (1.6%)	0 (0.0%)	N/A	N/A	964 (1.6%)	0 (0.0%)	N/A	N/A	N/A	N/A
	Women	9 (0.0%)	0 (0.0%)	N/A	N/A	19 (0.0%)	0 (0.0%)	N/A	N/A	N/A	N/A
	Subtotal	350 (1.6%)	0 (0.0%)	N/A	N/A	996 (1.6%)	0 (0.0%)	N/A	N/A	N/A	N/A
Black Other	Men	128 (0.6%)	18 (2.6%)	7.11	0.18* (0.11-0.30)	336 (0.6%)	4 (2.7%)	84.00	0.14* (0.05-0.38)	11.81* (3.92-35.58)	0.76 (0.24-2.36)
	Women	6 (0.0%)	8 (1.1%)	0.75	0.02* (0.01-0.06)	13 (0.0%)	4 (2.7%)	3.25	0.01* (0.00-0.02)	4.33** (0.93-20.24)	0.28 (0.06-1.33)
	Subtotal	134 (0.6%)	26 (3.7%)	5.15	N/A	358 (0.6%)	6 (4.1%)	59.67	N/A	11.58* (4.66-28.75)	N/A
Asian	Men	1,041 (4.9%)	46 (6.5%)	22.63	0.57* (0.42-0.78)	4,413 (7.3%)	9 (6.1%)	490.33	0.80 (0.40-1.60)	21.67* (10.57-44.41)	1.39 (0.65-2.98)
	Women	46 (0.2%)	4 (0.6%)	11.50	0.29** (0.10-0.81)	86 (0.1%)	0 (0.0%)	N/A	N/A	N/A	N/A
	Subtotal	1,092 (5.1%)	50 (7.1%)	21.84	N/A	4,616 (7.6%)	9 (6.1%)	512.89	N/A	23.48* (11.51-47.90)	N/A
Mixed/ other	Men	1,646 (7.7%)	64 (9.1%)	25.72	0.65* (0.50-0.85)	4,675 (7.7%)	14 (9.5%)	333.93	0.54** (0.31-0.97)	12.98* (7.26-23.21)	0.83 (0.44-1.58)
	Women	87 (0.4%)	5 (0.7%)	17.40	0.44** (0.18-1.09)	175 (0.3%)	4 (2.7%)	43.75	0.07* (0.03-0.20)	2.51 (0.66-9.60)	0.16* (0.04-0.63)
	Subtotal	1,740 (8.2%)	69 (9.8%)	25.22	N/A	4,960 (8.2%)	17 (11.5%)	291.76	N/A	11.57* (6.79-19.73)	N/A
Not stated	Men	1,462 (6.9%)	49 (7.0%)	29.84	0.76** (0.56-1.02)	3,966 (6.6%)	24 (16.2%)	165.25	0.27* (0.17-0.43)	5.54* (3.39-9.06)	0.36* (0.20-0.62)
	Women	72 (0.3%)	9 (1.3%)	8.00	0.20* (0.10-0.41)	149 (0.2%)	4 (2.7%)	37.25	0.06* (0.02-0.17)	4.66** (1.39-15.63)	0.30** (0.09-1.03)
	Subtotal	1,539 (7.2%)	58 (8.3%)	26.53	N/A	4,217 (7.0%)	22 (14.9%)	191.68	N/A	7.22* (4.41-11.84)	N/A
Latin American ²	Men	714 (3.4%)	24 (3.4%)	29.75	0.75 (0.50-1.15)	2,459 (4.1%)	4 (2.7%)	614.75	1.00 (0.36-2.75)	20.67* (7.15-59.76)	1.33 (0.45-3.96)
	Women	81 (0.4%)	4 (0.6%)	20.25	0.51 (0.19-1.41)	218 (0.4%)	4 (2.7%)	54.50	0.09* (0.03-0.25)	2.69 (0.66-11.02)	0.17** (0.04-0.72)
	Subtotal	796 (3.7%)	24 (3.4%)	33.17	N/A	2,702 (4.5%)	4 (2.7%)	675.50	N/A	20.37* (7.05-58.88)	N/A

² Latin American is not an ethnicity readily available in the GUMCAD and HARS datasets and was derived from the attendee's country of birth (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Argentina, Bolivia, Bouvet, Brazil, Chile, Colombia, Ecuador, Falkland Islands, French Guiana, Guyana, Paraguay, Peru, South Georgia and the South Sandwich Islands, Suriname, Uruguay, Venezuela)

* p-value<0.01

** p-value<0.1

Table 3. Distribution of the number of PrEP users and PrEP need (via the recent new HIV diagnosis proxy) in England during the pre- (PrEP Impact Trial – October 2017 to February 2020) and post-commissioning (2021) period of PrEP by region of residence and gender.

Region	Gender	Pre-commissioning (Oct 2017 – Feb 2020)				Post-commissioning (2021)				Pre- to post-commissioning comparisons within groups	Pre- to post-commissioning comparisons across groups
		PrEP users N (%)	Recent new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PrEP users N (%)	Recent new HIV dx N (%)	PnR	PnR relative difference (95% CI)	PnR relative difference (95% CI)	PnR relative difference (95% CI)
London	Men	10,927 (52.1%)	287 (40.8%)	38.07	Baseline group	32,708 (55.2%)	48 (32.4%)	681.42	Baseline group	17.90* (13.17-24.31)	Baseline group
	Women	330 (1.6%)	34 (4.8%)	9.71	0.25* (0.18-0.37)	668 (1.1%)	8 (5.4%)	83.50	0.12* (0.06-0.26)	8.60* (3.94-18.79)	0.48** (0.21-1.11)
	Subtotal	11,275 (53.8%)	321 (45.7%)	35.12	N/A	33,569 (56.6%)	56 (37.8%)	599.45	N/A	17.07* (12.84-22.69)	N/A
Midlands & East of England	Men	2,518 (12.0%)	97 (13.8%)	25.96	0.68* (0.54-0.86)	5,816 (9.8%)	27 (18.2%)	215.41	0.32* (0.20-0.51)	8.30* (5.40-12.74)	0.46* (0.27-0.79)
	Women	92 (0.4%)	26 (3.7%)	3.54	0.09* (0.06-0.15)	152 (0.3%)	7 (4.7%)	21.71	0.03* (0.01-0.07)	6.14* (2.56-14.70)	0.34** (0.14-0.87)
	Subtotal	2,615 (12.5%)	123 (17.5%)	21.26	N/A	6,726 (11.3%)	34 (23.0%)	197.82	N/A	9.30* (6.35-13.64)	N/A
North of England	Men	3,274 (15.6%)	139 (19.8%)	23.55	0.62* (0.50-0.76)	9,231 (15.6%)	27 (18.2%)	341.89	0.50* (0.31-0.80)	14.52* (9.59-21.96)	0.81 (0.48-1.36)
	Women	84 (0.4%)	23 (3.3%)	3.65	0.10* (0.06-0.15)	180 (0.3%)	9 (6.1%)	20.00	0.03* (0.01-0.06)	5.48* (2.43-12.35)	0.31* (0.13-0.73)
	Subtotal	3,366 (16.1%)	162 (23.0%)	20.78	N/A	9,858 (16.6%)	36 (24.3%)	273.83	N/A	13.18* (9.16-18.95)	N/A
South of England	Men	3,595 (17.2%)	78 (11.1%)	46.09	1.21 (0.94-1.56)	8,454 (14.3%)	24 (16.2%)	352.25	0.52* (0.32-0.84)	7.64* (4.83-12.10)	0.43* (0.25-0.74)
	Women	94 (0.4%)	19 (2.7%)	4.95	0.13* (0.08-0.22)	179 (0.3%)	4 (2.7%)	44.75	0.07* (0.02-0.18)	9.05* (2.99-27.36)	0.51 (0.16-1.59)
	Subtotal	3,700 (17.7%)	97 (13.8%)	38.14	N/A	9,147 (15.4%)	22 (14.9%)	415.77	N/A	10.90* (6.85-17.34)	N/A

* p-value<0.01

** p-value<0.1

Supplementary material 3

Table 1. Distribution of the number of PrEP users and PrEP need as defined by UKHSA (1) in England during the post-commissioning (2021) period of PrEP by age and gender (including gender and sexual orientation minorities)

Age	Gender	Post-commissioning (2021)			
		PrEP users (N, %)	SSHS patients with PrEP need (N, %)	PnR	PnR relative difference (95% CI)
Overall	Total	60,384 (100.0%)	87,828 (100.0%)	0.69	N/A
	Men, of which:	57,169 (94.7%)	80,877 (92.1%)	0.71	Baseline group
	MSM	49,543 (82.0%)	70,076 (79.8%)	0.71	N/A
	Heterosexual men	7,626 (12.6%)	10,801 (12.3%)	0.71	N/A
	Women	1,198 (2.0%)	3,901 (4.4%)	0.31	0.43* (0.41-0.46)
	Transgender people ¹	527 (0.9%)	847 (1.0%)	0.62	N/A
16 to 24	Men	8,691 (14.4%)	14,252 (16.2%)	0.61	Baseline group
	Women	261 (0.4%)	1,159 (1.3%)	0.23	0.37* (0.32-0.42)
	Subtotal	9,313 (15.4%)	16,088 (18.3%)	0.58	N/A
25 to 34	Men	23,603 (39.1%)	33,354 (38.0%)	0.71	1.16* (1.12-1.20)
	Women	492 (0.8%)	1,477 (1.7%)	0.33	0.55* (0.49-0.61)
	Subtotal	24,830 (41.1%)	35,956 (41.0%)	0.69	N/A
35 to 49	Men	17,972 (29.8%)	24,011 (27.3%)	0.75	1.23* (1.19-1.27)
	Women	348 (0.6%)	995 (1.1%)	0.35	0.57* (0.51-0.65)
	Subtotal	18,889 (31.3%)	25,800 (29.4%)	0.73	N/A
50 to 64	Men	6,184 (10.2%)	8,180 (9.3%)	0.76	1.24* (1.19-1.29)
	Women	88 (0.1%)	225 (0.3%)	0.39	0.64* (0.50-0.82)
	Subtotal	6,583 (10.9%)	8,793 (10.0%)	0.75	N/A
65 and over	Men	718 (1.2%)	1,072 (1.2%)	0.67	1.10** (1.00-1.21)
	Women	7 (0.0%)	26 (0.0%)	0.27	0.44** (0.19-1.02)
	Subtotal	766 (1.3%)	1,161 (1.3%)	0.66	N/A

¹ Transgender people includes transgender men, transgender women and those who identified as non-binary and was only available for the national gender breakdown to avoid small number masking, as required by UKHSA data request policy.

* p-value<0.01

**p-value<0.1

Table 2. Distribution of the number of PrEP users and PrEP need as defined by UKHSA (1) in England during the post-commissioning (2021) period of PrEP by ethnicity and gender

Ethnicity	Gender	Post-commissioning (2021)			
		PrEP users (N, %)	SSHS patients with PrEP need (N, %)	PnR	PnR relative difference (95% CI)
White	Men	41,765 (69.2%)	58,431 (66.5%)	0.71	Baseline group
	Women	714 (1.2%)	2,382 (2.7%)	0.30	0.42* (0.39-0.46)
	Subtotal	44,106 (73.0%)	63,190 (71.9%)	0.70	N/A
Black African	Men	1,050 (1.7%)	1,768 (2.0%)	0.59	0.83* (0.77-0.90)
	Women	42 (0.1%)	278 (0.3%)	0.15	0.21* (0.15-0.29)
	Subtotal	1,131 (1.9%)	2,130 (2.4%)	0.53	N/A
Black Caribbean	Men	964 (1.6%)	1,562 (1.8%)	0.62	0.86* (0.80-0.94)
	Women	19 (0.0%)	82 (0.1%)	0.23	0.32* (0.20-0.53)
	Subtotal	996 (1.6%)	1,663 (1.9%)	0.60	N/A
Black Other	Men	336 (0.6%)	538 (0.6%)	0.62	0.87** (0.76-1.00)
	Women	13 (0.0%)	55 (0.1%)	0.24	0.33* (0.18-0.61)
	Subtotal	358 (0.6%)	605 (0.7%)	0.59	N/A
Asian	Men	4,413 (7.3%)	6,033 (6.9%)	0.73	1.02 (0.98-1.07)
	Women	86 (0.1%)	208 (0.2%)	0.41	0.58* (0.45-0.74)
	Subtotal	4,616 (7.6%)	6,425 (7.3%)	0.72	N/A
Mixed/ other	Men	4,675 (7.7%)	6,428 (7.3%)	0.73	1.02 (0.98-1.06)
	Women	175 (0.3%)	377 (0.4%)	0.46	0.65* (0.54-0.78)
	Subtotal	4,960 (8.2%)	6,973 (7.9%)	0.71	N/A
Not stated	Men	3,966 (6.6%)	6,117 (7.0%)	0.65	0.91* (0.87-0.95)
	Women	149 (0.2%)	519 (0.6%)	0.29	0.40* (0.33-0.48)
	Subtotal	4,217 (7.0%)	6,842 (7.8%)	0.62	N/A
Latin American flag ²	Men	2,459 (4.1%)	3,032 (3.5%)	0.81	1.13* (1.07-1.20)
	Women	218 (0.4%)	325 (0.4%)	0.67	0.94 (0.79-1.11)
	Subtotal	2,702 (4.5%)	3,398 (3.9%)	0.80	N/A

² Latin American is not an ethnicity readily available in the GUMCAD and HARS datasets and was derived from the attendee's country of birth (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Argentina, Bolivia, Bouvet, Brazil, Chile, Colombia, Ecuador, Falkland Islands, French Guiana, Guyana, Paraguay, Peru, South Georgia and the South Sandwich Islands, Suriname, Uruguay, Venezuela)

* p-value<0.01

** p-value<0.1

Table 3. Distribution of the number of PrEP users and PrEP need as defined by UKHSA (1) in England during the post-commissioning (2021) period of PrEP by region of residence and gender. *p-value<0.01

Region	Gender	Post-commissioning (2021)			
		PrEP users (N, %)	SSHS patients with PrEP need (N, %)	PnR	PnR relative difference (95% CI)
London	Men	32,708 (55.2%)	40,963 (47.6%)	0.80	Baseline group
	Women	668 (1.1%)	1,524 (1.8%)	0.44	0.55* (0.50-0.60)
	Subtotal	33,569 (56.6%)	42,774 (49.7%)	0.78	N/A
Midlands & East of England	Men	5,816 (9.8%)	10,393 (12.1%)	0.56	0.70* (0.68-0.73)
	Women	152 (0.3%)	773 (0.9%)	0.20	0.25* (0.21-0.29)
	Subtotal	6,726 (11.3%)	12,337 (14.3%)	0.55	N/A
North of England	Men	9,231 (15.6%)	15,093 (17.5%)	0.61	0.77* (0.74-0.79)
	Women	180 (0.3%)	824 (1.0%)	0.22	0.27* (0.23-0.32)
	Subtotal	9,858 (16.6%)	16,587 (19.3%)	0.59	N/A
South of England	Men	8,454 (14.3%)	12,924 (15.0%)	0.65	0.82* (0.79-0.85)
	Women	179 (0.3%)	704 (0.8%)	0.25	0.32* (0.27-0.38)
	Subtotal	9,147 (15.4%)	14,385 (16.7%)	0.64	N/A

Table 4. Distribution of the number of PrEP users and PrEP need as defined by UKHSA (1) in England during the post-commissioning (2021) period of PrEP by region of residence and ethnicity. Here Black other includes people of Black Caribbean ethnicity.

Region	Ethnicity	Post-commissioning (2021)			
		PrEP users (N, %)	SSHS patients with PrEP need (N, %)	PnR	PnR ratio (95% CI)
London	White	22,371 (37.7%)	27,489 (31.9%)	0.81	Baseline group
	Black African	843 (1.4%)	1,375 (1.6%)	0.61	0.75* (0.69-0.82)
	Black other	1,032 (1.7%)	1,635 (1.9%)	0.63	0.78* (0.72-0.84)
	Asian	3,145 (5.3%)	3,988 (4.6%)	0.79	0.97 (0.92-1.02)
	Mixed/other	3,594 (6.1%)	4,682 (5.4%)	0.77	0.94** (0.90-0.99)
	Not stated	2,584 (4.4%)	3,605 (4.2%)	0.72	0.88* (0.83-0.93)
	Subtotal	33,569 (56.6%)	42,774 (49.7%)	0.78	N/A
Midlands & East of England	White	5,285 (8.9%)	9,261 (10.8%)	0.57	0.70* (0.68-0.73)
	Black African	99 (0.2%)	301 (0.3%)	0.33	0.40* (0.32-0.51)
	Black other	119 (0.2%)	262 (0.3%)	0.45	0.56* (0.45-0.69)
	Asian	478 (0.8%)	876 (1.0%)	0.55	0.67* (0.60-0.75)
	Mixed/other	316 (0.5%)	628 (0.7%)	0.50	0.62* (0.54-0.71)
	Not stated	429 (0.7%)	1,009 (1.2%)	0.43	0.52* (0.47-0.59)
	Subtotal	6,726 (11.3%)	12,337 (14.3%)	0.55	N/A
North of England	White	8,034 (13.5%)	13,400 (15.6%)	0.60	0.74* (0.71-0.76)
	Black African	102 (0.2%)	243 (0.3%)	0.42	0.52* (0.41-0.65)
	Black other	107 (0.2%)	191 (0.2%)	0.56	0.69* (0.54-0.87)
	Asian	502 (0.8%)	816 (0.9%)	0.62	0.76* (0.68-0.85)
	Mixed/other	503 (0.8%)	814 (0.9%)	0.62	0.76* (0.68-0.85)
	Not stated	610 (1.0%)	1,123 (1.3%)	0.54	0.67* (0.60-0.74)
	Subtotal	9,858 (16.6%)	16,587 (19.3%)	0.59	N/A
South of England	White	7,646 (12.9%)	11,846 (13.8%)	0.65	0.79* (0.77-0.82)
	Black African	69 (0.1%)	176 (0.2%)	0.39	0.48* (0.36-0.64)
	Black other	80 (0.1%)	144 (0.2%)	0.56	0.68* (0.52-0.90)
	Asian	403 (0.7%)	613 (0.7%)	0.66	0.81* (0.71-0.92)
	Mixed/other	463 (0.8%)	718 (0.8%)	0.64	0.79* (0.70-0.89)
	Not stated	486 (0.8%)	888 (1.0%)	0.55	0.67* (0.60-0.75)
	Subtotal	9,147 (15.4%)	14,385 (16.7%)	0.64	N/A

* p-value<0.01

** p-value<0.1

Table 5. Distribution of the number of PrEP users and PrEP need as defined by UKHSA (1) in England during the post-commissioning (2021) period of PrEP by Index of Multiple Deprivation (IMD) and gender

IMD	Gender	Post-commissioning (2021)			
		PrEP users (N, %)	SSHS patients with PrEP need (N, %)	PnR	PnR relative difference (95% CI)
5th Quintile - least deprived	Men	5,254 (8.7%)	7,798 (8.9%)	0.67	Baseline group
	Women	92 (0.2%)	347 (0.4%)	0.27	0.39* (0.31-0.50)
	Subtotal	5,624 (9.3%)	8,569 (9.8%)	0.66	N/A
4th Quintile	Men	8,354 (13.8%)	12,036 (13.7%)	0.69	1.03 (0.99-1.08)
	Women	204 (0.3%)	562 (0.6%)	0.36	0.54* (0.46-0.63)
	Subtotal	8,925 (14.8%)	13,157 (15.0%)	0.68	N/A
3rd Quintile	Men	12,302 (20.4%)	17,076 (19.4%)	0.72	1.07* (1.03-1.12)
	Women	219 (0.4%)	737 (0.8%)	0.30	0.44* (0.38-0.51)
	Subtotal	12,917 (21.4%)	18,378 (20.9%)	0.70	N/A
2nd Quintile	Men	18,768 (31.1%)	25,446 (29.0%)	0.74	1.09* (1.05-1.14)
	Women	369 (0.6%)	1,079 (1.2%)	0.34	0.51* (0.45-0.57)
	Subtotal	19,628 (32.5%)	27,258 (31.0%)	0.72	N/A
1st Quintile - most deprived	Men	11,512 (19.1%)	16,991 (19.3%)	0.68	1.01 (0.96-1.05)
	Women	295 (0.5%)	1,100 (1.3%)	0.27	0.40* (0.35-0.45)
	Subtotal	12,187 (20.2%)	18,695 (21.3%)	0.65	N/A
Not reported	Men	979 (1.6%)	1,530 (1.7%)	0.64	0.95 (0.87-1.04)
	Women	19 (0.0%)	76 (0.1%)	0.25	0.37* (0.22-0.61)
	Subtotal	1,103 (1.8%)	1,771 (2.0%)	0.62	N/A

* p-value<0.01

References

1. Routine commissioning of HIV pre-exposure prophylaxis (PrEP) in England: Monitoring and evaluation framework. London: UKHSA; 2022.