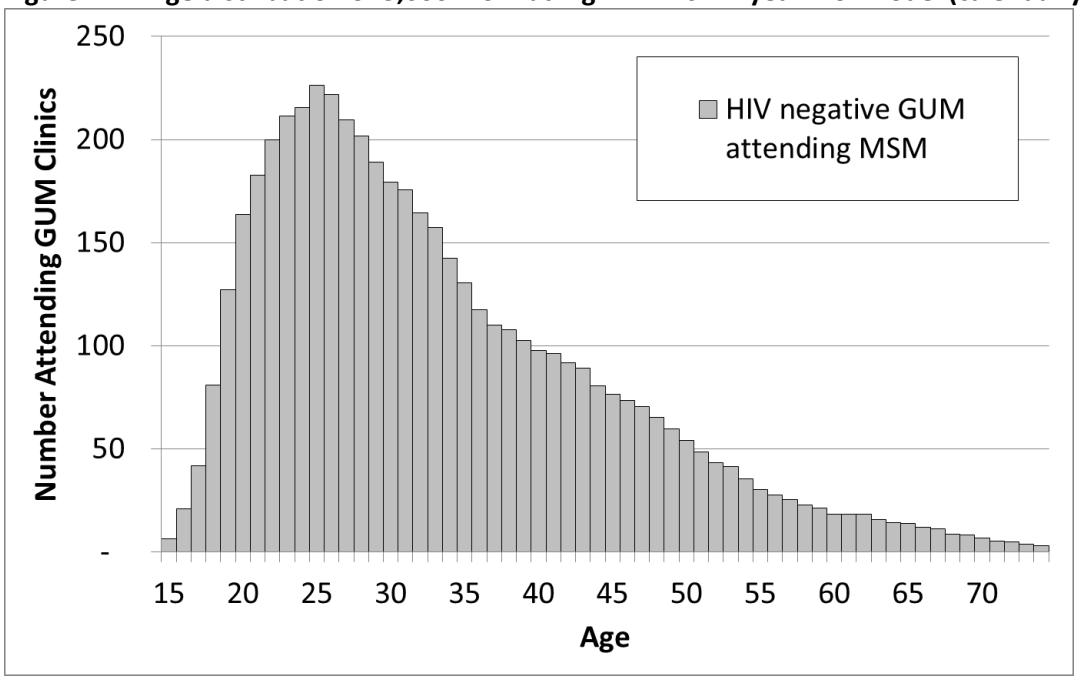
ECONOMIC EVALUATION OF HIV PRE-EXPOSURE PROPHYLAXIS AMONG MEN-WHO-HAVE-SEX-WITH-MEN IN ENGLAND: SUPPLEMENTARY MATERIAL

SUPPLEMENTARY MATERIAL 1

Age distribution of MSM GUM clinic attendees at high HIV risk

The 5,000 MSM at high HIV risk who were given HIV-PrEP in the first year of our model (calendar year 2016) were age stratified according to the ages of HIV negative MSM who attended GUM clinics in 2013 and/or 2014 – from the GUMCAD information system [1]. This age distribution is presented in **Figure A - 1**.

Figure A - 1 Age distribution of 5,000 MSM at high HIV risk in year-1 of model (calendar year 2016)



SUPPLEMENTARY MATERIAL 2

HIV-PrEP GUM pathway

The cost of HIV-PrEP delivery via GUM clinics was estimated using a micro-costing approach. The pathway of care for a patient receiving HIV-PrEP via a GUM clinic was derived from the UK PROUD trial protocol, with expert opinion input (Professor S McCormack, MRC Clinical Trials Unit at University College London, and Dr J Saunders, University College London, personal communications) [2]. Detailed pathway unit costs were taken from treatment pathways compiled by Pathway Analytics and modified accordingly, by selecting the steps relevant to HIV-PrEP, and updated with current laboratory pathology prices (published HIV test price, and a University College London provider-to-provider services tariff 2012-13) and consumables prices obtained from NHS Supply Chain [3–6]. A graphical representation of the flow of a patient through the HIV-PrEP management pathway at a GUM clinic is illustrated in **Figure A - 2**.

Individuals given PrEP were assumed to have five clinic visits in year-1. For MSM at high HIV risk, existing BASHH guidelines recommend quarterly STI screens, so a PrEP eligible MSM would require one additional visit per year [7]. Only the additional PrEP costs of a month-1 clinic visit and the PrEP specific staff time and renal function tests were included as the opportunity cost of clinic resource forgone through PrEP provision. This was estimated to cost an additional £176 (€239) per MSM during the first year of HIV-PrEP commencement. This covers HIV-PrEP-related costs within appointments during the first 12 months, occurring at month 0, 1, 3, 6, and 9. The additional HIV-PrEP clinic cost of £176 (€239) was calculated by firstly estimating the total cost of the HIV-PrEP GUM delivery pathway (£649 (€883), **Figure A - 2**), minus the recommended number of routine GUM clinic attendance for HIV testing and STI screens in MSM at high risk, as recommended by BASHH (quarterly, assumed to occur at month 0, 3, 6, and 9, giving a total cost of £473 (€644)) [7].

Figure A - 2 GUM pathway for the management of a patient on HIV-PrEP, and routine HIV/STI screening; costs are undiscounted; Month 3/6/9 costs will repeat for quarterly appointments in subsequent years for MSM continuing HIV-PrEP beyond one year, with renal function assessments occurring at an annual frequency

GUM pathway for HIV-PrEP

Year 1

Month 0 (Baseline, day start HIV-PrEP – assuming patient comes in for routine HIV/STI consultation and is clinically risk assessed for HIV-PrEP)

Total cost for this step: £191 *[routine £121 + HIV-PrEP-additional £70]*

	Pathway step	Data source/notes	Pathway cost *[routine + HIV-PrEP-additional]*
1	Patient consultation		£76 *[£34 + £42]*
	Routine discussion	E.g. check recent sexual behaviour, recreational drug use	
	Assess HIV-PrEP eligibility		
	Check for contraindications	Contraindications, medical history	
	Start HIV-PrEP if clinically indicated	Give 1 month's supply	
2	HIV/STI tests		£92 *[£87 + £5]*

	HIV test negative	Routine screen using serology, plus additional Point-Of-Care-Test in 67% of patients	
	STI test (Chlamydia/Gonorrhoea 3 site plus syphilis test)	Routine screen	
	Hepatitis C test	Routine screen every 6 months (serology test considered if there is history of recreational drug use/chem sex), assume 50% of patients will be screened due to risk[7,8]	
3	Tenofovir disoproxil fumarate 245mg/emtricitabine 200mg (proprietary name Truvada®) - renal function monitoring		£23 *[£0 + £23]*
	Serum creatinine	Assessment of renal function prior to HIV-PrEP commencement	

Month 1

Total cost for this step: £52 *[routine £0 + HIV-PrEP-additional £52]*

	Pathway step	**Data source/notes**	**Pathway cost *[routine + HIV-PrEP-additional]***
1	Patient consultation		£44 *[£0 + £44]*
	Check drug management	Include review of adherence, dosing pattern/frequency	
	Sexual behaviour assessment	Any risk compensation?	
	Top-up HIV-PrEP	Give 2 months' supply after clinical need assessment, until next follow-up at month 3	
2	Tenofovir disoproxil fumarate 245mg/emtricitabine 200mg (proprietary name Truvada®) - renal function monitoring		£8 *[£0 + £8]*
	Urinalysis	Any suggestion of renal impairment?	
	7% with 1+ protein from urinalysis will need serum creatinine or urine protein:creatinine ratio test	UK PROUD study analysis found 7% participants with 1+ protein identified from urinalysis (David Dolling, personal communications, 28 January 2015)	

Month 3/6/9

Total cost for this step: £133 (without Hepatitis C screen, month 3/9); £139 (with Hepatitis C screen, month-6) *[routine £115/£122 + HIV-PrEP-additional £18]*

	Pathway step	**Data source/notes**	**Pathway cost *[routine + HIV-PrEP-additional]***
1	Patient consultation		£44 *[£34 + £10]*
	Routine discussion		
	Review treatment adherence/safety/tolerability, sexual behaviour assessment, clinical need and risk-assessment	Any HIV-PrEP-related safety concerns? Any bone fracture in past 4 months? Review patient adherence, dosing pattern/frequency? Any risk compensation?	
	Top-up HIV-PrEP	Give 3 months' supply after clinical need assessment, until next follow-up in 3 months	
2	HIV/STI tests		£81 (without Hepatitis C screen); £87 (with Hepatitic C screen in 50% of patients) *[£81/£87 + £0]*
	HIV test	Serology only	
	STI test (Chlamydia/Gonorrhoea 3 site plus syphilis test)	Routine screen	
	Hepatitis C test	Routine screen every 6 months (serology test considered if there is history of recreational drug use/chem sex), assume 50% of patients will be screened due to risk; once only at month-6[7,8]	
3	Tenofovir disoproxil fumarate 245mg/emtricitabine 200mg (proprietary name Truvada®) - renal function monitoring		£8 *[£0 + £8]*
	Urinalysis	Any suggestion of renal impairment?	
	7% with 1+ protein from urinalysis will need serum creatinine or urine protein:creatinine ratio test	UK PROUD study analysis found 7% participants with 1+ protein identified from urinalysis (David Dolling, personal communications, 28 January 2015)	

Year 2: For those continuing HIV-PrEP after one year

Month 12

Total cost for this step: £162 *[routine £121 + HIV-PrEP-additional £41]*

	Pathway step	Data source/notes	Pathway cost *[routine + HIV-PrEP-additional]*
1	Patient consultation		£52 *[£34 + £18]*
	Routine discussion		
	Review treatment adherence/safety/tolerability, sexual behaviour assessment, clinical need and risk-assessment	Any HIV-PrEP-related safety concerns? Any bone fracture in past 4 months? Review patient adherence, dosing pattern/frequency? Any risk compensation?	
	Top-up HIV-PrEP	Give 3 months' supply after clinical need assessment, until next follow-up in 3 months	
2	HIV/STI tests		£81 (without Hepatitis C screen); £87 (with Hepatitic C screen in 50% of patients) *[£81/£87 + £0]*
	HIV test		
	STI test (Chlamydia/Gonorrhoea 3 site plus syphilis test)	Routine screen	
	Hepatitis C test	Routine screen every 6 months (serology test considered if there is history of recreational drug use/chem sex), assume 50% of patients will be screened due to risk; once only at month-6[7,8]	
3	Tenofovir disoproxil fumarate 245mg/emtricitabine 200mg (proprietary name Truvada®) - renal function monitoring		£23 *[£0 + £23]*
	Serum creatinine	Assessment of renal function after 12 months on HIV-PrEP	

Figure A - 2 GUM pathway for the management of a patient on HIV-PrEP, and routine HIV/STI screening; costs are undiscounted; Month 3/6/9 costs will repeat for quarterly appointments in subsequent years for MSM continuing HIV-PrEP beyond one year, with renal function assessments occurring at an annual frequency

GUM pathway for HIV-PrEP

Year 1

Month 0 (Baseline, day start HIV-PrEP – assuming patient comes in for routine HIV/STI consultation and is clinically risk assessed for HIV-PrEP)

Total cost for this step: €260 *[routine €165 + HIV-PrEP-additional €95]*

	Pathway step	**Data source/notes**	**Pathway cost** *[routine + HIV-PrEP-additional]*
1	Patient consultation		€103 *[€46 + €57]*
	Routine discussion	E.g. check recent sexual behaviour, recreational drug use	
	Assess HIV-PrEP eligibility		
	Check for contraindications	Contraindications, medical history	
	Start HIV-PrEP if clinically indicated	Give 1 month's supply	
2	HIV/STI tests		€125 *[€118 + €7]*
	HIV test negative	Routine screen using serology, plus additional Point-Of-Care-Test in 67% of patients	
	STI test (Chlamydia/Gonorrhoea 3 site plus syphilis test)	Routine screen	
	Hepatitis C test	Routine screen every 6 months (serology test considered if there is history of recreational drug use/chem sex), assume 50% of patients will be screened due to risk[7,8]	
3	Tenofovir disoproxil fumarate 245mg/emtricitabine 200mg (proprietary name Truvada®) - renal function monitoring		€23 *[€0 + €31]*
	Serum creatinine	Assessment of renal function prior to HIV-PrEP commencement	

Month 1

Total cost for this step: €71 *[routine €0 + HIV-PrEP-additional €71]*

	Pathway step	Data source/notes	Pathway cost *[routine + HIV-PrEP-additional]*
1	Patient consultation		€60 *[€0 + €60]*
	Check drug management	Include review of adherence, dosing pattern/frequency	
	Sexual behaviour assessment	Any risk compensation?	
	Top-up HIV-PrEP	Give 2 months' supply after clinical need assessment, until next follow-up at month 3	
2	Tenofovir disoproxil fumarate 245mg/emtricitabine 200mg (proprietary name Truvada®) - renal function monitoring		€11 *[€0 + €11]*
	Urinalysis	Any suggestion of renal impairment?	
	7% with 1+ protein from urinalysis will need serum creatinine or urine protein:creatinine ratio test	UK PROUD study analysis found 7% participants with 1+ protein identified from urinalysis (David Dolling, personal communications, 28 January 2015)	

Month 3/6/9

Total cost for this step: €181 (without Hepatitis C screen, month 3/9); €189 (with Hepatitis C screen, month-6) *[routine €156/€166 + HIV-PrEP-additional €24]*

	Pathway step	Data source/notes	Pathway cost *[routine + HIV-PrEP-additional]*
1	Patient consultation		€60 *[€46 + €14]*
	Routine discussion		
	Review treatment adherence/safety/tolerability, sexual behaviour assessment, clinical need and risk-assessment	Any HIV-PrEP-related safety concerns? Any bone fracture in past 4 months? Review patient adherence, dosing pattern/frequency? Any risk compensation?	
	Top-up HIV-PrEP	Give 3 months' supply after clinical need assessment, until next follow-up in 3 months	
2	HIV/STI tests		€110 (without Hepatitis C screen); €118 (with Hepatitic C screen in 50% of patients) *[€110/€118 + €0]*
	HIV test	Serology only	
	STI test (Chlamydia/Gonorrhoea 3 site plus syphilis test)	Routine screen	
	Hepatitis C test	Routine screen every 6 months (serology test considered if there is history of recreational drug use/chem sex), assume 50% of patients will be screened due to risk; once only at month-6[7,8]	
3	Tenofovir disoproxil fumarate 245mg/emtricitabine 200mg (proprietary name Truvada®) - renal function monitoring		€11 *[€0 + €11]*
	Urinalysis	Any suggestion of renal impairment?	
	7% with 1+ protein from urinalysis will need serum creatinine or urine protein:creatinine ratio test	UK PROUD study analysis found 7% participants with 1+ protein identified from urinalysis (David Dolling, personal communications, 28 January 2015)	

Year 2: For those continuing HIV-PrEP after one year

Month 12

Total cost for this step: €220 *[routine €165 + HIV-PrEP-additional €56]*

	Pathway step	Data source/notes	Pathway cost *[routine + HIV-PrEP-additional]*
1	Patient consultation		€71 *[€46 + €24]*
	Routine discussion		
	Review treatment adherence/safety/tolerability, sexual behaviour assessment, clinical need and risk-assessment	Any HIV-PrEP-related safety concerns? Any bone fracture in past 4 months? Review patient adherence, dosing pattern/frequency? Any risk compensation?	

	Top-up HIV-PrEP	Give 3 months' supply after clinical need assessment, until next follow-up in 3 months	
2	HIV/STI tests		€110 (without Hepatitis C screen); €118 (with Hepatitic C screen in 50% of patients) *[€110/€118 + €0]*
	HIV test		
	STI test (Chlamydia/Gonorrhoea 3 site plus syphilis test)	Routine screen	
	Hepatitis C test	Routine screen every 6 months (serology test considered if there is history of recreational drug use/chem sex), assume 50% of patients will be screened due to risk; once only at month-6[7,8]	
3	Tenofovir disoproxil fumarate 245mg/emtricitabine 200mg (proprietary name Truvada®) - renal function monitoring		€31 *[€0 + €31]*
	Serum creatinine	Assessment of renal function after 12 months on HIV-PrEP	

SUPPLEMENTARY MATERIAL 3

Background Post-Exposure Prophylaxis following Sexual Exposure (PEPSE) use

Of the 17,429 high-risk MSM identified in GUMCAD, there was a total of 781 PEPSE courses prescribed to 663 individuals in year 2012 [1]. The total number of PEPSE courses is higher than the total number of individuals as some individuals had more than one course of PEPSE. By dividing the absolute number of PEPSE prescriptions over the total number of high-risk MSM, the proportion of overall PEPSE use was 4·48%, which we rounded to 5%.

SUPPLEMENTARY MATERIAL 4

HIV positive care and treatment costs

Methods

The cost of care and management of diagnosed HIV cases, excluding antiretroviral drug costs, were obtained from Beck *et al.* (published in 2011, using data from 1996 to 2008) [9]. Information extracted from this paper included cost of average use of health care services, and related tests and procedures, stratified by CD4+ count at diagnosis (CD4+ count above or below 200). This was then applied to information on time to CD4+ recovery to above 200, obtained from the SOPHID (2013) annual survey and the new HIV, AIDS and Death databases, and CD4 surveillance system (data year 2013), to estimate the duration whereby HIV care costs at CD4+ below 200 was applicable [10].

As HIV care cost estimates from Beck *et al.* were obtained from older information (year 1996 to 2008), we expected that the price paid for antiretroviral drugs would have changed over time. Hence, the cost of antiretroviral drugs were estimated using a combination of more recent information from an NHS England Freedom of Information request (FOI-007334: 2013 to 2015 London spending data) and the House of Lords Select Committee on HIV and AIDS in the UK written evidence (2009/10 data) [11,12]. These estimates covered HIV spend on antiretrovirals in London over recent years 2009/10, and 2013/14/15, and were thought to be more representative of the current actual price paid for antiretrovirals, as well as reflect the combination of antiretroviral regime prescribed, at different prices.

For the purpose of cost-utility analysis, we were interested in costs excluding Value Added Tax (VAT); but for budgetary impact, VAT inclusive costs [13]. Value Added Tax is payable for hospital dispensed items but zero-rated if dispensed via homecare or community pharmacies [14]. We believed that the London reported spend on antiretroviral drug included some amount of VAT i.e. the VAT-net costs would be lower. We do not know the proportion of drugs dispensed that had zero-rated VAT to calculate the VAT-net antiretroviral drug spend, and appreciate that the reported spend for London was higher than actual London VAT-net costs. However, we assumed that the overall VAT-net spend on antiretrovirals for the whole of England would be balanced by the fact that antiretrovirals purchased in other parts of England were more expensive than antiretrovirals purchased pan-London, due to lower purchasing power for the former (an estimated 44% of diagnosed HIV positive cases was in London in 2013, contributing to its higher purchasing power) [15]. Therefore, we assumed that the reported London spend on antiretrovirals reflect VAT-net spend on antiretrovirals for England and used these estimates for HIV treatment costs in our cost-utility analysis.

We assumed that the HIV-related cost of undiagnosed HIV is £0 (€0). In Burns *et al.*, the authors estimated that the median number of general practitioner visits in the year before HIV diagnosis in 237 Africans was two (range 0 to 18) [16]. This level of visit may be lower than the general population estimates (around 3x general practitioner consultations per person-year estimated using the QRESEARCH general practice database for each year from 1995 to 2006, reported in Figure 5 of Hippisley-Cox et al.) [17]. Taken together, we concluded that there is currently no strong evidence to

suggest that HIV positive individuals have higher rates of consultation compared with the general population in England, hence, no additional costs of undiagnosed HIV.

Results

HIV infection diagnosis and enrolment into HIV care timeline

Using years 2011 to 2013 estimated average time between HIV infection date to diagnosis date for high-risk MSM, identified from HIV surveillance data, we expected that 52% of all HIV infected individuals would be diagnosed within two years of incident infection [10]. **Table A - 1** shows the proportion of HIV-infected high-risk MSM diagnosed over time, up to 15 years. It was further estimated that the median time to CD4+ reduction to below 200 at diagnosis was between 8 years (for individuals over 50 years old) and 11·8 years (for those between 15 to 24 years old). We took the more conservative assumption and assumed that after year-8, all new diagnoses will present as very late diagnosis with CD4+<200. In addition, we assumed that all newly diagnosed individuals will start antiretroviral treatment immediately, in line with NHS England 'treatment as prevention' policy [18]. Analysis based on HIV surveillance data suggested that the time between antiretroviral treatment initiation to CD4+ count stabilisation for those with CD4+<200 at diagnosis was 68 days. As a result, we applied the higher HIV care costs for CD4+<200 at diagnosis for the period from diagnosis and antiretroviral treatment commencement until CD4+ recovery.

Table A - 1 Time to HIV diagnosis, CD4+ count at diagnosis and assumption about diagnosed individuals starting and remaining on antiretroviral treatment used in the model

Time (Year)	Proportion of HIV Infections Occurring in Year-1 that are Diagnosed in Year-1 or in Subsequent Rears	Cumulative Proportion Diagnosed	CD4+ Count at Diagnosis	Proportion of Diagnosed HIV who Started and Remained on Antiretroviral Treatment
1	39%	39%	>=200	100%
2	12%	52%	>=200	100%
3	11%	63%	>=200	100%
4	10%	73%	>=200	100%
5	9%	82%	>=200	100%
6	5%	87%	>=200	100%
7	4%	90%	>=200	100%
8	3%	93%	>=200	100%
9	1%	94%	<200	100%
10	1%	95%	<200	100%
11	1%	96%	<200	100%
12	1%	97%	<200	100%
13	1%	98%	<200	100%
14	1%	99%	<200	100%
15	1%	100%	<200	100%

SUPPLEMENTARY MATERIAL 5

MSM population size and HIV incidence estimate

HIV negative MSM population size by risk stratum

To estimate HIV incidence, we needed estimates of the size of the HIV negative MSM population in England. Using GUMCAD 2012 data, we identified 85,505 HIV negative MSM attended GUM clinics in England, 17,429 of whom recorded a bacterial STI diagnosis in the previous year and/or during his first attendance at the GUM clinic (defined as high-risk) [1]. The balance 68,076 HIV negative MSM who attended GUM clinic but who did not have bacterial STI diagnosis were assumed to belong to the medium-risk stratum.

We undertook a series of steps to estimate the average number of adult non-GUM attending HIV negative MSM in England, i.e. the low-risk stratum. Firstly, the average number of non-GUM attending HIV negative MSM aged 15 to 44 years in England and Wales was 244,443 in 2012 [19]. Mid-2012 ONS population estimates indicated that 95% of the male population in England and Wales was from England; assuming the same distribution for MSM, we estimated the number for England alone was 232,221 (for 15 to 44 year olds) [20]. By applying the definition of MSM as men in the 2010-12 Third National Survey of Sexual Attitudes and Lifestyles (Natsal-3) who reported at least one male sexual partner in past five years to the 15 to 75 years male population in England, we estimated that 61% of MSM in England were aged between 15 to 44 years [20,21]. Therefore, the total number of adult non-GUM-attending HIV negative MSM aged between 15 to 75 years was estimated at 380,690.

HIV incidence by risk stratum

HIV incidence for high- and medium-risk MSM in England was estimated using GUMCAD 2012 data, the most recent year whereby complete 1-year follow-up data (up to year 2013) was available at the time of our analysis. To calculate HIV incidence in 2012, MSM were followed from their first HIV negative test of the calendar year until seroconversion or their last attendance occurring within 12 months of the first test [22]. In 2012, of the 17,429 high-risk HIV negative MSM attending GUM clinics, 6,239 repeat tested for HIV, with 130 seroconversions, and an estimated HIV incidence of 3·3 per 100 person-years (95% CI 2·8 to 4·9 per 100 person-years) [1,22]. Of the 68,076 medium-risk HIV negative MSM attending, 19,953 repeat tested, with 194 seroconversions, and an estimated HIV incidence of 1·5 per 100 person-years (95% CI 1·3 to 1·8 per 100 person-years). HIV incidence was 2 per 100 person-years (95% CI 1·8 to 2·2 per 100 person-years) in the overall HIV negative MSM GUM attendees.

In order to estimate HIV incidence among low-risk MSM (defined as non-GUM attending MSM), we used incidence estimates from a combination of GUMCAD and CD4 back calculation [1,23]. The number of incident HIV infections for MSM in England and Wales in 2012 was estimated at 2,937 [23]. Assuming the distribution of HIV positive MSM by country (England/Wales) is the same as the male population size for England and Wales i.e. 95% and 5%, respectively, the estimated number of incident HIV infections among MSM in England was 2,790.

Using an HIV incidence of 2 per 100 person-years among HIV negative MSM attending GUM clinics, the absolute number of HIV infections that occurred in 2012 was 1,710 [1,22]. Subtracting this value from the total number of infections (i.e. 2,790), gives us an estimated 1,080 infections among non-GUM attending MSM, an incidence of 0·28 per 100 person-years, which was rounded to 0·30 per 100 person-years.

Change in high-risk behaviour over time

We analysed change in high-risk behaviour via the longitudinal five year follow-up of year 2009 high-risk MSM (recent bacterial STI infection) identified from GUMCAD. **Table A - 2** shows that, overall, the proportion of MSM identified in the initial (2009) high-risk group who continued to be at high-risk in each of the subsequent four years (2010 to 2013) decreased rapidly over the first two subsequent years (2010 and 2011).

Table A - 2 Subsequent (2010–2013) attendances with bacterial STI of MSM who first attended in 2009 with bacterial STI (i.e. indicator of high risk), e.g. 2011 attendees (1,172) are all a subset of the 11,742 attendees in 2009 and mostly, but not all, a subset of the 3,083 attendees in 2010.

	2009		2010		2011		2012		2013	
Age Group	n		*x*	*x*/n%	*x*	*x*/n%	*x*	*x*/n%	*x*	*x*/n%
15-19	518	100%	119	23%	39	8%	22	4%	7	1%
20-24	2,114	100%	516	24%	206	10%	132	6%	78	4%
25-29	2,440	100%	651	27%	242	10%	164	7%	131	5%
30-34	1,842	100%	499	27%	199	11%	151	8%	97	5%
35-39	1,571	100%	406	26%	145	9%	120	8%	76	5%
40-44	1,304	100%	326	25%	135	10%	109	8%	77	6%
45-49	896	100%	270	30%	95	11%	58	6%	49	5%
50-54	491	100%	134	27%	51	10%	46	9%	35	7%
55+	566	100%	162	29%	60	11%	49	9%	39	7%
All Ages	**11,742**	**100%**	**3,083**	**26%**	**1,172**	**10%**	**851**	**7%**	**589**	**5%**

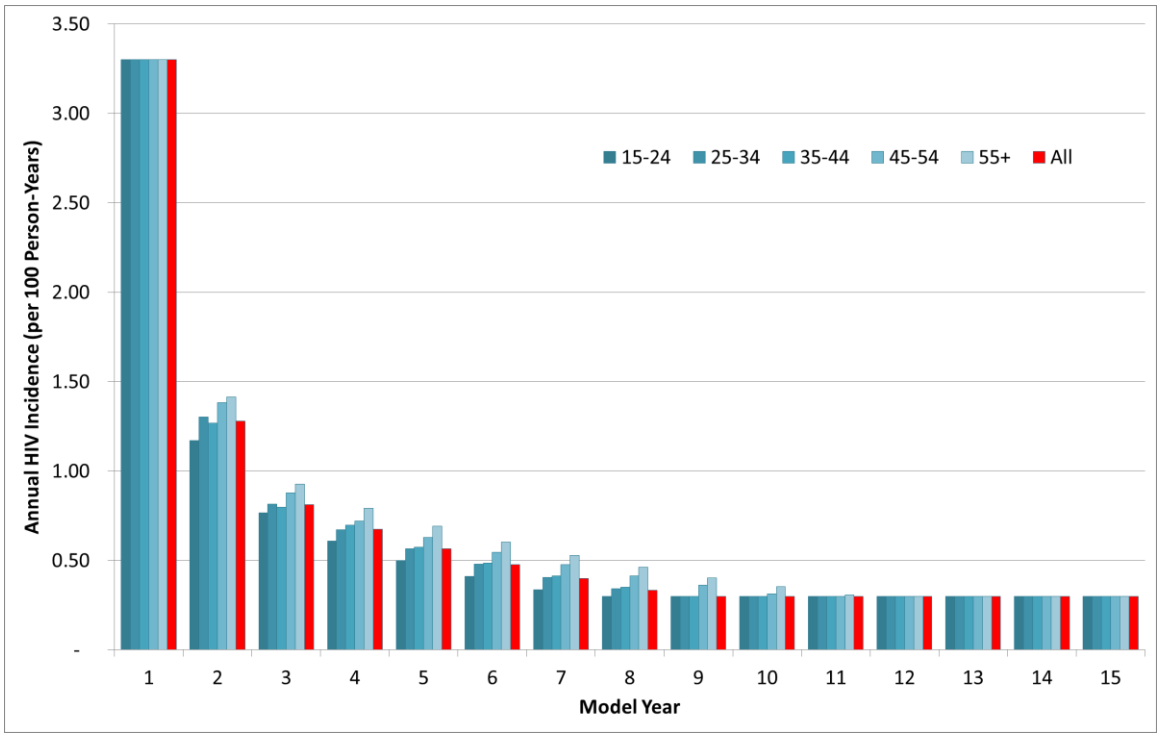
The average frequency of high risk was under two years after the initial high-risk year (2009). In **Table A – 3**, all 11,742 MSM were at high risk during the initial 1 year. However, only approximately 10% (1,199 MSM) of the initial year 11,742 MSM had bacterial STI diagnosed again in two or more of the four subsequent years of follow-up (2010 to 2013), as shown in the last row, final three columns of **Table A – 3**.

Table A - 3 Number and proportion of high-risk MSM in 2009 subsequently categorised as high-risk by age group and number of years at high risk over follow-up period from 2010 to 2013

		Recurrent bacterial STI									
		Number of years at high risk over follow-up period 2010 to 2013 (*x*)					Proportion (*x*/n%)				
Age Group	n (in year 2009)	Never	1	2	3	4	Never	1	2	3	4
15-19	518	369	118	25	5	1	71·24%	22·78%	4·83%	0·97%	0·19%
20-24	2,114	1,447	470	140	46	11	68·45%	22·23%	6·62%	2·18%	0·52%
25-29	2,440	1,596	596	170	60	18	65·41%	24·43%	6·97%	2·46%	0·74%
30-34	1,842	1,185	456	126	62	13	64·33%	24·76%	6·84%	3·37%	0·71%
35-39	1,571	1,038	378	107	37	11	66·07%	24·06%	6·81%	2·36%	0·70%
40-44	1,304	859	302	96	35	12	65·87%	23·16%	7·36%	2·68%	0·92%
45-49	896	561	236	68	24	7	62·61%	26·34%	7·59%	2·68%	0·78%
50-54	491	306	128	41	8	8	62·32%	26·07%	8·35%	1·63%	1·63%
55+	566	347	151	48	17	3	61·31%	26·68%	8·48%	3·00%	0·53%
All	**11,742**	**7,708**	**2,835**	**821**	**294**	**84**	**65·64%**	**24·14%**	**6·99%**	**2·50%**	**0·72%**

The movement of the initial high-risk group to medium- and low-risk were used to derive the weighted HIV incidence over time. **Figure A - 3** shows this estimated risk of HIV infection for each year by 10-year age groups, and for all ages. The HIV incidence for all ages was subsequently used in the model.

Figure A - 3 Estimated HIV incidence in high-risk MSM, up to year 15 (subsequent incidence stays at 0·30 per 100 person-years annually until age 75)



Impact of initial-year HIV-PrEP on cumulative HIV incidence to age 75

Estimated future age-specific cumulative HIV incidence to age 75 for MSM at high HIV risk in 2016, and the impact of an initial PrEP year, is illustrated in **Table A - 4**. Slightly greater reductions were estimated for the older ages, given less number of lifetime years remaining at risk (up until age 75). For example, the cumulative HIV risk to age 75 for a high-risk 35 year-old MSM in year-1 was 16·6%, whilst for a 25 year-old it was 19·1%. Since year-1 HIV risk was 3·3 per 100 person-years, this equals 19·9% of the cumulative risk to age 75 for the 35 year-old, and 17·3% for the 25 year-old. When combined with the age distribution of MSM at high HIV risk eligible for PrEP (**Figure A - 1**), the adjusted average cumulative incidence to age 75 for our 5,000 MSM was equivalent to 16·96% in the absence of PrEP.

Table A - 4 Age-specific cumulative HIV incidence to age 75 with or without HIV-PrEP, shown to illustrate difference by age; cumulative lifetime incidence for ages 56 and above not shown but was considered in the model up until the age of 75

Age in 2016	Birth Year	Cumulative Incidence to Age 75 (%)		
		No HIV-PrEP	HIV-PrEP 86% Effective plus 20% Risk Compensation	HIV-PrEP 64% Effective plus 20% Risk Compensation
15	2001	21·5	19·2	19·9
16	2000	21·5	19·2	19·9
17	1999	21·5	19·2	19·9

18	1998	21·5	19·2	19·9
19	1997	21·5	19·2	19·9
20	1996	21·5	19·2	19·9
21	1995	21·2	19·0	19·7
22	1994	21·0	18·7	19·5
23	1993	20·7	18·5	19·2
24	1992	20·5	18·3	19·0
25	1991	20·3	18·0	18·7
26	1990	20·0	17·8	18·5
27	1989	19·8	17·5	18·2
28	1988	19·5	17·3	18·0
29	1987	19·3	17·0	17·7
30	1986	19·1	16·8	17·5
31	1985	18·8	16·5	17·2
32	1984	18·6	16·3	17·0
33	1983	18·3	16·0	16·7
34	1982	18·1	15·8	16·5
35	1981	17·8	15·5	16·2
36	1980	17·6	15·3	16·0
37	1979	17·3	15·0	15·7
38	1978	17·1	14·7	15·5
39	1977	16·8	14·5	15·2
40	1976	16·6	14·2	15·0
41	1975	16·3	14·0	14·7
42	1974	16·1	13·7	14·5
43	1973	15·8	13·5	14·2
44	1972	15·6	13·2	14·0
45	1971	15·3	12·9	13·7
46	1970	15·1	12·7	13·4
47	1969	14·8	12·4	13·2
48	1968	14·6	12·1	12·9
49	1967	14·3	11·9	12·6
50	1966	14·1	11·6	12·4
51	1965	13·8	11·3	12·1
52	1964	13·5	11·1	11·9
53	1963	13·3	10·8	11·6
54	1962	13·0	10·5	11·3
55	1961	12·8	10·3	11·1

Impact of initial-year HIV-PrEP over the initial decade

Table A - 5 shows detailed breakdown of number of new HIV infections (undiscounted), discounted costs and discounted QALYs, in each of the initial 10 years and over a lifetime, of 5,000 HIV negative MSM eligible for HIV-PrEP in the initial high-risk year. From year 2 onwards, after the year-1 PrEP

intervention, the number of new HIV infections each year was slightly higher in the group that had the intervention compared with those that had not. This is because by preventing new HIV infections in year-1, there is a larger number in the intervention group who remained susceptible from year 2 onwards.

Table A - 5 Contribution of incident HIV cases, costs and QALY losses in the first ten years to the overall lifetime estimated number of undiscounted HIV cases, discounted total costs, and discounted total QALY losses (no HIV-PrEP versus HIV-PrEP at 86% effectiveness, and HIV-PrEP at 64%, both assuming 20% HIV incidence increase among those given HIV-PrEP as a form of risk compensation); Scenario assuming 5,000 high-risk MSM with HIV incidence of 3·3 per 100 person-years in the absence of HIV-PrEP, daily oral combination antiretroviral tenofovir disoproxil fumarate 245mg/emtricitabine 200mg (proprietary name Truvada®) at a cost of £4,331 (€5,892) per person per year

Model Year	1	2	3	4	5	6	7	8	9	10	overall (up to year 61)
Number of HIV Infections (Undiscounted)											
No HIV-PrEP	165	65	42	35	28	23	19	16	14	14	**848**
Proportion of Lifetime HIV Infections	*19%*	*8%*	*5%*	*4%*	*3%*	*3%*	*2%*	*2%*	*2%*	*2%*	
HIV-PrEP – 86% Effective *plus* Risk Compensation	28	67	44	36	29	24	20	16	14	14	**730**
Proportion of Lifetime HIV Infections	*4%*	*9%*	*6%*	*5%*	*4%*	*3%*	*3%*	*2%*	*2%*	*2%*	
HIV-PrEP – 64% Effective *plus* Risk Compensation	71	66	43	35	29	24	20	16	14	14	**768**
Proportion of Lifetime HIV Infections	*9%*	*9%*	*6%*	*5%*	*4%*	*3%*	*3%*	*2%*	*2%*	*2%*	
Lifetime HIV Care Costs (Discounted at 3·5% per Annum)											
No HIV-PrEP	£31·2 M	£11·7 M	£7·3 M	£5·7 M	£4·4 M	£3·5 M	£2·7 M	£2·2 M	£1·8 M	£1·7 M	**£93·3 M**
No HIV-PrEP	€ 42.4 M	€ 15.9 M	€ 9.9 M	€ 7.8 M	€ 6.0 M	€ 4.8 M	€ 3.7 M	€ 3.0 M	€ 2.4 M	€ 2.3 M	**€ 126.9 M**
Proportion of Costs of Lifetime HIV Infections	*33%*	*13%*	*8%*	*6%*	*5%*	*4%*	*3%*	*2%*	*2%*	*2%*	
HIV-PrEP – 86% Effective plus Risk Compensation	£5·2 M	£12·1 M	£7·5 M	£5·8 M	£4·6 M	£3·6 M	£2·8 M	£2·2 M	£1·8 M	£1·7 M	**£69·2 M**
HIV-PrEP – 86% Effective plus Risk Compensation	€ 7.1 M	€ 16.5 M	€ 10.2 M	€ 7.9 M	€ 6.3 M	€ 4.9 M	€ 3.8 M	€ 3.0 M	€ 2.4 M	€ 2.3 M	**€ 94.1 M**
Proportion of Costs of Lifetime HIV Infections	*8%*	*17%*	*11%*	*8%*	*7%*	*5%*	*4%*	*3%*	*3%*	*2%*	
HIV-PrEP – 64% Effective plus Risk Compensation	£13·5 M	£12·0 M	£7·4 M	£5·8 M	£4·5 M	£3·6 M	£2·8 M	£2·2 M	£1·8 M	£1·7 M	**£76·8 M**
HIV-PrEP – 64% Effective plus Risk Compensation	€ 18.4 M	€ 16.3 M	€ 10.1 M	€ 7.9 M	€ 6.1 M	€ 4.9 M	€ 3.8 M	€ 3.0 M	€ 2.4 M	€ 2.3 M	**€ 104.5 M**
Proportion of Costs of Lifetime HIV Infections	*18%*	*16%*	*10%*	*8%*	*6%*	*5%*	*4%*	*3%*	*2%*	*2%*	
Lifetime QALY Loss (Discounted at 3·5% per Annum)											
No HIV-PrEP	480	185	117	93	75	60	48	39	33	32	**1,829**
Proportion of QALY Loss of Lifetime HIV Infections	*26%*	*10%*	*6%*	*5%*	*4%*	*3%*	*3%*	*2%*	*2%*	*2%*	
HIV-PrEP – 86% Effective plus	81	190	120	96	77	62	50	40	34	33	**1,468**

Risk Compensation											
Proportion of QALY Loss of Lifetime HIV Infections	*5%*	*13%*	*8%*	*7%*	*5%*	*4%*	*3%*	*3%*	*2%*	*2%*	
HIV-PrEP – 64% Effective plus Risk Compensation	207	188	119	95	76	61	49	40	33	32	**1,582**
Proportion of QALY Loss of Lifetime HIV Infections	*13%*	*12%*	*8%*	*6%*	*5%*	*4%*	*3%*	*3%*	*2%*	*2%*	

SUPPLEMENTARY MATERIAL 6

Sensitivity analyses

The ICER values generated for the univariate sensitivity analysis of various scenarios considered are presented in **Table A - 6**. The analysis compared no HIV-PrEP versus HIV-PrEP at 86% or 64% effectiveness, plus risk compensation (as 20% increase in HIV incidence when given HIV-PrEP). This table supplements the tornado diagram presented in the main text (64% effectiveness plus risk compensation) and in **Figure A - 4** below.

Table A - 6 Output of scenario analyses; gray cells indicate no change from base case scenario output; bold texts are base case scenarios (5,000 MSM with HIV incidence of 3·3 per 100 person-years given HIV-PrEP, 86% or 64% clinical effectiveness, daily oral HIV-PrEP, HIV care costs and QALY losses discounted at 3·5% per annum, undiscounted HIV infections presented); *Risk compensation in the base case assumes a 20% increase in HIV incidence when given HIV-PrEP

	No HIV-PrEP			HIV-PrEP (86% Effective plus Risk Compensation*)				HIV-PrEP (64% Effective plus Risk Compensation*)			
	Number of HIV Infections	HIV Care Costs	QALY Losses	Number of HIV Infections	HIV Care Costs	QALY Losses	ICERs	Number of HIV Infections	HIV Care Costs	QALY Losses	ICERs
Base Case Scenario Output	**848**	**£93·34 M**	**1,829**	**730**	**£69·17 M**	**1,468**	**-£5,218**	**768**	**£76·84 M**	**1,582**	**£23,465**
HIV-PrEP Effectiveness: 44% –96%											
44%				802	£83·81 M	1,686	£89,608	802	£83·81 M	1,686	£89,608
64%											
86%											
96%				713	£65·69 M	1,415	-£12,997	713	£65·69 M	1,415	-£12,997
Year-1 HIV Incidence, per 100 Person-Years: 2 to 9											
2	764	£76·69 M	1,576	692	£61·96 M	1,356	£34,275	715	£66·63 M	1,426	£81,304
3·3											
5·2	970	£117·41 M	2,194	786	£79·67 M	1,630	-£27,430	844	£91·64 M	1,809	-£9,058
9	1,209	£164·71 M	2,911	897	£100·56 M	1,954	-£43,746	996	£120·92 M	2,258	-£32,928
HIV-PrEP Annual Drug Price, as a Percentage of Current 2016 BNF List Price for Combination Antiretroviral (Tenofovir Disoproxil Fumarate 245mg/Emtricitabine 200mg Tablet): 10% or 100%											
£433 (10%)							-£59,202				-£55,610
£4,331 (100%)											
Proportion of MSM Given HIV-PrEP Drugs Based on an Intermittent (4 Tablets per 7-Day) Dosing Schedule: 10% or 100%											
0%											
100%							-£30,924				-£14,189
Discount Rate Applied to Future Costs and QALYs: 1·5% or 3·5%											
1·50%		£148·12 M	3,576		£113·36 M	3,002	-£21,703		£124·39 M	3,184	-£3,684
3·50%											
Percentage Reduction in Antiretroviral Treatment Costs from Year 2019 (Used for Treating Diagnosed HIV Infections): 0% to 80%											
0%											

30%		£79·78 M			£58·95 M		£4,038		£65·56 M		£32,721
50%		£70·74 M			£52·14 M		£10,208		£58·04 M		£38,891
80%		£57·17 M			£41·92 M		£19,463		£46·76 M		£48,146
Risk Compensation (Increased HIV Incidence in Year-1 if Given HIV-PrEP as Proxy for Risk Compensation): 0% to 30%											
0%				726	£68·36 M	1,455	-£7,227	757	£74·75 M	1,551	£13,296
10%				728	£68·77 M	1,461	-£6,239	762	£75·79 M	1,566	£18,078
20%											
30%				732	£69·58 M	1,474	-£4,161	773	£77·89 M	1,598	£29,582
Adjustments for GUM clinic change behaviour, such that a higher proportion remain at high-risk for longer: No adjustments or Assume that 30% of High-Risk MSM in the First Year but Subsequently Changed Clinic (Hence, Loss to Follow-Up) will Continue to Remain High-Risk in the Second, Third, Fourth, and Fifth Year											
No Adjustments											
Assume 30% of High-Risk MSM in the First Year but Subsequently Changed Clinic Remained High-Risk	1,308	£158·6 M	2,982	1,203	£136·3 M	2,654	-£97	1,237	£143·3 M	2,758	£31,449
Disutility After Diagnosis: 0·10 to 0·13											
0·10			1,713			1,377	-£5,606			1,484	£25,212
0·11											
0·13			2,059			1,648	-£4,583			1,779	£20,609
Disutility between Infection and Diagnosis: 0 or 0·11											
0											
0·11			1,967			1,576	-£4,810			1,700	£21,633
HIV-PrEP-Related GUM Clinic Costs, per Person per Annum: £0 to £406											
£0							-£7,655				£19,895
£176											
£406							-£2,032				£28,131

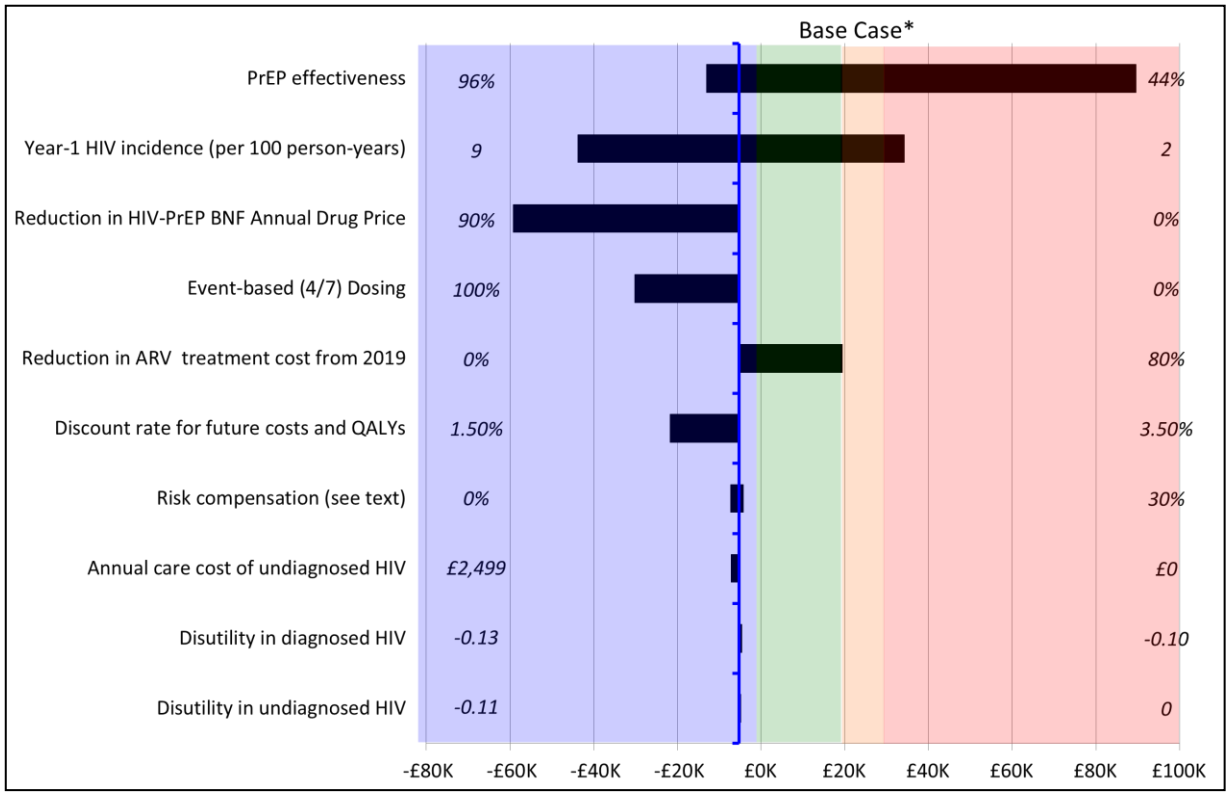
Table A - 6 Output of scenario analyses; gray cells indicate no change from base case scenario output; bold texts are base case scenarios (5,000 MSM with HIV incidence of 3·3 per 100 person-years given HIV-PrEP, 86% or 64% clinical effectiveness, daily oral HIV-PrEP, HIV care costs and QALY losses discounted at 3·5% per annum, undiscounted HIV infections presented); *Risk compensation in the base case assumes a 20% increase in HIV incidence when given HIV-PrEP

	No HIV-PrEP			HIV-PrEP (86% Effective plus Risk Compensation*)				HIV-PrEP (64% Effective plus Risk Compensation*)			
	Number of HIV Infections	HIV Care Costs	QALY Losses	Number of HIV Infections	HIV Care Costs	QALY Losses	ICERs	Number of HIV Infections	HIV Care Costs	QALY Losses	ICERs
Base Case Scenario Output	**848**	**€127 M**	**1,829**	**730**	**€94.1 M**	**1,468**	**-€7,099**	**768**	**€105 M**	**1,582**	**€31,900**
HIV-PrEP Effectiveness: 44% –96%											
44%				802	€114 M	1,686	€121,900	802	€114 M	1,686	€121,900
64%											
86%											
96%				713	€89.4 M	1,415	-€17,700	713	€89.4 M	1,415	-€17,700

Year-1 HIV Incidence, per 100 Person-Years: 2 to 9											
2	764	€104.34 M	1,576	692	€84.30 M	1,356	€46,600	715	€90.7 M	1,426	€110,600
3·3											
5·2	970	€160 M	2,194	786	€108 M	1,630	-€37,300	844	€125 M	1,809	-€12,300
9	1,209	€224 M	2,911	897	€137 M	1,954	-€59,500	996	€165 M	2,258	-€44,800
HIV-PrEP Annual Drug Price, as a Percentage of Current 2016 BNF List Price for Combination Antiretroviral (Tenofovir Disoproxil Fumarate 245mg/Emtricitabine 200mg Tablet): 10% or 100%											
€589 (10%)							-€80,500				-€75,700
€5,892 (100%)											
Proportion of MSM Given HIV-PrEP Drugs Based on an Intermittent (4 Tablets per 7-Day) Dosing Schedule: 10% or 100%											
0%											
100%							-€42,100				-€19,300
Discount Rate Applied to Future Costs and QALYs: 1·5% or 3·5%											
1·50%		€202 M	3,576		€154 M	3,002	-€29,500		€169 M	3,184	-€5,010
3·50%											
Percentage Reduction in Antiretroviral Treatment Costs from Year 2019 (Used for Treating Diagnosed HIV Infections): 0% to 80%											
0%											
30%		€109 M			€80.2 M		€5,490		€89.2 M		€44,500
50%		€96.2 M			€70.9 M		€13,900		€79.0 M		€52,900
80%		€77.8 M			€57.0 M		€26,500		€63.6 M		€65,500
Risk Compensation (Increased HIV Incidence in Year-1 if Given HIV-PrEP as Proxy for Risk Compensation): 0% to 30%											
0%				726	€93.0 M	1,455	-€9,830	757	€102 M	1,551	€18,100
10%				728	€93.6 M	1,461	-€8,490	762	€103 M	1,566	€24,600
20%											
30%				732	€94.7 M	1,474	-€5,660	773	€106 M	1,598	€40,300
Adjustments for GUM clinic change behaviour, such that a higher proportion remain at high-risk for longer: No adjustments or Assume that 30% of High-Risk MSM in the First Year but Subsequently Changed Clinic (Hence, Loss to Follow-Up) will Continue to Remain High-Risk in the Second, Third, Fourth, and Fifth Year											
No Adjustments											
Assume 30% of High-Risk MSM in the First Year but Subsequently Changed Clinic Remained High-Risk	1,308	€216 M	2,982	1,203	€185 M	2,654	-€132	1,237	€195 M	2,758	€42,800
Disutility After Diagnosis: 0·10 to 0·13											
0·10			1,713			1,377	-€7,630			1,484	€34,300
0·11											
0·13			2,059			1,648	-€6,240			1,779	€28,000
Disutility between Infection and Diagnosis: 0 or 0·11											
0											
0·11			1,967			1,576	-€6,540			1,700	€29,400
HIV-PrEP-Related GUM Clinic Costs, per Person per Annum: €0 to €552											
€0							-€10,400				€27,100
€240											

€552							-€2,770				€38,300

Figure A - 4 Univariate sensitivity analyses of PrEP ICER around base case* for plausible ranges† of key parameters.



Note:

*Base case (negative ICER = PrEP is cost-saving), set at 86% PrEP effectiveness level and a 20% increase in HIV incidence in those given PrEP due to risk compensation (see main text).

†Extremes of parameter ranges shown at either end of horizontal bars.

Other scenarios explored

Adjustment for attendance at another GUM clinic with consequent loss to longitudinal follow-up and impact on lifetime HIV risk

Individuals attending the same GUM clinic will hold the same local patient identifier number in GUMCAD and can be followed longitudinally. However, because GUMCAD is pseudo-anonymised, when individuals moved clinic, their local patient identifier number would change. This meant that in our longitudinal follow-up of our initial high-risk group from 2009, up to 2013, there may be those who remained at high- or medium-risk but changed clinic, and whom we would have assumed they no longer attend GUM clinics and were at low-risk. A preliminary analysis of an enhanced version of GUMCAD that captured data on previous attendance at another clinic found that, of the 2,962 MSM who responded to this question, 483 (16·3%) attended another GUM clinic in the past year, and another 442 (14·9%) attended in the last 1 to 5 years (H Mohammed, Public Health England, personal communications, 30 June 2015). Thus, we explored a scenario whereby 30% (combined 0

to 5 years previous attendance at another clinic) of our initial high-risk group continued to remain high-risk throughout the first five years. This adjustment resulted in an increased lifetime HIV incidence as more individuals continue to remain at high-risk. Consequently, the HIV prevention effect of an initial high-risk year on HIV-PrEP on this increased cumulative lifetime HIV incidence was reduced, resulting in less favourable ICER (see **Table A - 7**).

Table A - 7 Comparison of ICER output of base case and after adjusting for potential loss to follow-up following movement out of the initial GUM clinic; shaded empty cells mean there is no change from base case (take the base case scenario output); *Risk compensation in the base case assumes a 20% increase in HIV incidence when given HIV-PrEP

	No HIV-PrEP			HIV-PrEP (86% Effective plus Risk Compensation*)				HIV-PrEP (64% Effective plus Risk Compensation*)			
	Number of HIV Infections	HIV Care Costs	QALY Losses	Number of HIV Infections	HIV Care Costs	QALY Losses	ICERs	Number of HIV Infections	HIV Care Costs	QALY Losses	ICERs
Base Case Scenario Output	**848**	**£93·34 M (€127)**	**1,829**	**730**	**£69·17 M (€94.1 M)**	**1,468**	**-£5,218 (-€7,100)**	**768**	**£76·84 M (€105 M)**	**1,582**	**£23,465 (€31,900)**
Adjustments for movement out of initial GUM clinic with consequent loss to longitudinal follow-up, such that a higher proportion should remain at high-risk for longer: No adjustments or Assume that 30% of High-Risk MSM in the First Year but Subsequently Changed Clinic (Hence, Loss to Follow-Up) will Continue to Remain High-Risk in the Second, Third, Fourth, and Fifth Year											
No Adjustments											
Assume 30% of High-Risk MSM in the First Year but Subsequently Changed Clinic Remained High-Risk	1,308	£158·6 M (**€215.8 M)**	2,982	1,203	£136·3 M (**€185.4 M)**	2,654	-£97	1,237	£143·3 M (**€195 M)**	2,758	£31,449 (**€42,800)**

Duration of remaining lifetime at risk

We further explored scenarios whereby after 10, 20, or 30 years, our initial high-risk group of MSM stopped having any residual risk of HIV. The impact on the ICER was minimal in these scenarios, since the large majority of the new HIV infections occurred in the initial 10 years, and costs and QALY losses in the future were increasingly discounted (see **Table A – 5**) for proportion of new HIV infections, costs and QALY losses occurring in the first 10 years versus lifetime; and **Table A - 8** for overall ICER output comparison).

Table A - 8 Impact on ICER output by considering shorter duration of remaining lifetime at risk; shaded empty cells mean there is no change from base case (take the base case scenario output); *Risk compensation in the base case assumes a 20% increase in HIV incidence when given HIV-PrEP

	No HIV-PrEP			HIV-PrEP (86% Effective plus Risk Compensation*)				HIV-PrEP (64% Effective plus Risk Compensation*)			
	Number of HIV Infections	HIV Care Costs	QALY Losses	Number of HIV Infections	HIV Care Costs	QALY Losses	ICERs	Number of HIV Infections	HIV Care Costs	QALY Losses	ICERs
Base Case Scenario Output	**848**	**£93·34 M (€127 M)**	**1,829**	**730**	**£69·17 M (€94.1 M)**	**1,468**	**-£5,218 (€7,100)**	**768**	**£76·84 M (€105 M)**	**1,582**	**£23,465 (€31,900)**
Lifetime HIV Incidence: Stops Being At Risk After 10, 20, 30 Years or Lifetime Risk											
Stops Being At Risk After 10 Years	422	£72·06 M (**€98 M**)	1,161	292	£47·30 M (**€64.4 M**)	781	-£6,547 (-**€8,910**)	333	£55·16 M (**€75.1 M**)	902	£20,706 (**€28,200**)
Stops Being At Risk After 20 Years	553	£84·16 M (**€115 M**)	1,431	427	£59·74 M (**€81.3 M**)	1,058	-£5,759 (-**€7,840**)	467	£67·49 M (**€91.8 M**)	1,176	£22,054 (**€30,000**)
Stops Being At Risk After 30 Years	673	£90·23 M (**€123 M**)	1,625	550	£65·97 M (**€89.8 M**)	1,258	-£5,376 (-**€7,310**)	589	£73·67 M (**€98 M**)	1,374	£22,855 (**€31,100**)
Lifetime Risk											

REFERENCES

1. Savage E, Mohammed H, Leong G, Duffell S, G H. Improving surveillance of sexually transmitted infections using mandatory electronic clinical reporting: the genitourinary medicine clinic activity dataset, England, 2009 to 2013. Euro Surveill. 2014;19(48):20981.
2. McCormack S, Dunn D. PROUD PRe-exposure Option for reducing HIV in the UK : an open-label randomisation to immediate or Deferred daily Truvada for HIV negative gay men Version : 1.3. 2014.
3. Pathway Analytics. Integrated Sexual Health Tariff [Internet]. Available from: http://www.pathwayanalytics.com/sexual-health
4. Ong KJ, Thornton AC, Fisher M, Hutt R, Nicholson S, Palfreeman A, Perry N, Stedman-Bryce G, Wilkinson P, Delpech V, Nardone A. Estimated cost per HIV infection diagnosed through routine HIV testing offered in acute general medical admission units and general practice settings in England. HIV Med. 2016;17(4):247–54.
5. UCLH. 2012-2013 Tariff. 2013;1–28. Available from: https://www.uclh.nhs.uk/aboutus/wwd/Documents/Provider to Provider Tariff 2012-13.pdf
6. NHS Business Services Authority. NHS Supply Chain [Internet]. [cited 2015 Jul 30]. Available from: https://www.supplychain.nhs.uk/
7. British Association of Sexual Health and HIV. BASHH Recommendations for Testing for Sexually Transmitted infections in Men who have Sex with Men [Internet]. London, United Kingdom; 2014. p. 2. Available from: http://www.bashh.org/documents/BASHH Recommendations for testing for STIs in MSM - FINAL.pdf
8. Brook G, Bhagani S, Kulasegaram R, Torkington A, Mutimer D, Hodges E, Hesketh L, Farnworth S, Sullivan V, Gore C, Devitt E, Sullivan AK, Clinical Effectiveness Group British Association for Sexual Health and HIV. United Kingdom National Guideline on the Management of the Viral Hepatitides A , B and C 2015. Int J STI AIDS. 2016;0(0):1–25.
9. Beck EJ, Mandalia S, Sangha R, Sharott P, Youle M, Baily G, Brettle R, Gompels M, Johnson M, McCarron B, Ong E, Pozniak A, Schwenk A, Taylor S, Walsh J, Wilkins E, Williams I, Gazzard B. The cost-effectiveness of early access to HIV services and starting cART in the UK 1996-2008. PLoS One [Internet]. 2011 Jan [cited 2014 Oct 17];6(12):e27830. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3237423&tool=pmcentrez&rendertype=abstract
10. Public Health England. HIV surveillance systems [Internet]. Available from: https://www.gov.uk/hiv-surveillance-systems
11. NHS England. Freedom of Information request (Ref: FOI-007334). London, United Kingdom; 2015.
12. House of Lords. SELECT COMMITTEE ON HIV AND AIDS IN THE UNITED KINGDOM HIV and AIDS in the United Kingdom Written Evidence [Internet]. 2011 p. 342. Available from: https://www.parliament.uk/documents/lords-committees/hivaids/WrittenEvAtoZHIVAIDS.pdf
13. National Institute for Health and Care Excellence. Guide to the methods of technology appraisal 2013. London, United Kingdom; 2013.
14. HM Revenue & Customs. VAT Notice 701/57: health professionals and pharmaceutical products [Internet]. 2014 [cited 2016 Apr 19]. Available from: https://www.gov.uk/government/publications/vat-notice-70157-health-professionals-and-

pharmaceutical-products/vat-notice-70157-health-professionals-and-pharmaceutical-products

15. Conti S, Presanis A, de Angelis D. Inferences from an MPES Model of HIV Prevalence and Number of PLWH in the UK in 2013. London, United Kingdom; 2014.

16. Burns FM, Johnson AM, Nazroo J, Ainsworth J, Anderson J, Fakoya A, Fakoya I, Hughes A, Jungmann E, Sadiq ST, Sullivan AK. Missed opportunities for earlier HIV diagnosis within primary and secondary healthcare settings in the UK. 2008;(January 2007).

17. Hippisley-Cox J, Fenty J, Heaps M. Trends in Consultation Rates in General Practice 1995 to 2006 : Analysis of the QRESEARCH database - Final report to the Information Centre and Department of Health. 2007.

18. NHS England Specialised Commissioning Team. Clinical Commissioning Policy : Treatment as Prevention (TasP) in HIV infected adults [Internet]. 2015. p. 1–24. Available from: https://www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2015/10/f03pc-tasp-oct15.pdf

19. Public Health England. HIV in the United Kingdom : 2013 Report. London, United Kingdom; 2013.

20. Office for National Statistics. ONS population estimates [Internet]. Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland

21. Mercer CH, Tanton C, Prah P, Erens B, Sonnenberg P, Clifton S, Macdowall W, Lewis R, Field N, Datta J, Copas AJ, Phelps A, Wellings K, Johnson AM. Changes in sexual attitudes and lifestyles in Britain through the life course and over time: findings from the National Surveys of Sexual Attitudes and Lifestyles (Natsal). Lancet [Internet]. 2013 Nov 30 [cited 2014 Jul 12];382(9907):1781–94. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3899021&tool=pmcentrez&rendertype=abstract

22. Desai S, Nardone A, Hughes G, Delpech V, Burns F, Hart G, Gill ON. HIV incidence in an open national cohort of men who have sex with men attending STI clinics in England. HIV Med. 2017;

23. Birrell PJ, Gill ON, Delpech VC, Brown AE, Desai S, Chadborn TR, Rice BD, De Angelis D. HIV incidence in men who have sex with men in England and Wales 2001-10: a nationwide population study. Lancet Infect Dis [Internet]. 2013 Apr [cited 2015 Aug 6];13(4):313–8. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3610092&tool=pmcentrez&rendertype=abstract