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A cohort study of factors associated with return of home sampling kits for sexually transmitted infections requested online

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Abstract

Objectives: To investigate factors associated with the return of home sampling testing kits for sexually transmitted infections (STI) testing kits.

Setting: online STI testing service offered to the residents of Birmingham.

Participants: all patients requesting home sampling STI testing kits via Birmingham Umbrella sexual health service website between July 15th and December 14th 2016. The service is available to residents of Birmingham only.

Interventions: the service issues different testing kits to different sex groups. Data on online registration and return of STI home sampling kits at the Umbrella sexual health clinic in Birmingham between 15th July and 14th December 2016 were reviewed.

Results: a total of 5,310 (61% for female testing) kits were requested, of which 3,099 (58.4%) were returned to the medical microbiology laboratory. Women and men who have sex with men had equally higher likelihood of return of their testing kits. Heterosexual men were significantly less likely to return their testing kits (OR: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. females). Patients reporting symptoms were also less likely to return kits, (OR 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients). Requests made in less economically deprived neighbourhoods were more likely to return the kits (OR 1.08, 95% CI: 1.01 – 1.15, p=0.029).

Conclusion: Improved instructions for groups less likely to return their testing kits would be beneficial. Further research in improvement of return rate of the testing kits among individuals with those factors would be beneficial.

Trial registration: Registered with R&D department at University Hospitals Birmingham; CARMS-13551

239 words

Keywords: STI, home sampling, online registration, return rate

Article summary

- A large cohort study on the factors associated with the return of STI home sampling testing kits requested online.
- The study includes large numbers of different groups of sex groups tested for chlamydia, gonorrhoea, HIV and syphilis.
- Heterosexual men, those living in neighbourhoods with more socioeconomic deprivation and those with symptoms were less likely to return their STI testing kits.
- The study's observational design made it difficult to investigate reason(s) for failure to return testing kits.
- The findings of the study help with improved use of similar services rolled over by many sexual health departments in the UK.

Introduction

The advent of new technologies has provided opportunities for expansion of screening for sexually transmitted infections (STI) and HIV in general population. Home sampling kits for STI testing take advantage of the features of nucleic acid amplification tests (NAAT) for detection of chlamydia and gonorrhoea. The high sensitivity and specificity of the tests allows for testing of ano-genital specimens obtained by self-collecting procedures. New laboratory based HIV assays can operate on small volume of blood samples that can be obtained through a finger prick, and collected in a small blood tube that fits inside a small box or envelope. Specimens for NAAT can be stored at in room temperature whilst being transported to the laboratory.

Home sampling STI and HIV testing provides optimal privacy, and the choice of being tested on any occasion. The service is perceived to have a number of limitations such as not being able to talk to a doctor about test results [1]. Over the past two decades several studies have reported on acceptability of home sampling for chlamydia and gonorrhoea home testing [2-6]. Studies have also investigated the success of internet based home sampling services for chlamydia testing [7,8]. In England, 76,842 individuals aged between 15 and 24 years were tested for chlamydia using internet services in 2015 [9].

Following the tendering process of sexual health services in England, many services are now expected to offer home sampling kits for STI screening. Improving return rates of home sampling kits would improve the cost-effectiveness of these services, whilst potentially enhancing the success of the services in reducing the incidence of STI.

Studies reporting on the return rates of internet registered home sampling kits have focused on the use of kits for chlamydia and gonorrhoea testing or on HIV screening and only on specific sex groups; men who have sex with men (MSM) or women [7,8,10,11]. Limited data currently exist on the return rates of internet registered home sampling kits for STI and HIV screening in general population.

The aim of this cohort study was to investigate the rate of return of home sampling testing kits after registration with an online health website in the city of Birmingham, UK. To the best of our knowledge, this is the first report on return rate of home sampling testing kits for chlamydia, gonorrhoea, HIV, and syphilis screening offered to all patients at the same time.

Methods

Following the tender of the services by Birmingham and Solihull local governments, the new sexual health service (Umbrella Health) was formed in August 2015. This offers an online service for requesting home sampling testing kits for STI and HIV. The use of service is limited to addresses within Birmingham and Solihull areas.

Requesting testing kits
The service allows for individuals' self-registration on Umbrella Health website (https://umbrellahealth.co.uk/our-services/self-sampling-kits). The registration process includes provision of information on sexual orientation and presence of ano-genital symptoms. Individuals with ano genital symptoms are advised to attend one of several community umbrella health clinics across Birmingham and Solihull. They are still able to request home testing kits for STI screening.

The service offers four types of testing kits depending on the individual's risk group; women without history of receptive anal sex (Design A), women with history of receptive anal sex (Design B), heterosexual men, and men who have sex with men (MSM).

After registration with the service, the individual can choose to receive their home testing kits at their address of choice or to collect it from one of 66 locations in partnership with Umbrella Health including 24 local pharmacies and 24 community sexual health clinics across Birmingham and Solihull.

Contents of testing kits
The home sampling testing kits include the swabs and manufacturer's transport media for chlamydia and gonorrhoea testing on Aptima Combo. Urine samples for male urethral testing, and swabs for volvo-vaginal, ano-rectal and throat specimens are included in the testing kits where appropriate. Each swab is paired with a single specific transport medium according to the manufacturer's guidelines.

Sterile disposable lancets with tiny blood bottles for blood specimens required for serology testing for HIV and syphilis are also added to each testing kit. Blood specimens are obtained by finger prick with disposable lancets. Blood drops are then collected into sterile plastic tiny tubes for a minimum of 400 µmL for HIV and syphilis testing.

All women provide a vulvo-vaginal swab for chlamydia and gonorrhoea testing, and a blood sample for HIV and syphilis. Women who report history of receptive anal sex also receive an additional swab for ano-rectal swab for chlamydia and gonorrhoea testing (Design B kit).

Heterosexual men provide urine samples for chlamydia and gonorrhoea testing and blood specimens for HIV and syphilis screening. Men who have sex with men (MSM) provide additional ano-rectal and throat specimens using the two extra swabs provided in their testing kits.

Testing kits contain pictorial information and guidance on how to obtain the appropriate sample for each test. They also hold an envelope pre-addressed to the medical microbiology laboratory at Queen Elizabeth Hospital Birmingham. The packaging of the kits complies with Royal Mail standards requiring three layers of packaging. This includes a watertight leak-proof container for the sample, packed with enough porous material to absorb all fluids in

case of breakage, which is enclosed in a second watertight leak proof container. The two layers of packaging are then enclosed in a third outer package, to protect against external damage during the delivery of the specimens.

Testing of samples

On receipt of specimens from the home testing kits, their unique number is entered in the medical microbiology laboratory registry system. Individuals' details are then automatically retrieved from the web-booking database. The specimens are simultaneously registered in the sexual health service's electronic patients' system.

The specimens are then processed according to UK medical laboratory standards (UKAS). Chlamydia and gonorrhoea tests are carried out on an Aptima Combo assay and platform. HIV serology is carried out on Abbott's 4th generation ELISA HIV assay, and the EIA IgG assay is used for syphilis screening

Patients were informed of their test results by a text message to their mobile phones within one hour of their authorisation by the laboratory.

Study design

This was service evaluation cohort study of factors associated with return of STI testing kits requested online after registration in Umbrella Health website.

Data collection

Data were collected on patients requesting STI and HIV testing kits from Umbrella Health website between 15th July and 14th December 2016. Information on patients' demography, the responses to questions relating to drug usage, sexual history and symptoms were recorded.

The final question of the online registration asked the patients if they have had unprotected sex with someone born or raised outside of the following 16 countries:: Austria, Belgium, Czech Republic, Denmark, Faroe Islands, Finland, France, Germany, Iceland, Ireland, Luxemburg, The Netherlands, Norway, Sweden, Switzerland and the UK (which will be subsequently referred to the "EU" for brevity). A negative response to this question revealed a second question, asking whether the patient was born or raised outside of the countries listed. As such, the two parts of the question were combined in the analysis to give three groups of patients: those that answered "Yes" to the first part, those that answered "Yes" to the second part of the question, and the remainder that answered "No" to each part of the question that was displayed to them.

Temporal factors relating to the day and time that the request for testing kits was placed were also available. All individuals were required to provide a postcode, which was converted to a 2015 Index of Multiple Deprivation Score (IMD), based on the data from the Department For Communities and Local Government [12]. For 39 cases, the given postcodes were not available in the IMD database, hence these cases were excluded from the analysis of IMD score.

The medical microbiology laboratory system was then interrogated, to identify which of the individuals requesting testing kits actually returned samples.

Statistical analysis

Initially, the proportions of STI kits where a sample was returned were compared across the factors using Chi-square tests or Mann-Whitney tests, as appropriate. Continuous variables were expressed as medians and interquartile ranges (IQRs). For some of the questions in online registration, a different set of answers was displayed, depending on the gender of the respondent. In these cases, the analyses were performed separately for males and females, with the small number of transgender respondents excluded.

A multivariable binary logistic regression model was then produced, to identify significant independent predictors of the return of samples. The transgender respondents were also excluded from this analysis, due to the small number of cases, as were those cases where the IMD score was unavailable. A forwards stepwise approach was used to select factors for inclusion in the model.

All analyses were performed using IBM SPSS 22 (IBM Corp. Armonk, NY), with $p<0.05$ deemed to be indicative of statistical significance throughout.

This is a study on an already operational service. We used anonymised retrospective data for analysis. To reduce the risk of unaccounted bias, we included all patients within the study period in the analysis.

Our report is a service improvement analysis. We did not seek approval of ethics committee approval.

Results

Between the 15th July and the 14th October 2016, a total of 5,310 kits were requested, of which 3,099 (58.4%) were returned to the medical microbiology laboratory. The age distributions were similar in the groups of patients that did and did not return samples, at 24 years (IQR: 20-28) for both (p=0.100). Associations between other factors and the return rate of samples are reported in Tables 1a and 1b.

Females were significantly more likely than males to return samples on univariate analysis (61.2% vs. 53.1%, p<0.001). Only one of the 10 (10%) transgender respondents returned their samples, making them the gender group least likely to return samples. The place of delivery of the testing kit was also significantly associated with their return (p<0.001), with the greatest rate of return observed in those kits delivered to the patient's homes (60.6%), and the lowest rate in those delivered to pharmacies (44.0%).

Analysis of the deprivation score (IMD 2015) of the area of request of the kits found that those who returned samples gave postcodes which were in significantly less deprived areas, with a median IMD rank of 9,444 (IQR: 2,907 – 15,387) compared to 8,574 (IQR: 2,546 – 14,338) for areas that did not return the kits (p=0.007). Neither the day of the week (p=0.059), nor the time of day (p=0.665) that the request was made were found to be significantly predictive of whether a sample would be received.

A significant association with the questions about countries of birth of the patient and their sexual partners was detected (p=0.031), with patients born within and with partners within UK/ EU having the highest rate of return of the samples (59.1%) and those born outside the EU having the lowest rate (51.3%).

The rate of returned samples did not differ significantly by the type of the kit requested for females (p=0.572). Amongst men however, the return rate of MSM STI kits was significantly higher than that for heterosexual male STI kit (63.2% vs. 49.6%, p<0.001). Asymptomatic patients were more likely to return their testing kits compared to those with symptoms in each gender (p=0.020 for females, p=0.010 for males). However, the rate of return of the samples did not differ significantly with the history of sex with someone with STI (p=0.085).

A multivariable analysis was then performed, to identify independent predictors of the return of samples (Table 2). This found the type of kit requested to be significantly predictive of the return of samples (p<0.001). The rates of return were similar for females without or with history of anal sex (OR: 0.96, 95% CI: 0.74 – 1.24, p=0.736) and the MSM kit (OR: 1.06, 95% CI: 0.86 – 1.30, p=0.593). However, patients requesting the heterosexual male STI kit were significantly less likely to return samples than those requesting the other kit types (OR: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. female without history of anal sex).

The place of delivery of the testing kits was also a significant independent predictor of the return of samples (p<0.001), with those delivered to the pharmacy the least likely to be returned (OR: 0.53, 95% CI: 0.44 - 0.63, p<0.001 vs. home). Patients reporting symptoms were also less likely to return kits, (OR 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients).

Decreasing deprivation was associated with an increased chance of the return of kits. For each increase of 10,000 ranks in the IMD score (i.e. becoming less deprived), the likelihood of kits being returned increased with an odds ratio of 1.08 (95% CI: 1.01 – 1.15, p=0.029).

Discussion

We identified a number of factors associated with return of STI and HIV testing kits. Women and MSM were more likely to return their testing kits, as were patients who requested delivery of their kits to their home. However, patients requesting from neighbourhoods with higher socioeconomic deprivation or with genitourinary symptoms were found to be less likely to return their testing kits.

Little comparable evidence for an online service for STI and HIV testing of all sex groups is currently available. Most studies report on home sampling services for HIV or chlamydia testing. In an earlier population study on uptake of postal screening for chlamydia, 25% (95% CI 21.7 to 28.6%) of 14382 randomly selected men and women returned their testing kits [13]. An online HIV home sampling service for MSM reported 55% of 10323 men returned their testing kits; a rate comparable to that for MSM in our study [10]. In an earlier study on the uptake of home sampling of vaginal chlamydia testing, 31% (350/1139) of the kits requested via email were returned [7]. A study on home sampling kits for STI testing of 433 HIV negative MSM reported a return rate of 47% [11].

Online surveys of target populations for home STI and HIV testing have identified some factors associated with the use of the service and return of the testing kits. In a survey of 7938 MSM, those who identified themselves as gay or bi-sexual were more likely to use home sampling testing than men who identified as straight/ other men [1]. Other surveys have identified level of education, level of income, ethnicity and age as predictor of return of the testing kits [14-17]. Some of these findings have not been supported by other surveys [1].

In our study testing kits collected from pharmacies were less likely to be returned. This may be secondary to individuals' difficulties with securing a venue where they can obtain their specimens in a confidential manner.

We hypothesise that patients with genitourinary symptoms may have decided to attend our sexual health clinics rather than to return their testing kits. This is the advice we offer to the patients on our website.

We found that heterosexual men and those from neighbourhoods with higher socioeconomic deprivation were less likely to return their testing kits. These are populations at risk of STI and HIV [18]. Increasing the return rate of testing kits from these populations is priority for our service.

Our study suffered from a number of limitations. We assumed all requested kits were delivered to the patients. We do not know how many of the testing kits were actually received by the patients. A number of online requests for the testing kits may have not been genuine and the applicant could have used false delivery address when registering online. Finally, it is likely that some patients struggled with obtaining all the required specimens for STI and HIV testing and decided not to return kits containing incomplete specimens.

Home sampling for STI and HIV testing is rapidly becoming a standard of care. Return of samples for testing is crucial for the success of the service. We identified a number of factors that were associated with non-return of the testing kits. Improved instructions for groups less likely to return their testing kits would be beneficial. Further research in improvement of return rate of the testing kits among individuals with those factors would be beneficial.

Contributor ship statement: KM researched and proposed the protocol, drafted the manuscript. JH conducted the statistical analysis of the data. KM and JH have contributed to the final version of the manuscript.

Competing interests: None to declare

Funding: None to declare

Data sharing statement: We have included analysis of all the data abstracted according to the study protocol. We are prepared to share the anonymised data on request and after approval of our Trust's Information Governance department.

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Table 1a – Comparisons of the rates of samples received by temporal factors and survey responses

	STI Kits	Samples Received	p-Value
Day of Request			0.059
Monday	936	550 (58.8%)	
Tuesday	882	510 (57.8%)	
Wednesday	888	518 (58.3%)	
Thursday	814	454 (55.8%)	
Friday	738	435 (58.9%)	
Saturday	466	257 (55.2%)	
Sunday	586	375 (64.0%)	
Time of Day			0.665
8:00 - 12:59	1437	858 (59.7%)	
13:00 - 17:59	1702	980 (57.6%)	
18:00 - 22:59	1407	818 (58.1%)	
23:00 - 7:59	764	443 (58.0%)	
Gender			**<0.001***
Female	3513	2149 (61.2%)	
Male	1787	949 (53.1%)	
Transgender (female to male)	3	0 (0.0%)	
Transgender (male to female)	7	1 (14.3%)	
Place of Kit Collection/Delivery			**<0.001**
Home	4115	2495 (60.6%)	
Clinic	633	357 (56.4%)	
Pharmacy	562	247 (44.0%)	
History of Sex with Someone with Infections in the Last 6 Months			0.085
None of these infections	4747	2782 (58.6%)	
Chlamydia or NSU	469	267 (56.9%)	
Gonorrhoea	52	35 (67.3%)	
Hepatitis B or C	12	4 (33.3%)	
HIV	11	5 (45.5%)	
Syphilis	8	2 (25.0%)	
Trichomonas	10	4 (40.0%)	
Country of Birth Questions**			**0.031**
Neither option	4407	2605 (59.1%)	
Unprotected Sex with Someone Born Outside EU	715	398 (55.7%)	
Respondent Born Outside EU	187	96 (51.3%)	
2015 IMD Rank***			**0.007**
< 5000	1855	1039 (56.0%)	
5000 - 14999	2095	1239 (59.1%)	
15000+	1321	798 (60.4%)	

**A comparison of male vs. female (excluding transgender) was also significant at p<0.001.*
*** Combines the questions: "Do you have a history of unprotected sex with someone born or raised outside any of the countries listed?" and "Were you born outside of the countries listed?", as the latter is only asked if an answer of "No" is given to the former.*
****Excludes the N=39 with for whom the IMD was not available, and p-value is from a Mann-Whitney test, treating the IMD rank as continuous.*
p-Values are from Chi-square tests, unless stated otherwise, and bold p-values are significant at p<0.05

Table 1b – Comparisons of the rates of samples received by gender-specific questions

	Female			Male		
	STI Kits	***Sample Received***	***p-Value***	***STI Kits***	***Sample Received***	***p-Value***
Kit Type**			0.572			**<0.001**
Female - design A	3246	1990 (61.3%)		*	-	
Female - design B	267	159 (59.6%)		*	-	
Male STI	*	-		1325	657 (49.6%)	
MSM STI	*	-		462	292 (63.2%)	
Symptoms			**0.020**			**0.010**
I don't have any of these symptoms	2769	1723 (62.2%)		1424	781 (54.8%)	
Deep pain during sex	151	83 (55.0%)		*	-	
Ongoing lower abdominal pain	215	132 (61.4%)		*	-	
Pain when you pass urine	299	174 (58.2%)		146	75 (51.4%)	
Sores, ulcers or cuts on your genitals or around your anus	79	37 (46.8%)		46	20 (43.5%)	
Pain in your testicles	*	-		73	36 (49.3%)	
Unusual discharge from penis or anus	*	-		98	37 (37.8%)	
Sexual and drug taking behaviour (In the Last 6 Months)			0.736			**<0.001**
None of these statements apply to me	2961	1810 (61.1%)		1300	644 (49.5%)	
I've had anal sex with a man	213	126 (59.2%)		*	-	
I've had sex with 6 or more men	301	186 (61.8%)		12	5 (41.7%)	
I've used amyl nitrate (poppers)	11	8 (72.7%)		5	1 (20.0%)	
I've used methamphetamines	27	19 (70.4%)		23	13 (56.5%)	
I've had sex with other men	*	-		438	279 (63.7%)	
I've had receptive anal sex (I was the bottom) with a man	*	-		9	7 (77.8%)	

**Not applicable to the specified gender*

***Female Design B is for respondents reporting a history of receptive anal sex*

Excludes the transgender respondents (N=10)

p-Values are from Chi-square tests, and bold p-values are significant at p<0.05

Table 2 – Multivariable analysis of return of samples

	OR (95% CI)	p-Value
Kit Type*		**<0.001**
Female - Design A	-	-
Female - Design B	0.96 (0.74 - 1.24)	0.736
Male STI	0.63 (0.55 - 0.72)	**<0.001**
MSM STI	1.06 (0.86 - 1.30)	0.593
Place of Delivery		**<0.001**
Home	-	-
Clinic	0.84 (0.71 - 1.00)	**0.048**
Pharmacy	0.53 (0.44 - 0.63)	**<0.001**
Any Symptoms Reported	0.77 (0.67 - 0.89)	**<0.001**
2015 IMD Rank (x10,000)**	1.08 (1.01 - 1.15)	**0.029**

Results are from a multivariable binary logistic regression model, using a forwards stepwise approach. All factors in Tables 1a/1b were considered for inclusion, as well as patient age. The questions regarding sexual infections, symptoms and statements about sexual and drug history were dichotomised into yes/no responses. The 10 transgender respondents and the 39 cases where the IMD was not available were excluded.

**Female Design B is for respondents reporting a history of receptive anal sex*

***The odds ratio represents the increase in the odds of sample return associated with an increase of 10,000 ranks of the IMD.*

Bold p-values are significant at $p<0.05$

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
		A cohort study of factors associated with return of home sampling kits for sexually transmitted infections requested online
		Page 2: Objectives: To investigate factors associated with the return of home sampling testing kits for sexually transmitted infections (STI) testing kits. Setting: online STI testing service offered to the residents of Birmingham. Participants: all patients requesting home sampling STI testing kits via Birmingham Umbrella sexual health service website between July 15th and December 14th 2016. The service is available to residents of Birmingham only. Interventions: the service issues different testing kits to different sex groups. Data on online registration and return of STI home sampling kits at the Umbrella sexual health clinic in Birmingham between 15th July and 14th December 2016 were reviewed. Results: a total of 5,310 (61% for female testing) kits were requested, of which 3,099 (58.4%) were returned to the medical microbiology laboratory. Women and men who have sex with men had equally higher likelihood of return of their testing kits. Heterosexual men were significantly less likely to return their testing kits (OR: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. females). Patients reporting symptoms were also less likely to return kits, (OR 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients). Requests made in less economically deprived neighbourhoods were more likely to return the kits (OR 1.08, 95% CI: 1.01 – 1.15, p=0.029). Conclusion: Improved instructions for groups less likely to return their testing kits would be beneficial. Further research in improvement of return rate of the testing kits among individuals with those factors would be beneficial. Trial registration: Registered with R&D department at University Hospitals Birmingham; CARMS-13551 239 words
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
		Page 4: The advent of new technologies has provided opportunities for expansion of screening for sexually transmitted infections (STI) and HIV in general population. Home sampling kits for STI testing take advantage of the features of nucleic acid amplification tests (NAAT) for detection of chlamydia and gonorrhoea. The high sensitivity and specificity of the tests allows for testing of ano-genital specimens obtained by self-collecting procedures. New laboratory based HIV assays can operate on small volume of blood samples that can be obtained through a finger prick, and collected in a small blood tube that fits inside a small box or envelope. Specimens for

NAAT can be stored at in room temperature whilst being transported to the laboratory.

Home sampling STI and HIV testing provides optimal privacy, and the choice of being tested on any occasion. The service is perceived to have a number of limitations such as not being able to talk to a doctor about test results [1]. Over the past two decades several studies have reported on acceptability of home sampling for chlamydia and gonorrhoea home testing [2-6]. Studies have also investigated the success of internet based home sampling services for chlamydia testing [7,8]. In England, 76,842 individuals aged between 15 and 24 years were tested for chlamydia using internet services in 2015 [9].

Following the tendering process of sexual health services in England, many services are now expected to offer home sampling kits for STI screening. Improving return rates of home sampling kits would improve the cost-effectiveness of these services, whilst potentially enhancing the success of the services in reducing the incidence of STI.

Studies reporting on the return rates of internet registered home sampling kits have focused on the use of kits for chlamydia and gonorrhoea testing or on HIV screening and only on specific sex groups; men who have sex with men (MSM) or women [7,8,10,11]. Limited data currently exist on the return rates of internet registered home sampling kits for STI and HIV screening in general population.

Objectives	3	State specific objectives, including any prespecified hypotheses Page 4; last paragraph: The aim of this cohort study was to investigate the rate of return of home sampling testing kits after registration with an online health website in the city of Birmingham, UK. To the best of our knowledge, this is the first report on return rate of home sampling testing kits for chlamydia, gonorrhoea, HIV, and syphilis screening offered to all patients at the same time.
Methods		
Study design	4	Present key elements of study design early in the paper Page 6: *Study design* This was service evaluation cohort study of factors associated with return of STI testing kits requested online after registration in Umbrella Health website.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Page 5 and 6: Following the tender of the services by Birmingham and Solihull local governments, the new sexual health service (Umbrella Health) was formed in August 2015. This offers an online service for requesting home sampling testing kits for STI and HIV. The use of service is limited to addresses within Birmingham and Solihull areas. *Requesting testing kits* The service allows for individuals' self-registration on Umbrella Health website (https://umbrellahealth.co.uk/our-services/self-sampling-kits). The registration process includes provision of information on sexual orientation and presence of ano-genital symptoms. Individuals with ano genital symptoms are advised to attend one of several community umbrella health clinics across Birmingham and Solihull. They are still able to request home testing kits for STI screening. The service offers four types of testing kits depending on the individual's risk group; women without history of receptive anal sex (Design A), women with history of receptive anal sex (Design B), heterosexual men, and men who have sex with men

(MSM).

After registration with the service, the individual can choose to receive their home testing kits at their address of choice or to collect it from one of 66 locations in partnership with Umbrella Health including 24 local pharmacies and 24 community sexual health clinics across Birmingham and Solihull.

Contents of testing kits
The home sampling testing kits include the swabs and manufacturer's transport media for chlamydia and gonorrhoea testing on Aptima Combo. Urine samples for male urethral testing, and swabs for volvo-vaginal, ano-rectal and throat specimens are included in the testing kits where appropriate. Each swab is paired with a single specific transport medium according to the manufacturer's guidelines.

Sterile disposable lancets with tiny blood bottles for blood specimens required for serology testing for HIV and syphilis are also added to each testing kit. Blood specimens are obtained by finger prick with disposable lancets. Blood drops are then collected into sterile plastic tiny tubes for a minimum of 400 µmL for HIV and syphilis testing.

All women provide a vulvo-vaginal swab for chlamydia and gonorrhoea testing, and a blood sample for HIV and syphilis. Women who report history of receptive anal sex also receive an additional swab for ano-rectal swab for chlamydia and gonorrhoea testing (Design B kit).

Heterosexual men provide urine samples for chlamydia and gonorrhoea testing and blood specimens for HIV and syphilis screening. Men who have sex with men (MSM) provide additional ano-rectal and throat specimens using the two extra swabs provided in their testing kits.

Testing kits contain pictorial information and guidance on how to obtain the appropriate sample for each test. They also hold an envelope pre-addressed to the medical microbiology laboratory at Queen Elizabeth Hospital Birmingham. The packaging of the kits complies with Royal Mail standards requiring three layers of packaging. This includes a watertight leak-proof container for the sample, packed with enough porous material to absorb all fluids in case of breakage, which is enclosed in a second watertight leak proof container. The two layers of packaging are then enclosed in a third outer package, to protect against external damage during the delivery of the specimens.

Testing of samples
On receipt of specimens from the home testing kits, their unique number is entered in the medical microbiology laboratory registry system. Individuals' details are then automatically retrieved from the web-booking database. The specimens are simultaneously registered in the sexual health service's electronic patients' system.

The specimens are then processed according to UK medical laboratory standards (UKAS). Chlamydia and gonorrhoea tests are carried out on an Aptima Combo assay and platform. HIV serology is carried out on Abbott's 4th generation ELISA HIV assay, and the EIA IgG assay is used for syphilis screening

Patients were informed of their test results by a text message to their mobile phones within one hour of their authorisation by the laboratory.

Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed
		Page 4; first paragraph: Participants: all patients requesting home sampling STI testing kits via Birmingham Umbrella sexual health service website between July 15th and December 14th 2016. The service is available to residents of Birmingham only.

Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Pages 6 and 7: *Data collection* Data were collected on patients requesting STI and HIV testing kits from Umbrella Health website between 15th July and 14th December 2016. We investigated the factors associated with the return of the STI testing kits to our laboratory. Information on patients' demography, the responses to questions relating to drug usage, sexual history and symptoms were recorded. The final question of the online registration asked the patients if they have had unprotected sex with someone born or raised outside of the following 16 countries:: Austria, Belgium, Czech Republic, Denmark, Faroe Islands, Finland, France, Germany, Iceland, Ireland, Luxemburg, The Netherlands, Norway, Sweden, Switzerland and the UK (which will be subsequently referred to the "EU" for brevity). A negative response to this question revealed a second question, asking whether the patient was born or raised outside of the countries listed. As such, the two parts of the question were combined in the analysis to give three groups of patients: those that answered "Yes" to the first part, those that answered "Yes" to the second part of the question, and the remainder that answered "No" to each part of the question that was displayed to them. Temporal factors relating to the day and time that the request for testing kits was placed were also available. All individuals were required to provide a postcode, which was converted to a 2015 Index of Multiple Deprivation Score (IMD), based on the data from the Department For Communities and Local Government [12]. For 39 cases, the given postcodes were not available in the IMD database, hence these cases were excluded from the analysis of IMD score. The medical microbiology laboratory system was then interrogated, to identify which of the individuals requesting testing kits actually returned samples.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Page 6, data collection section: Demographical and laboratory information for all patients registered on the Umbrella Health website for an STI home sampling testing kit were abstracted and included in the study. We carried out a cross sectional analysis to understand the factors associated with the return of the testing kits within the group of patients registered to receive the testing kits.
Bias	9	Describe any efforts to address potential sources of bias Page 7, penultimate paragraph: The study is retrospective and may have suffered from some unaccounted bias. We have included all patients within the study period to minimise any possible bias in our conclusions.
Study size	10	Explain how the study size was arrived at Page 7, penultimate paragraph:

		We included all patients using the service within a three month period. At present there is very little data on our study group to draw any hypothesis on primary endpoint (return rate of testing kits).
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Page 4; requesting testing kits, page 6, Table 1a and Table 1b : Online registration of patients require minimum data set before dispatch of the appropriate testing kit. We therefore had complete data set for all applications within the study period. We investigated a number of possible factors in return of the testing kits: age, gender, sex group, time of the day the kits were requested, day of the week the kits were requested, ethnicity, financial deprivation index of the neighbourhood from where the application was made, sex with partners of countries with high prevalence of HIV, and presence of genitourinary symptoms. The groups were chosen to investigate their possible roles in the return of testing kits to the laboratory. We included significant factors in univariate analysis in the multivariate model as described below.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding (*b*) Describe any methods used to examine subgroups and interactions (*c*) Explain how missing data were addressed (*d*) If applicable, explain how loss to follow-up was addressed (*e*) Describe any sensitivity analyses Page6 and 7: statistical analysis: Initially, the proportions of STI kits where a sample was returned were compared across the factors using Chi-square tests or Mann-Whitney tests, as appropriate. Continuous variables were expressed as medians and interquartile ranges (IQRs). For some of the questions in online registration, a different set of answers was displayed, depending on the gender of the respondent. In these cases, the analyses were performed separately for males and females, with the small number of transgender respondents excluded. A multivariable binary logistic regression model was then produced, to identify significant independent predictors of the return of samples. The transgender respondents were also excluded from this analysis, due to the small number of cases, as were those cases where the IMD score was unavailable. A forwards stepwise approach was used to select factors for inclusion in the model. All analyses were performed using IBM SPSS 22 (IBM Corp. Armonk, NY), with $p<0.05$ deemed to be indicative of statistical significance throughout. This is a study on an already operational service. We used anonymised data for analysis. Our report is a service improvement analysis. We did not seek approval of ethics committee approval.
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram

		Page 8, Results, Table 1a and Table 1b: 5310 requests were included in the study; 3099 were returned to the microbiology laboratory. Comparisons were made between different demographical and clinical features of 3099 patients who returned their kits and 2211 patients who did not return their kits. The proportions of the following factors were not significantly different between the two groups: Day of the week of request, time of the day of request, and history of sex with someone with an STI in the past six months. The following factors were associated with non-return of the STI testing kits on multivariable analysis: heterosexual men, having genitourinary symptoms, being from economically deprived neighbourhoods, and use of recreational substances (in male participants only).
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) Summarise follow-up time (eg, average and total amount) Page 8, Results, Table 1a, Table 1b: Please see above (section 13) for the details.
Outcome data	15*	Report numbers of outcome events or summary measures over time Page 8, results, Table 1a, 1b, 2: Distribution of the participants and their features (tables 1a, 1b) Multivariable analysis (Table 2) to identify independent predictors of the return of the samples. The rates of return were similar for females without or with history of anal sex (OR: 0.96, 95% CI: 0.74 – 1.24, p=0.736) and the MSM kit (OR: 1.06, 95% CI: 0.86 – 1.30, p=0.593). However, patients requesting the heterosexual male STI kit were significantly less likely to return samples than those requesting the other kit types (OR: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. female without history of anal sex). The place of delivery of the testing kits was also a significant independent predictor of the return of samples (p<0.001), with those delivered to the pharmacy the least likely to be returned (OR: 0.53, 95% CI: 0.44 - 0.63, p<0.001 vs. home). Patients reporting symptoms were also less likely to return kits, (OR 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients). Decreasing deprivation was associated with an increased chance of the return of kits. For each increase of 10,000 ranks in the IMD score (i.e. becoming less deprived), the likelihood of kits being returned increased with an odds ratio of 1.08 (95% CI: 1.01 – 1.15, p=0.029).
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period Page 8, results, Table 2

In our analysis, heterosexual men were 37% less likely to return their testing kits compared with women. Patients opting to collect their testing kits from their local pharmacy or one of our sexual health clinics were 47% and 16% less likely to return their testing kits respectively. Patients with any genitourinary symptom were 23% less likely to return their testing kits. Decrease in the deprivation index by each 10,000 point improved the likelihood of the return of the testing kits by 8%. All the above factors were independent and statistically significant in multivariate analysis.

	OR (95% CI)	p-Value
Kit Type*		**<0.001**
Female - Design A	-	-
Female - Design B	0.96 (0.74 - 1.24)	0.736
Male STI	0.63 (0.55 - 0.72)	**<0.001**
MSM STI	1.06 (0.86 - 1.30)	0.593
Place of Delivery		**<0.001**
Home	-	-
Clinic	0.84 (0.71 - 1.00)	**0.048**
Pharmacy	0.53 (0.44 - 0.63)	**<0.001**
Any Symptoms Reported	0.77 (0.67 - 0.89)	**<0.001**
2015 IMD Rank (x10,000)**	1.08 (1.01 - 1.15)	**0.029**

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses As per section 16.
Discussion		
Key results	18	Summarise key results with reference to study objectives Page 10, Discussion We identified a number of factors associated with return of STI and HIV testing kits. Women and MSM were more likely to return their testing kits, as were patients who requested delivery of their kits to their home. However, patients requesting from neighbourhoods with higher socioeconomic deprivation or with genitourinary symptoms were found to be less likely to return their testing kits.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Page 10, last paragraph: Our study suffered from a number of limitations. We assumed all requested kits were delivered to the patients. We do not know how many of the testing kits were actually received by the patients. A number of online requests for the testing kits may have not been genuine and the applicant could have used false delivery address when registering online. Finally, it is likely that some patients struggled with obtaining all the required specimens for STI and HIV testing and decided not to return kits containing incomplete specimens.

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Page 11: Home sampling for STI and HIV testing is rapidly becoming a standard of care. Return of samples for testing is crucial for the success of the service. We identified a number of factors that were associated with non-return of the testing kits. Improved instructions for groups less likely to return their testing kits would be beneficial. Further research in improvement of return rate of the testing kits among individuals with those factors would be beneficial.
Generalisability	21	Discuss the generalisability (external validity) of the study results As per section 20.
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based None to declare.

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

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A study of factors associated with return of home sampling kits for sexually transmitted infections requested online in the UK

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A study of factors associated with return of home sampling kits for sexually transmitted infections requested online in the UK

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Abstract

Objectives: To investigate factors associated with the return of home sampling kits for sexually transmitted infections (STI).

Setting: Online STI testing service offered to the residents of Birmingham and Solihull.

Participants: All patients requesting STI home sampling kits via the Umbrella sexual health service website between July 15th and December 14th 2016.

Interventions: Associations between data collected at online registration and the rate of return of STI home sampling kits within 30 days of request was assessed.

Results: A total of 5,310 kits were requested, of which 3,099 (58.4%) were returned to the medical microbiology laboratory. On multivariable analysis, women and men who have sex with men were similarly likely to return their sampling kits (Adjusted Odds Ratio [OR_{adj}]: 1.06, 95% CI: 0.86 - 1.30), whilst heterosexual men were significantly less likely to return their sampling kits (OR_{adj}: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. females). Patients reporting symptoms were also less likely to return kits (OR_{adj}: 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients). Kits that were delivered to the patient's home, rather than to a clinic or pharmacy (p<0.001), and those requested from less economically deprived neighbourhoods (p=0.029) were significantly more likely to be returned.

Conclusion: STI self sampling testing kits delivered to patients' homes are most likely to be returned. Heterosexual males and those from more economically deprived areas are the less likely groups to return the kits. Further research on the barriers to return self sampling STI testing kits of these sub-groups of patients is warranted I, .

Trial registration: Registered with R&D department at University Hospitals Birmingham; CARMS-13551

249 words

Keywords: STI, home sampling, online registration, return rate

Article summary

- The study showed large numbers of different sex groups tested for chlamydia, gonorrhoea, HIV and syphilis by self sampling kits delivered to their address of choice.
- Kits delivered to heterosexual men, those with symptoms, neighbourhoods with more socioeconomic deprivation and locations other than the patient's home are the least likely to be returned
- The study's observational design made it difficult to investigate reason(s) for failure to return sampling kits.
- The findings of the study may help to improve the usage of similar services rolled out by other sexual health departments in the UK.

Introduction

The advent of new technologies has provided opportunities for expansion of screening for sexually transmitted infections (STI) and HIV in general population. Home sampling kits for STI testing take advantage of the features of nucleic acid amplification tests (NAAT) for detection of chlamydia and gonorrhoea. The high sensitivity and specificity of the tests allows for testing of ano-genital specimens obtained by self-collecting procedures. New laboratory based HIV assays can operate on small volume blood samples that can be obtained through a finger prick, and collected in a small blood tube that fits inside a small box or envelope. Specimens for NAAT can be stored at in room temperature whilst being transported to the laboratory.

Home sampling STI and HIV testing provides optimal privacy, and the choice of being tested on any occasion. Because of savings on the cost of clinical overheads, home sampling STI testing services may be more cost effective compared with traditional services. However, the service is also perceived to have a number of limitations, such as not being able to talk to a doctor about test results [1]. Over the past two decades, several studies have reported on acceptability of home sampling for chlamydia and gonorrhoea testing [2-6]. Studies have also investigated the success of internet based home sampling services for chlamydia testing [7,8]. In England, 76,842 individuals aged between 15 and 24 years were tested for chlamydia using internet services in 2015 [9].

Following the tendering process of sexual health services in England, many services are now expected to offer home sampling kits for STI screening. Improving return rates of home sampling kits would improve the cost-effectiveness of these services, whilst potentially enhancing the success of the services in reducing the incidence of STI.

Studies reporting on the return rates of internet registered home sampling kits have focused on the use of kits for chlamydia and gonorrhoea testing or on HIV screening, and only on specific sex groups; men who have sex with men (MSM) or women [7,8,10,11]. Limited data currently exist on the return rates of internet registered home sampling kits for STI and HIV screening in general population.

The aim of this study was to investigate the rate of return of home sampling kits after registration with an online health website in the cities of Birmingham and Solihull, UK. To the best of our knowledge, this is the first report on return rate of home sampling kits offering combined chlamydia, gonorrhoea, HIV, and syphilis screening to all patients.

Methods

Following the tender of the services by Birmingham and Solihull local governments, the new sexual health service (Umbrella Health) was formed in August 2015. This offers an online service for requesting home sampling kits for STI and HIV, which can be used by any adult residents of Birmingham and Solihull. The service is promoted online and through a number of local media outlets and venues, including community partnerships and primary care centres. Individuals are encouraged to visit the service's website and request a sampling kit at the time of their convenience.

Requesting sampling kits

The service allows for individuals' self-registration on Umbrella Health website (https://umbrellahealth.co.uk/our-services/self-sampling-kits). When applying for kits, individuals are asked a range for questions relating to sexual orientation, anogenital symptoms and sexual behaviours, in order to identify the appropriate type of sampling kit they should receive. All questions must be answered to complete the application process. Because of the risk of having an STI, individuals who report anogenital symptoms are advised to attend one of several community umbrella health clinics across Birmingham and Solihull. They are still able to request home sampling kits for STI screening.

After registration with the service, the individual can choose to receive their home sampling kits at their address of choice, or to collect it from one of 66 locations in partnership with Umbrella Health, including 24 local pharmacies and 24 community sexual health clinics across Birmingham and Solihull.

Contents of sampling kits

Depending on the responses given to questions when requesting, there are four different types of sampling kit that can be ordered, which are tailored to the risk profile of the patient. For females, there are two types of kit – "Design A" is for patients that do not report having engaged in anal sex within the previous six months, and "Design B" is for those that answered yes to this question. Similarly, for males, the standard male kit is dispatched to those who do not report having sex with men within the previous six months, with an MSM (men who have sex with men) kit being dispatched otherwise. The contents of the various sampling kits are summarised below, and in Table 1.

All four of the home sampling kits contain sterile disposable lancets, to obtain finger prick blood samples, which are collected in the included tiny blood bottles. The aim is to collect a minimum of 400 µmL, so that samples can be used for HIV and syphilis serology testing. The female kits also include the swabs and manufacturer's transport media for chlamydia and gonorrhoea testing on an Aptima Combo assay. Both of the female kits include a vulvovaginal swab, with the Design B kit additionally including an anorectal swab. The two male kits also include urine sample bottles, for urethral testing, whilst the MSM kit additionally includes anorectal and throat swabs.

All kits contain pictorial information and guidance on how to obtain the appropriate sample for each test. They also hold an envelope pre-addressed to the medical microbiology laboratory at Queen Elizabeth Hospital Birmingham. The packaging of the kits complies with Royal Mail standards requiring three layers of packaging. This includes a watertight leak-proof container for the sample, packed with enough porous material to absorb all fluids in case of breakage, which is enclosed in a second watertight leak-proof container. The two

layers of packaging are then enclosed in a third outer package, to protect against external damage during the delivery of the specimens.

Testing of samples

On receipt of specimens from the home sampling kits, their unique number is entered in the medical microbiology laboratory registry system. Individuals' details are then automatically retrieved from the web-booking database. The specimens are simultaneously registered in the sexual health service's electronic patients' system. The specimens are then processed according to UK medical laboratory standards (UKAS). Chlamydia and gonorrhoea tests are carried out on an Aptima Combo assay and platform. HIV serology is carried out on Abbott's 4th generation ELISA HIV assay, and the EIA IgG assay is used for syphilis screening

Patients were informed of their test results by a text message to their mobile phones within one hour of their authorisation by the laboratory.

Study design

This was service evaluation study of factors associated with return of STI sampling kits within 30 days of their online request through the Umbrella Health website. The analysis was based on anonymised retrospective data and, as such, we did not seek ethics committee approval.

Data collection

Data were collected on patients requesting STI and HIV sampling kits from Umbrella Health website between 15th July and 14th December 2016. Information on patients' demography and responses to questions relating to drug usage, sexual history and symptoms were recorded. Since all of these questions needed to be completed in order to request a sampling kit, complete data were available for all of these factors.

The final question of the online registration was in two parts, first asking if the patient had a history of unprotected sex with someone born or raised outside of a list of 16 countries. A negative response to this revealed the second part of the question, asking whether the patient was born or raised outside of the countries listed. The 16 countries in the list were: Austria, Belgium, Czech Republic, Denmark, Faroe Islands, Finland, France, Germany, Iceland, Ireland, Luxemburg, The Netherlands, Norway, Sweden, Switzerland and the UK (which will be subsequently referred to the "Northern EU" for brevity). We consider these 16 Northern European countries to have low overall prevalence of hepatitis B infection. Individuals that were born and raised, or have sex with partners from outside the Northern EU may be at increased risk of hepatitis B infection. Hence, in accordance with NICE guidelines, the website advises those individuals to attend one of Umbrella Health clinics for hepatitis B screening and vaccination [12].

Temporal factors relating to the day and time that the request for sampling kits was placed were also collected automatically by the website. All individuals were required to provide a postcode, which was converted to a 2015 Index of Multiple Deprivation Score (IMD), based on the data from the Department for Communities and Local Government [13]. For 39 cases, the given postcodes were not available in the IMD database, hence these cases were excluded from the analysis of IMD score.

The medical microbiology laboratory system was then interrogated, to identify which of the individuals requesting sampling kits actually returned samples.

Statistical analysis

Initially, the proportions of STI sampling kits where a sample was returned were compared across the factors using Chi-square tests or Mann-Whitney tests, as appropriate. Continuous variables were expressed as medians and interquartile ranges (IQRs). For some of the questions in online registration, a different set of answers was displayed, depending on the gender of the respondent. In these cases, the analyses were performed separately for males and females, with the small number of transgender respondents excluded.

A multivariable binary logistic regression model was then produced, to identify significant independent predictors of the return of samples. The transgender respondents were also excluded from this analysis, due to the small number of cases, as were those cases where the IMD score was unavailable. A forwards stepwise approach was used to select factors for inclusion in the model.

All analyses were performed using IBM SPSS 22 (IBM Corp. Armonk, NY), with $p<0.05$ deemed to be indicative of statistical significance throughout.

Results

Between the 15th July and the 14th October 2016, a total of 5,310 kits were requested, of which 3,099 (58.4%) were returned to the medical microbiology laboratory. The age distributions were similar in the groups of patients that did and did not return sampling kits, with a median of 24 years (IQR: 20-28) for both (p=0.100). Associations between other factors and the return rate of kits are reported in Tables 2a and 2b.

On univariable analysis, females were found to be significantly more likely than males to return sampling kits (61.2% vs. 53.1%, p<0.001). There was also a small group of 10 transgender respondents, who were the least likely to return kits, with only 10% (N=1) doing so. Analysis of gender was then further broken down by the type of kit requested. Females were found to have similar rates of kit return, regardless of whether or not they reported having receptive anal sex (61.3% vs. 59.6% for Design A vs. B, p=0.572). Of the male respondents, those requesting an MSM kit had a similar rate of kit return to females, at 62.5% (p=0.416). However, heterosexual males were significantly less likely to return kits (p<0.001), with only 49.6% doing so.

Analysis of the deprivation score (IMD 2015) of the area from which the kits were requested found that those who returned kits gave postcodes which were in significantly less deprived areas, with a median IMD rank of 9,444 (IQR: 2,907 – 15,387) compared to 8,574 (IQR: 2,546 – 14,338) for areas that did not return the kits (p=0.007). In addition, the place of delivery of the sampling kits was also significantly associated with their return (p<0.001), with the greatest rate of return observed in those kits delivered to the patient's homes (60.6%), and the lowest rate in those delivered to pharmacies (44.0%). Neither the day of the week (p=0.059), nor the time of day (p=0.665) that the request was made were found to be significantly predictive of whether a kit would be returned.

A significant association with the questions about countries of birth of the patient and their sexual partners was detected (p=0.031), with patients born within and with partners within UK/ Northern EU having the highest rate of return of the samples (59.1%) and those born outside the Northern EU having the lowest rate (51.3%). In addition, asymptomatic patients were found to be more likely to return their sampling kits compared to those with symptoms, regardless of gender (p=0.020 for females, p=0.010 for males). However, the rate of return of the samples did not differ significantly with the history of sex with someone with STI (p=0.085).

A multivariable analysis was then performed, to identify independent predictors of the return of samples, which returned results that were consistent with the univariable analysis (Table 3). The type of kit requested was found to be significantly predictive of the return of samples (p<0.001). The rates of return were similar for females without or with history of anal sex (Adjusted Odds Ratio [OR_{adj}]: 0.96, 95% CI: 0.74 – 1.24, p=0.736) and the male MSM kit (OR_{adj}: 1.06, 95% CI: 0.86 – 1.30, p=0.593). However, patients requesting the heterosexual male STI kit were significantly less likely to return samples than those requesting the other kit types (OR_{adj}: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. female without history of anal sex).

The place of delivery of the sampling kits was also a significant independent predictor of the return of samples (p<0.001), with those delivered to the pharmacy the least likely to be returned (OR_{adj}: 0.53, 95% CI: 0.44 - 0.63, p<0.001 vs. home). Patients reporting symptoms were also less likely to return kits, (OR_{adj}: 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients).

Decreasing deprivation was associated with an increased chance of the return of kits. For each increase of 10,000 ranks in the IMD score (i.e. becoming less deprived), the likelihood of kits being returned increased, with an adjusted odds ratio of 1.08 (95% CI: 1.01 – 1.15, p=0.029).

Discussion

We identified a number of factors associated with return of STI and HIV sampling kits. Kits requested by heterosexual males, those with genitourinary symptoms and kits delivered to neighbourhoods with higher socioeconomic deprivation and to locations other than the patient's home were all found to have significantly lower rates of return.

Little comparable evidence for an online service for STI and HIV testing of all sex groups is currently available. Most studies report on home sampling services for HIV or chlamydia testing. In an earlier population study on uptake of postal screening for chlamydia, 25% (95% CI: 21.7 - 28.6%) of 14,382 randomly selected men and women returned their sampling kits [14]. An online HIV home sampling service for MSM reported 55% of 10,323 men returned their sampling kits; a rate comparable to that for MSM in our study [10]. In an earlier study on the uptake of home sampling of vaginal chlamydia testing, 31% (350/1139) of the kits requested via email were returned [7]. A study on home sampling kits for STI testing of 433 HIV negative MSM reported a return rate of 47% [11].

Online surveys of target populations for home STI and HIV testing have identified some factors associated with the use of the service and return of the sampling kits. In a survey of 7,938 MSM, those who identified themselves as gay or bi-sexual were more likely to use home sampling testing than men who identified as straight/ other men [1]. Other surveys have identified level of education, level of income, ethnicity and age as predictor of return of the sampling kits [15-18]. Some of these findings have not been supported by other surveys [1].

In our study, sampling kits collected from pharmacies were less likely to be returned. This may be secondary to individuals' difficulties with securing a venue where they can obtain their specimens in a confidential manner. Rates of return were also found to be lower in patients with genitourinary symptoms. We hypothesise that this may have been due to patients deciding to attend our sexual health clinics, rather than return their sampling kits, as this is the advice we offer to the patients on our website.

We found that heterosexual men and those from neighbourhoods with higher socioeconomic deprivation were less likely to return their sampling kits. As these are populations at risk of STI and HIV [19], increasing the return rate of sampling kits from these populations is a priority for our service. However, based on the data available from the surveys, we were not able to hypothesise as to why these groups were less likely to return their samples and, as such, are not able to propose changes to the service to improve sample return.

We aim to survey patients who do not return their STI sampling kits to understand their reasons for non-return of the testing kits better. Our study suffered from a number of limitations, the main one being that, in patients that did not return their sampling kits, the rationale behind this decision was not known. This additional information may have been highly valuable in explaining the observed differences between subgroups (e.g. heterosexual vs. MSM males) and identifying areas in which the service and, hence, the return rate of kits

could be improved. As a result, a questionnaire targeted at those patients that did not return their kits would make for interesting further work in this area. However, the response rates to such questionnaires is likely to be poor, especially since the majority of patients of interest are likely to be non-responders, on account of the fact that they did not return their sampling kits. Consequently, such a study may be hampered by selection bias and a small sample size.

In this study, we assumed all requested kits were delivered to the patients but, since proof of delivery was not recorded, we do not know how many of the sampling kits were actually received. The number of kits lost in transit would be expected to be minimal. However, since the service was free, a number of online requests for the sampling kits may have not been genuine and may have used false delivery addresses, which would likely have resulted in the unwitting recipient disposing of the kit.

The study also only focused on whether or not the kits were returned, and did not consider the quality or quantity of the samples themselves. As such, it is likely that a proportion of those kits returned contained incomplete or inadequate specimens on which the full range of STI and HIV sampling could not be performed. Further assessment of the factors associated with the return of incomplete samples may have yielded useful results. However, anonymised data relating to the samples were not available, hence this was outside the scope of this service evaluation.

Home sampling for STI and HIV testing is rapidly becoming a standard of care. Return of samples for testing is crucial for the success of the service. We identified a number of factors that were associated with non-return of the sampling kits. Further research into the subgroups of patients with the lowest return rates may identify the reasons behind this and changes to the service that could improve the rate of return and, hence, the effectiveness of the programme.

Contributor ship statement: KM researched and proposed the protocol, drafted the manuscript. JH conducted the statistical analysis of the data. KM and JH have contributed to the final version of the manuscript.

Competing interests: None to declare

Funding: None to declare

Data sharing statement: We have included analysis of all the data abstracted according to the study protocol. We are prepared to share the anonymised data on request and after approval of our Trust's Information Governance department.

All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work [or describe if any]; no financial relationships with any organisations that

might have an interest in the submitted work in the previous three years [or describe if any], no other relationships or activities that could appear to have influenced the submitted work.

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Table 1 – Contents of the four types of sampling kit

	Female Design A	Female Design B	Male	MSM
Pictorial information and guidance leaflet	✓	✓	✓	✓
Pre-addressed return envelope	✓	✓	✓	✓
Sterile disposable lancet and tiny blood bottle	✓	✓	✓	✓
Urine sample bottle			✓	✓
Vulvovaginal swab	✓	✓		
Anorectal swab		✓		✓
Throat swab				✓

Table 2a – Comparisons of the rates of samples received by temporal factors and survey responses

	STI Kits	Samples Received	p-Value
Day of Request			0.059
Monday	936	550 (58.8%)	
Tuesday	882	510 (57.8%)	
Wednesday	888	518 (58.3%)	
Thursday	814	454 (55.8%)	
Friday	738	435 (58.9%)	
Saturday	466	257 (55.2%)	
Sunday	586	375 (64.0%)	
Time of Day			0.665
8:00 - 12:59	1437	858 (59.7%)	
13:00 - 17:59	1702	980 (57.6%)	
18:00 - 22:59	1407	818 (58.1%)	
23:00 - 7:59	764	443 (58.0%)	
Gender			**<0.001***
Female	3513	2149 (61.2%)	
Male	1787	949 (53.1%)	
Transgender (female to male)	3	0 (0.0%)	
Transgender (male to female)	7	1 (14.3%)	
Place of Kit Collection/Delivery			**<0.001**
Home	4115	2495 (60.6%)	
Clinic	633	357 (56.4%)	
Pharmacy	562	247 (44.0%)	
History of Sex with Someone with Infections in the Last 6 Months			0.085
None of these infections	4747	2782 (58.6%)	
Chlamydia or NSU	469	267 (56.9%)	
Gonorrhoea	52	35 (67.3%)	
Hepatitis B or C	12	4 (33.3%)	
HIV	11	5 (45.5%)	
Syphilis	8	2 (25.0%)	
Trichomonas	10	4 (40.0%)	
Country of Birth Questions**			**0.031**
Neither option	4407	2605 (59.1%)	
Unprotected Sex with Someone Born Outside Northern EU	715	398 (55.7%)	
Respondent Born Outside Northern EU	187	96 (51.3%)	
2015 IMD Rank***			**0.007**
< 5000	1855	1039 (56.0%)	
5000 - 14999	2095	1239 (59.1%)	
15000+	1321	798 (60.4%)	

**A comparison of male vs. female (excluding transgender) was also significant at p<0.001.*

*** Combines the questions: "Do you have a history of unprotected sex with someone born or raised outside any of the countries listed?" and "Were you born outside of the countries listed?", as the latter is only asked if an answer of "No" is given to the former.*

****Excludes the N=39 with for whom the IMD was not available, and p-value is from a Mann-Whitney test, treating the IMD rank as continuous.*

p-Values are from Chi-square tests, unless stated otherwise, and bold p-values are significant at p<0.05

Table 2b – Comparisons of the rates of samples received by gender-specific questions

	Female			Male		
	STI Kits	***Sample Received***	***p-Value***	***STI Kits***	***Sample Received***	***p-Value***
Kit Type**			0.572			**<0.001**
Female - design A	3246	1990 (61.3%)		*	-	
Female - design B	267	159 (59.6%)		*	-	
Male STI	*	-		1325	657 (49.6%)	
MSM STI	*	-		462	292 (63.2%)	
Symptoms			**0.020**			**0.010**
I don't have any of these symptoms	2769	1723 (62.2%)		1424	781 (54.8%)	
Deep pain during sex	151	83 (55.0%)		*	-	
Ongoing lower abdominal pain	215	132 (61.4%)		*	-	
Pain when you pass urine	299	174 (58.2%)		146	75 (51.4%)	
Sores, ulcers or cuts on your genitals or around your anus	79	37 (46.8%)		46	20 (43.5%)	
Pain in your testicles	*	-		73	36 (49.3%)	
Unusual discharge from penis or anus	*	-		98	37 (37.8%)	
Sexual and drug taking behaviour (In the Last 6 Months)			0.736			**<0.001**
None of these statements apply to me	2961	1810 (61.1%)		1300	644 (49.5%)	
I've had anal sex with a man	213	126 (59.2%)		*	-	
I've had sex with 6 or more men	301	186 (61.8%)		12	5 (41.7%)	
I've used amyl nitrate (poppers)	11	8 (72.7%)		5	1 (20.0%)	
I've used methamphetamines	27	19 (70.4%)		23	13 (56.5%)	
I've had sex with other men	*	-		438	279 (63.7%)	
I've had receptive anal sex (I was the bottom) with a man	*	-		9	7 (77.8%)	

**Not applicable to the specified gender*

***Female Design B is for respondents reporting a history of receptive anal sex*

Excludes the transgender respondents (N=10)

p-Values are from Chi-square tests, and bold p-values are significant at p<0.05

Table 3 – Multivariable analysis of return of samples

	OR_{adj} (95% CI)	p-Value
Kit Type*		**<0.001**
Female - Design A	-	-
Female - Design B	0.96 (0.74 - 1.24)	0.736
Male STI	0.63 (0.55 - 0.72)	**<0.001**
MSM STI	1.06 (0.86 - 1.30)	0.593
Place of Delivery		**<0.001**
Home	-	-
Clinic	0.84 (0.71 - 1.00)	**0.048**
Pharmacy	0.53 (0.44 - 0.63)	**<0.001**
Any Symptoms Reported	0.77 (0.67 - 0.89)	**<0.001**
2015 IMD Rank (x10,000)**	1.08 (1.01 - 1.15)	**0.029**

Results are from a multivariable binary logistic regression model, using a forwards stepwise approach. All factors in Tables 2a/2b were considered for inclusion, as well as patient age. The questions regarding sexual infections, symptoms and statements about sexual and drug history were dichotomised into yes/no responses. The 10 transgender respondents and the 39 cases where the IMD was not available were excluded.

OR_{adj} = adjusted odds ratio, CI = confidence interval

**Female Design B is for respondents reporting a history of receptive anal sex*

***The odds ratio represents the increase in the odds of sample return associated with an increase of 10,000 ranks of the IMD.*

Bold p-values are significant at $p<0.05$

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
		A cohort study of factors associated with return of home sampling kits for sexually transmitted infections requested online
		Page 2: Objectives: To investigate factors associated with the return of home sampling testing kits for sexually transmitted infections (STI) testing kits. Setting: online STI testing service offered to the residents of Birmingham. Participants: all patients requesting home sampling STI testing kits via Birmingham Umbrella sexual health service website between July 15th and December 14th 2016. The service is available to residents of Birmingham only. Interventions: the service issues different testing kits to different sex groups. Data on online registration and return of STI home sampling kits at the Umbrella sexual health clinic in Birmingham between 15th July and 14th December 2016 were reviewed. Results: a total of 5,310 (61% for female testing) kits were requested, of which 3,099 (58.4%) were returned to the medical microbiology laboratory. Women and men who have sex with men had equally higher likelihood of return of their testing kits. Heterosexual men were significantly less likely to return their testing kits (OR: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. females). Patients reporting symptoms were also less likely to return kits, (OR 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients). Requests made in less economically deprived neighbourhoods were more likely to return the kits (OR 1.08, 95% CI: 1.01 – 1.15, p=0.029). Conclusion: Improved instructions for groups less likely to return their testing kits would be beneficial. Further research in improvement of return rate of the testing kits among individuals with those factors would be beneficial. Trial registration: Registered with R&D department at University Hospitals Birmingham; CARMS-13551 239 words
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
		Page 4: The advent of new technologies has provided opportunities for expansion of screening for sexually transmitted infections (STI) and HIV in general population. Home sampling kits for STI testing take advantage of the features of nucleic acid amplification tests (NAAT) for detection of chlamydia and gonorrhoea. The high sensitivity and specificity of the tests allows for testing of ano-genital specimens obtained by self-collecting procedures. New laboratory based HIV assays can operate on small volume of blood samples that can be obtained through a finger prick, and collected in a small blood tube that fits inside a small box or envelope. Specimens for

NAAT can be stored at in room temperature whilst being transported to the laboratory.

Home sampling STI and HIV testing provides optimal privacy, and the choice of being tested on any occasion. The service is perceived to have a number of limitations such as not being able to talk to a doctor about test results [1]. Over the past two decades several studies have reported on acceptability of home sampling for chlamydia and gonorrhoea home testing [2-6]. Studies have also investigated the success of internet based home sampling services for chlamydia testing [7,8]. In England, 76,842 individuals aged between 15 and 24 years were tested for chlamydia using internet services in 2015 [9].

Following the tendering process of sexual health services in England, many services are now expected to offer home sampling kits for STI screening. Improving return rates of home sampling kits would improve the cost-effectiveness of these services, whilst potentially enhancing the success of the services in reducing the incidence of STI.

Studies reporting on the return rates of internet registered home sampling kits have focused on the use of kits for chlamydia and gonorrhoea testing or on HIV screening and only on specific sex groups; men who have sex with men (MSM) or women [7,8,10,11]. Limited data currently exist on the return rates of internet registered home sampling kits for STI and HIV screening in general population.

Objectives	3	State specific objectives, including any prespecified hypotheses Page 4; last paragraph: The aim of this cohort study was to investigate the rate of return of home sampling testing kits after registration with an online health website in the city of Birmingham, UK. To the best of our knowledge, this is the first report on return rate of home sampling testing kits for chlamydia, gonorrhoea, HIV, and syphilis screening offered to all patients at the same time.
Methods		
Study design	4	Present key elements of study design early in the paper Page 6: *Study design* This was service evaluation cohort study of factors associated with return of STI testing kits requested online after registration in Umbrella Health website.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Page 5 and 6: Following the tender of the services by Birmingham and Solihull local governments, the new sexual health service (Umbrella Health) was formed in August 2015. This offers an online service for requesting home sampling testing kits for STI and HIV. The use of service is limited to addresses within Birmingham and Solihull areas. *Requesting testing kits* The service allows for individuals' self-registration on Umbrella Health website (https://umbrellahealth.co.uk/our-services/self-sampling-kits). The registration process includes provision of information on sexual orientation and presence of ano-genital symptoms. Individuals with ano genital symptoms are advised to attend one of several community umbrella health clinics across Birmingham and Solihull. They are still able to request home testing kits for STI screening. The service offers four types of testing kits depending on the individual's risk group; women without history of receptive anal sex (Design A), women with history of receptive anal sex (Design B), heterosexual men, and men who have sex with men

(MSM).

After registration with the service, the individual can choose to receive their home testing kits at their address of choice or to collect it from one of 66 locations in partnership with Umbrella Health including 24 local pharmacies and 24 community sexual health clinics across Birmingham and Solihull.

Contents of testing kits
The home sampling testing kits include the swabs and manufacturer's transport media for chlamydia and gonorrhoea testing on Aptima Combo. Urine samples for male urethral testing, and swabs for volvo-vaginal, ano-rectal and throat specimens are included in the testing kits where appropriate. Each swab is paired with a single specific transport medium according to the manufacturer's guidelines.

Sterile disposable lancets with tiny blood bottles for blood specimens required for serology testing for HIV and syphilis are also added to each testing kit. Blood specimens are obtained by finger prick with disposable lancets. Blood drops are then collected into sterile plastic tiny tubes for a minimum of 400 µmL for HIV and syphilis testing.

All women provide a vulvo-vaginal swab for chlamydia and gonorrhoea testing, and a blood sample for HIV and syphilis. Women who report history of receptive anal sex also receive an additional swab for ano-rectal swab for chlamydia and gonorrhoea testing (Design B kit).

Heterosexual men provide urine samples for chlamydia and gonorrhoea testing and blood specimens for HIV and syphilis screening. Men who have sex with men (MSM) provide additional ano-rectal and throat specimens using the two extra swabs provided in their testing kits.

Testing kits contain pictorial information and guidance on how to obtain the appropriate sample for each test. They also hold an envelope pre-addressed to the medical microbiology laboratory at Queen Elizabeth Hospital Birmingham. The packaging of the kits complies with Royal Mail standards requiring three layers of packaging. This includes a watertight leak-proof container for the sample, packed with enough porous material to absorb all fluids in case of breakage, which is enclosed in a second watertight leak proof container. The two layers of packaging are then enclosed in a third outer package, to protect against external damage during the delivery of the specimens.

Testing of samples
On receipt of specimens from the home testing kits, their unique number is entered in the medical microbiology laboratory registry system. Individuals' details are then automatically retrieved from the web-booking database. The specimens are simultaneously registered in the sexual health service's electronic patients' system.

The specimens are then processed according to UK medical laboratory standards (UKAS). Chlamydia and gonorrhoea tests are carried out on an Aptima Combo assay and platform. HIV serology is carried out on Abbott's 4th generation ELISA HIV assay, and the EIA IgG assay is used for syphilis screening

Patients were informed of their test results by a text message to their mobile phones within one hour of their authorisation by the laboratory.

Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed
		Page 4; first paragraph: Participants: all patients requesting home sampling STI testing kits via Birmingham Umbrella sexual health service website between July 15th and December 14th 2016. The service is available to residents of Birmingham only.

Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Pages 6 and 7: *Data collection* Data were collected on patients requesting STI and HIV testing kits from Umbrella Health website between 15th July and 14th December 2016. We investigated the factors associated with the return of the STI testing kits to our laboratory. Information on patients' demography, the responses to questions relating to drug usage, sexual history and symptoms were recorded. The final question of the online registration asked the patients if they have had unprotected sex with someone born or raised outside of the following 16 countries:: Austria, Belgium, Czech Republic, Denmark, Faroe Islands, Finland, France, Germany, Iceland, Ireland, Luxemburg, The Netherlands, Norway, Sweden, Switzerland and the UK (which will be subsequently referred to the "EU" for brevity). A negative response to this question revealed a second question, asking whether the patient was born or raised outside of the countries listed. As such, the two parts of the question were combined in the analysis to give three groups of patients: those that answered "Yes" to the first part, those that answered "Yes" to the second part of the question, and the remainder that answered "No" to each part of the question that was displayed to them. Temporal factors relating to the day and time that the request for testing kits was placed were also available. All individuals were required to provide a postcode, which was converted to a 2015 Index of Multiple Deprivation Score (IMD), based on the data from the Department For Communities and Local Government [12]. For 39 cases, the given postcodes were not available in the IMD database, hence these cases were excluded from the analysis of IMD score. The medical microbiology laboratory system was then interrogated, to identify which of the individuals requesting testing kits actually returned samples.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Page 6, data collection section: Demographical and laboratory information for all patients registered on the Umbrella Health website for an STI home sampling testing kit were abstracted and included in the study. We carried out a cross sectional analysis to understand the factors associated with the return of the testing kits within the group of patients registered to receive the testing kits.
Bias	9	Describe any efforts to address potential sources of bias Page 7, penultimate paragraph: The study is retrospective and may have suffered from some unaccounted bias. We have included all patients within the study period to minimise any possible bias in our conclusions.
Study size	10	Explain how the study size was arrived at Page 7, penultimate paragraph:

		We included all patients using the service within a three month period. At present there is very little data on our study group to draw any hypothesis on primary endpoint (return rate of testing kits).
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Page 4; requesting testing kits, page 6, Table 1a and Table 1b : Online registration of patients require minimum data set before dispatch of the appropriate testing kit. We therefore had complete data set for all applications within the study period. We investigated a number of possible factors in return of the testing kits: age, gender, sex group, time of the day the kits were requested, day of the week the kits were requested, ethnicity, financial deprivation index of the neighbourhood from where the application was made, sex with partners of countries with high prevalence of HIV, and presence of genitourinary symptoms. The groups were chosen to investigate their possible roles in the return of testing kits to the laboratory. We included significant factors in univariate analysis in the multivariate model as described below.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding (*b*) Describe any methods used to examine subgroups and interactions (*c*) Explain how missing data were addressed (*d*) If applicable, explain how loss to follow-up was addressed (*e*) Describe any sensitivity analyses Page6 and 7: statistical analysis: Initially, the proportions of STI kits where a sample was returned were compared across the factors using Chi-square tests or Mann-Whitney tests, as appropriate. Continuous variables were expressed as medians and interquartile ranges (IQRs). For some of the questions in online registration, a different set of answers was displayed, depending on the gender of the respondent. In these cases, the analyses were performed separately for males and females, with the small number of transgender respondents excluded. A multivariable binary logistic regression model was then produced, to identify significant independent predictors of the return of samples. The transgender respondents were also excluded from this analysis, due to the small number of cases, as were those cases where the IMD score was unavailable. A forwards stepwise approach was used to select factors for inclusion in the model. All analyses were performed using IBM SPSS 22 (IBM Corp. Armonk, NY), with $p<0.05$ deemed to be indicative of statistical significance throughout. This is a study on an already operational service. We used anonymised data for analysis. Our report is a service improvement analysis. We did not seek approval of ethics committee approval.
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram

		Page 8, Results, Table 1a and Table 1b: 5310 requests were included in the study; 3099 were returned to the microbiology laboratory. Comparisons were made between different demographical and clinical features of 3099 patients who returned their kits and 2211 patients who did not return their kits. The proportions of the following factors were not significantly different between the two groups: Day of the week of request, time of the day of request, and history of sex with someone with an STI in the past six months. The following factors were associated with non-return of the STI testing kits on multivariable analysis: heterosexual men, having genitourinary symptoms, being from economically deprived neighbourhoods, and use of recreational substances (in male participants only).
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) Summarise follow-up time (eg, average and total amount) Page 8, Results, Table 1a, Table 1b: Please see above (section 13) for the details.
Outcome data	15*	Report numbers of outcome events or summary measures over time Page 8, results, Table 1a, 1b, 2: Distribution of the participants and their features (tables 1a, 1b) Multivariable analysis (Table 2) to identify independent predictors of the return of the samples. The rates of return were similar for females without or with history of anal sex (OR: 0.96, 95% CI: 0.74 – 1.24, p=0.736) and the MSM kit (OR: 1.06, 95% CI: 0.86 – 1.30, p=0.593). However, patients requesting the heterosexual male STI kit were significantly less likely to return samples than those requesting the other kit types (OR: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. female without history of anal sex). The place of delivery of the testing kits was also a significant independent predictor of the return of samples (p<0.001), with those delivered to the pharmacy the least likely to be returned (OR: 0.53, 95% CI: 0.44 - 0.63, p<0.001 vs. home). Patients reporting symptoms were also less likely to return kits, (OR 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients). Decreasing deprivation was associated with an increased chance of the return of kits. For each increase of 10,000 ranks in the IMD score (i.e. becoming less deprived), the likelihood of kits being returned increased with an odds ratio of 1.08 (95% CI: 1.01 – 1.15, p=0.029).
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period Page 8, results, Table 2

In our analysis, heterosexual men were 37% less likely to return their testing kits compared with women. Patients opting to collect their testing kits from their local pharmacy or one of our sexual health clinics were 47% and 16% less likely to return their testing kits respectively. Patients with any genitourinary symptom were 23% less likely to return their testing kits. Decrease in the deprivation index by each 10,000 point improved the likelihood of the return of the testing kits by 8%. All the above factors were independent and statistically significant in multivariate analysis.

	OR (95% CI)	p-Value
Kit Type*		**<0.001**
Female - Design A	-	-
Female - Design B	0.96 (0.74 - 1.24)	0.736
Male STI	0.63 (0.55 - 0.72)	**<0.001**
MSM STI	1.06 (0.86 - 1.30)	0.593
Place of Delivery		**<0.001**
Home	-	-
Clinic	0.84 (0.71 - 1.00)	**0.048**
Pharmacy	0.53 (0.44 - 0.63)	**<0.001**
Any Symptoms Reported	0.77 (0.67 - 0.89)	**<0.001**
2015 IMD Rank (x10,000)**	1.08 (1.01 - 1.15)	**0.029**

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses As per section 16.
Discussion		
Key results	18	Summarise key results with reference to study objectives Page 10, Discussion We identified a number of factors associated with return of STI and HIV testing kits. Women and MSM were more likely to return their testing kits, as were patients who requested delivery of their kits to their home. However, patients requesting from neighbourhoods with higher socioeconomic deprivation or with genitourinary symptoms were found to be less likely to return their testing kits.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Page 10, last paragraph: Our study suffered from a number of limitations. We assumed all requested kits were delivered to the patients. We do not know how many of the testing kits were actually received by the patients. A number of online requests for the testing kits may have not been genuine and the applicant could have used false delivery address when registering online. Finally, it is likely that some patients struggled with obtaining all the required specimens for STI and HIV testing and decided not to return kits containing incomplete specimens.

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Page 11: Home sampling for STI and HIV testing is rapidly becoming a standard of care. Return of samples for testing is crucial for the success of the service. We identified a number of factors that were associated with non-return of the testing kits. Improved instructions for groups less likely to return their testing kits would be beneficial. Further research in improvement of return rate of the testing kits among individuals with those factors would be beneficial.
Generalisability	21	Discuss the generalisability (external validity) of the study results As per section 20.
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based None to declare.

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

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An observational study of factors associated with return of home sampling kits for sexually transmitted infections requested online in the UK

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A study of factors associated with return of home sampling kits for sexually transmitted infections requested online in the UK

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Abstract

Objectives: To investigate factors associated with the return of home sampling kits for sexually transmitted infections (STI).

Setting: Online STI testing service offered to the residents of Birmingham and Solihull.

Participants: All patients requesting STI home sampling kits via the Umbrella sexual health service website between July 15th and December 14th 2016.

Interventions: Associations between data collected at online registration and the rate of return of STI home sampling kits within 30 days of request was assessed.

Results: A total of 5,310 kits were requested, of which 3,099 (58.4%) were returned to the medical microbiology laboratory. On multivariable analysis, women and men who have sex with men were similarly likely to return their sampling kits (Adjusted Odds Ratio [OR_{adj}]: 1.06, 95% CI: 0.86 - 1.30), whilst heterosexual men were significantly less likely to return their sampling kits (OR_{adj}: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. females). Patients reporting symptoms were also less likely to return kits (OR_{adj}: 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients). Kits that were delivered to the patient's home, rather than to a clinic or pharmacy (p<0.001), and those requested from less economically deprived neighbourhoods (p=0.029) were significantly more likely to be returned.

Conclusion: STI self sampling testing kits delivered to patients' homes are most likely to be returned. Heterosexual males and those from more economically deprived areas are the less likely groups to return the kits. Further research on the barriers to return self sampling STI testing kits of these sub-groups of patients is warranted I, .

Trial registration: Registered with R&D department at University Hospitals Birmingham; CARMS-13551

249 words

Keywords: STI, home sampling, online registration, return rate

Article summary

- The study showed large numbers of different sex groups tested for chlamydia, gonorrhoea, HIV and syphilis by self sampling kits delivered to their address of choice.
- Kits delivered to heterosexual men, those with symptoms, neighbourhoods with more socioeconomic deprivation and locations other than the patient's home are the least likely to be returned
- The study's observational design made it difficult to investigate reason(s) for failure to return sampling kits.
- The findings of the study may help to improve the usage of similar services rolled out by other sexual health departments in the UK.

Introduction

The advent of new technologies has provided opportunities for expansion of screening for sexually transmitted infections (STI) and HIV in general population. Home sampling kits for STI testing take advantage of the features of nucleic acid amplification tests (NAAT) for detection of chlamydia and gonorrhoea. The high sensitivity and specificity of the tests allows for testing of ano-genital specimens obtained by self-collecting procedures. New laboratory based HIV assays can operate on small volume blood samples that can be obtained through a finger prick, and collected in a small blood tube that fits inside a small box or envelope. Specimens for NAAT can be stored at in room temperature whilst being transported to the laboratory.

Home sampling STI and HIV testing provides optimal privacy, and the choice of being tested on any occasion. Because of savings on the cost of clinical overheads, home sampling STI testing services may be more cost effective compared with traditional services. However, the service is also perceived to have a number of limitations, such as not being able to talk to a doctor about test results [1]. Over the past two decades, several studies have reported on acceptability of home sampling for chlamydia and gonorrhoea testing [2-6]. Studies have also investigated the success of internet based home sampling services for chlamydia testing [7,8]. In England, 76,842 individuals aged between 15 and 24 years were tested for chlamydia using internet services in 2015 [9].

Following the tendering process of sexual health services in England, many services are now expected to offer home sampling kits for STI screening. Improving return rates of home sampling kits would improve the cost-effectiveness of these services, whilst potentially enhancing the success of the services in reducing the incidence of STI.

Studies reporting on the return rates of internet registered home sampling kits have focused on the use of kits for chlamydia and gonorrhoea testing or on HIV screening, and only on specific sex groups; men who have sex with men (MSM) or women [7,8,10,11]. Limited data currently exist on the return rates of internet registered home sampling kits for STI and HIV screening in general population.

The aim of this study was to investigate the rate of return of home sampling kits after registration with an online health website in the cities of Birmingham and Solihull, UK. To the best of our knowledge, this is the first report on return rate of home sampling kits offering combined chlamydia, gonorrhoea, HIV, and syphilis screening to all patients.

Methods

Following the tender of the services by Birmingham and Solihull local governments, the new sexual health service (Umbrella Health) was formed in August 2015. This offers an online service for requesting home sampling kits for STI and HIV, which can be used by any adult residents of Birmingham and Solihull and without the need for direct referral from their general practitioners.. The service is promoted online and through a number of local media outlets and venues, including community partnerships and primary care centres. Individuals are encouraged to visit the service's website and request a sampling kit at the time of their convenience.

Requesting sampling kits

The service allows for individuals' self-registration on Umbrella Health website (https://umbrellahealth.co.uk/our-services/self-sampling-kits). When applying for kits, individuals are asked a range for questions relating to sexual orientation, anogenital symptoms and sexual behaviours, in order to identify the appropriate type of sampling kit they should receive. All questions must be answered to complete the application process. Because of the risk of having an STI, individuals who report anogenital symptoms are advised to attend one of several community umbrella health clinics across Birmingham and Solihull. They are still able to request home sampling kits for STI screening.

After registration with the service, the individual can choose to receive their home sampling kits at their address of choice, or to collect it from one of 66 locations in partnership with Umbrella Health, including 24 local pharmacies and 24 community sexual health clinics across Birmingham and Solihull.

Contents of sampling kits

Depending on the responses given to questions when requesting, there are four different types of sampling kit that can be ordered, which are tailored to the risk profile of the patient. For females, there are two types of kit – "Design A" is for patients that do not report having engaged in anal sex within the previous six months, and "Design B" is for those that answered yes to this question. Similarly, for males, the standard male kit is dispatched to those who do not report having sex with men within the previous six months, with an MSM (men who have sex with men) kit being dispatched otherwise. The contents of the various sampling kits are summarised below, and in Table 1.

All four of the home sampling kits contain sterile disposable lancets, to obtain finger prick blood samples, which are collected in the included tiny blood bottles. The aim is to collect a minimum of 400 µmL, so that samples can be used for HIV and syphilis serology testing. The female kits also include the swabs and manufacturer's transport media for chlamydia and gonorrhoea testing on an Aptima Combo assay. Both of the female kits include a vulvovaginal swab, with the Design B kit additionally including an anorectal swab. The two male kits also include urine sample bottles, for urethral testing, whilst the MSM kit additionally includes anorectal and throat swabs.

All kits contain pictorial information and guidance on how to obtain the appropriate sample for each test. They also hold an envelope pre-addressed to the medical microbiology laboratory at Queen Elizabeth Hospital Birmingham. The packaging of the kits complies with Royal Mail standards requiring three layers of packaging. This includes a watertight leak-proof container for the sample, packed with enough porous material to absorb all fluids in

case of breakage, which is enclosed in a second watertight leak-proof container. The two layers of packaging are then enclosed in a third outer package, to protect against external damage during the delivery of the specimens.

Testing of samples

On receipt of specimens from the home sampling kits, their unique number is entered in the medical microbiology laboratory registry system. Individuals' details are then automatically retrieved from the web-booking database. The specimens are simultaneously registered in the sexual health service's electronic patients' system. The specimens are then processed according to UK medical laboratory standards (UKAS). Chlamydia and gonorrhoea tests are carried out on an Aptima Combo assay and platform. HIV serology is carried out on Abbott's 4th generation ELISA HIV assay, and the EIA IgG assay is used for syphilis screening

Patients were informed of their test results by a text message to their mobile phones within one hour of their authorisation by the laboratory.

Study design

This was service evaluation study of factors associated with return of STI sampling kits within 30 days of their online request through the Umbrella Health website. The analysis was based on anonymised retrospective data and, as such, we did not seek ethics committee approval.

Data collection

Data were collected on patients requesting STI and HIV sampling kits from Umbrella Health website between 15th July and 14th December 2016. Information on patients' demography and responses to questions relating to drug usage, sexual history and symptoms were recorded. Since all of these questions needed to be completed in order to request a sampling kit, complete data were available for all of these factors.

The final question of the online registration was in two parts, first asking if the patient had a history of unprotected sex with someone born or raised outside of a list of 16 countries. A negative response to this revealed the second part of the question, asking whether the patient was born or raised outside of the countries listed. The 16 countries in the list were: Austria, Belgium, Czech Republic, Denmark, Faroe Islands, Finland, France, Germany, Iceland, Ireland, Luxemburg, The Netherlands, Norway, Sweden, Switzerland and the UK (which will be subsequently referred to the "Northern EU" for brevity). We consider these 16 Northern European countries to have low overall prevalence of hepatitis B infection. Individuals that were born and raised, or have sex with partners from outside the Northern EU may be at increased risk of hepatitis B infection. Hence, in accordance with NICE guidelines, the website advises those individuals to attend one of Umbrella Health clinics for hepatitis B screening and vaccination [12].

Temporal factors relating to the day and time that the request for sampling kits was placed were also collected automatically by the website. All individuals were required to provide a postcode, which was converted to a 2015 Index of Multiple Deprivation Score (IMD), based on the data from the Department for Communities and Local Government [13]. For 39 cases, the given postcodes were not available in the IMD database, hence these cases were excluded from the analysis of IMD score.

The medical microbiology laboratory system was then interrogated, to identify which of the individuals requesting sampling kits actually returned samples.

Statistical analysis

Initially, the proportions of STI sampling kits where a sample was returned were compared across the factors using Chi-square tests or Mann-Whitney tests, as appropriate. Continuous variables were expressed as medians and interquartile ranges (IQRs). For some of the questions in online registration, a different set of answers was displayed, depending on the gender of the respondent. In these cases, the analyses were performed separately for males and females, with the small number of transgender respondents excluded.

A multivariable binary logistic regression model was then produced, to identify significant independent predictors of the return of samples. The transgender respondents were also excluded from this analysis, due to the small number of cases, as were those cases where the IMD score was unavailable. A forwards stepwise approach was used to select factors for inclusion in the model.

All analyses were performed using IBM SPSS 22 (IBM Corp. Armonk, NY), with $p<0.05$ deemed to be indicative of statistical significance throughout.

Results

Between the 15th July and the 14th October 2016, a total of 5,310 kits were requested, of which 3,099 (58.4%) were returned to the medical microbiology laboratory. The age distributions were similar in the groups of patients that did and did not return sampling kits, with a median of 24 years (IQR: 20-28) for both (p=0.100). Associations between other factors and the return rate of kits are reported in Tables 2a and 2b.

On univariable analysis, females were found to be significantly more likely than males to return sampling kits (61.2% vs. 53.1%, p<0.001). There was also a small group of 10 transgender respondents, who were the least likely to return kits, with only 10% (N=1) doing so. Analysis of gender was then further broken down by the type of kit requested. Females were found to have similar rates of kit return, regardless of whether or not they reported having receptive anal sex (61.3% vs. 59.6% for Design A vs. B, p=0.572). Of the male respondents, those requesting an MSM kit had a similar rate of kit return to females, at 62.5% (p=0.416). However, heterosexual males were significantly less likely to return kits (p<0.001), with only 49.6% doing so.

Analysis of the deprivation score (IMD 2015) of the area from which the kits were requested found that those who returned kits gave postcodes which were in significantly less deprived areas, with a median IMD rank of 9,444 (IQR: 2,907 – 15,387) compared to 8,574 (IQR: 2,546 – 14,338) for areas that did not return the kits (p=0.007). In addition, the place of delivery of the sampling kits was also significantly associated with their return (p<0.001), with the greatest rate of return observed in those kits delivered to the patient's homes (60.6%), and the lowest rate in those delivered to pharmacies (44.0%). Neither the day of the week (p=0.059), nor the time of day (p=0.665) that the request was made were found to be significantly predictive of whether a kit would be returned.

A significant association with the questions about countries of birth of the patient and their sexual partners was detected (p=0.031), with patients born within and with partners within UK/ Northern EU having the highest rate of return of the samples (59.1%) and those born outside the Northern EU having the lowest rate (51.3%). In addition, asymptomatic patients were found to be more likely to return their sampling kits compared to those with symptoms, regardless of gender (p=0.020 for females, p=0.010 for males). However, the rate of return of the samples did not differ significantly with the history of sex with someone with STI (p=0.085).

A multivariable analysis was then performed, to identify independent predictors of the return of samples, which returned results that were consistent with the univariable analysis (Table 3). The type of kit requested was found to be significantly predictive of the return of samples (p<0.001). The rates of return were similar for females without or with history of anal sex (Adjusted Odds Ratio [OR_{adj}]: 0.96, 95% CI: 0.74 – 1.24, p=0.736) and the male MSM kit (OR_{adj}: 1.06, 95% CI: 0.86 – 1.30, p=0.593). However, patients requesting the heterosexual male STI kit were significantly less likely to return samples than those requesting the other kit types (OR_{adj}: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. female without history of anal sex).

The place of delivery of the sampling kits was also a significant independent predictor of the return of samples (p<0.001), with those delivered to the pharmacy the least likely to be returned (OR_{adj}: 0.53, 95% CI: 0.44 - 0.63, p<0.001 vs. home). Patients reporting symptoms were also less likely to return kits, (OR_{adj}: 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients).

Decreasing deprivation was associated with an increased chance of the return of kits. For each increase of 10,000 ranks in the IMD score (i.e. becoming less deprived), the likelihood of kits being returned increased, with an adjusted odds ratio of 1.08 (95% CI: 1.01 – 1.15, p=0.029).

Discussion

We identified a number of factors associated with return of STI and HIV sampling kits. Kits requested by heterosexual males, those with genitourinary symptoms and kits delivered to neighbourhoods with higher socioeconomic deprivation and to locations other than the patient's home were all found to have significantly lower rates of return.

Little comparable evidence for an online service for STI and HIV testing of all sex groups is currently available. Most studies report on home sampling services for HIV or chlamydia testing. In an earlier population study on uptake of postal screening for chlamydia, 25% (95% CI: 21.7 - 28.6%) of 14,382 randomly selected men and women returned their sampling kits [14]. An online HIV home sampling service for MSM reported 55% of 10,323 men returned their sampling kits; a rate comparable to that for MSM in our study [10]. In an earlier study on the uptake of home sampling of vaginal chlamydia testing, 31% (350/1139) of the kits requested via email were returned [7]. A study on home sampling kits for STI testing of 433 HIV negative MSM reported a return rate of 47% [11].

Online surveys of target populations for home STI and HIV testing have identified some factors associated with the use of the service and return of the sampling kits. In a survey of 7,938 MSM, those who identified themselves as gay or bi-sexual were more likely to use home sampling testing than men who identified as straight/ other men [1]. Other surveys have identified level of education, level of income, ethnicity and age as predictor of return of the sampling kits [15-18]. Some of these findings have not been supported by other surveys [1].

In our study, sampling kits collected from pharmacies were less likely to be returned. This may be secondary to individuals' difficulties with securing a venue where they can obtain their specimens in a confidential manner. Rates of return were also found to be lower in patients with genitourinary symptoms. We hypothesise that this may have been due to patients deciding to attend our sexual health clinics, rather than return their sampling kits, as this is the advice we offer to the patients on our website.

We found that heterosexual men and those from neighbourhoods with higher socioeconomic deprivation were less likely to return their sampling kits. As these are populations at risk of STI and HIV [19], increasing the return rate of sampling kits from these populations is a priority for our service. However, based on the data available from the surveys, we were not able to hypothesise as to why these groups were less likely to return their samples and, as such, are not able to propose changes to the service to improve sample return.

We suspect improving the process of obtaining specimens would improve the return of the testing kits. We aim to survey patients who do not return their STI sampling kits to understand their reasons for non-return of the testing kits better.

Our study suffered from a number of limitations, the main one being that, in patients that did not return their sampling kits, the rationale behind this decision was not known. This

additional information may have been highly valuable in explaining the observed differences between subgroups (e.g. heterosexual vs. MSM males) and identifying areas in which the service and, hence, the return rate of kits could be improved. As a result, a questionnaire targeted at those patients that did not return their kits would make for interesting further work in this area. However, the response rates to such questionnaires is likely to be poor, especially since the majority of patients of interest are likely to be non-responders, on account of the fact that they did not return their sampling kits. Consequently, such a study may be hampered by selection bias and a small sample size.

In this study, we assumed all requested kits were delivered to the patients but, since proof of delivery was not recorded, we do not know how many of the sampling kits were actually received. The number of kits lost in transit would be expected to be minimal. However, since the service was free, a number of online requests for the sampling kits may have not been genuine and may have used false delivery addresses, which would likely have resulted in the unwitting recipient disposing of the kit.

The study also only focused on whether or not the kits were returned, and did not consider the quality or quantity of the samples themselves. As such, it is likely that a proportion of those kits returned contained incomplete or inadequate specimens on which the full range of STI and HIV sampling could not be performed. Further assessment of the factors associated with the return of incomplete samples may have yielded useful results. However, anonymised data relating to the samples were not available, hence this was outside the scope of this service evaluation.

Home sampling for STI and HIV testing is rapidly becoming a standard of care. Return of samples for testing is crucial for the success of the service. We identified a number of factors that were associated with non-return of the sampling kits. Further research into the subgroups of patients with the lowest return rates may identify the reasons behind this and changes to the service that could improve the rate of return and, hence, the effectiveness of the programme.

Contributor ship statement: KM researched and proposed the protocol, drafted the manuscript. JH conducted the statistical analysis of the data. KM and JH have contributed to the final version of the manuscript.

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Data sharing statement: We have included analysis of all the data abstracted according to the study protocol. We are prepared to share the anonymised data on request and after approval of our Trust's Information Governance department.

All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work [or describe if any]; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years [or describe if any], no other relationships or activities that could appear to have influenced the submitted work.

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Table 1 – Contents of the four types of sampling kit

	Female Design A	Female Design B	Male	MSM
Pictorial information and guidance leaflet	✓	✓	✓	✓
Pre-addressed return envelope	✓	✓	✓	✓
Sterile disposable lancet and tiny blood bottle	✓	✓	✓	✓
Urine sample bottle			✓	✓
Vulvovaginal swab	✓	✓		
Anorectal swab		✓		✓
Throat swab				✓

Table 2a – Comparisons of the rates of samples received by temporal factors and survey responses

	STI Kits	Samples Received	p-Value
Day of Request			0.059
Monday	936	550 (58.8%)	
Tuesday	882	510 (57.8%)	
Wednesday	888	518 (58.3%)	
Thursday	814	454 (55.8%)	
Friday	738	435 (58.9%)	
Saturday	466	257 (55.2%)	
Sunday	586	375 (64.0%)	
Time of Day			0.665
8:00 - 12:59	1437	858 (59.7%)	
13:00 - 17:59	1702	980 (57.6%)	
18:00 - 22:59	1407	818 (58.1%)	
23:00 - 7:59	764	443 (58.0%)	
Gender			**<0.001***
Female	3513	2149 (61.2%)	
Male	1787	949 (53.1%)	
Transgender (female to male)	3	0 (0.0%)	
Transgender (male to female)	7	1 (14.3%)	
Place of Kit Collection/Delivery			**<0.001**
Home	4115	2495 (60.6%)	
Clinic	633	357 (56.4%)	
Pharmacy	562	247 (44.0%)	
History of Sex with Someone with Infections in the Last 6 Months			0.085
None of these infections	4747	2782 (58.6%)	
Chlamydia or NSU	469	267 (56.9%)	
Gonorrhoea	52	35 (67.3%)	
Hepatitis B or C	12	4 (33.3%)	
HIV	11	5 (45.5%)	
Syphilis	8	2 (25.0%)	
Trichomonas	10	4 (40.0%)	
Country of Birth Questions**			**0.031**
Neither option	4407	2605 (59.1%)	
Unprotected Sex with Someone Born Outside Northern EU	715	398 (55.7%)	
Respondent Born Outside Northern EU	187	96 (51.3%)	
2015 IMD Rank***			**0.007**
< 5000	1855	1039 (56.0%)	
5000 - 14999	2095	1239 (59.1%)	
15000+	1321	798 (60.4%)	

**A comparison of male vs. female (excluding transgender) was also significant at p<0.001.*

*** Combines the questions: "Do you have a history of unprotected sex with someone born or raised outside any of the countries listed?" and "Were you born outside of the countries listed?", as the latter is only asked if an answer of "No" is given to the former.*

****Excludes the N=39 with for whom the IMD was not available, and p-value is from a Mann-Whitney test, treating the IMD rank as continuous.*

p-Values are from Chi-square tests, unless stated otherwise, and bold p-values are significant at p<0.05

Table 2b – Comparisons of the rates of samples received by gender-specific questions

	Female			Male		
	STI Kits	***Sample Received***	***p-Value***	***STI Kits***	***Sample Received***	***p-Value***
Kit Type**			0.572			**<0.001**
Female - design A	3246	1990 (61.3%)		*	-	
Female - design B	267	159 (59.6%)		*	-	
Male STI	*	-		1325	657 (49.6%)	
MSM STI	*	-		462	292 (63.2%)	
Symptoms			**0.020**			**0.010**
I don't have any of these symptoms	2769	1723 (62.2%)		1424	781 (54.8%)	
Deep pain during sex	151	83 (55.0%)		*	-	
Ongoing lower abdominal pain	215	132 (61.4%)		*	-	
Pain when you pass urine	299	174 (58.2%)		146	75 (51.4%)	
Sores, ulcers or cuts on your genitals or around your anus	79	37 (46.8%)		46	20 (43.5%)	
Pain in your testicles	*	-		73	36 (49.3%)	
Unusual discharge from penis or anus	*	-		98	37 (37.8%)	
Sexual and drug taking behaviour (In the Last 6 Months)			0.736			**<0.001**
None of these statements apply to me	2961	1810 (61.1%)		1300	644 (49.5%)	
I've had anal sex with a man	213	126 (59.2%)		*	-	
I've had sex with 6 or more men	301	186 (61.8%)		12	5 (41.7%)	
I've used amyl nitrate (poppers)	11	8 (72.7%)		5	1 (20.0%)	
I've used methamphetamines	27	19 (70.4%)		23	13 (56.5%)	
I've had sex with other men	*	-		438	279 (63.7%)	
I've had receptive anal sex (I was the bottom) with a man	*	-		9	7 (77.8%)	

**Not applicable to the specified gender*

***Female Design B is for respondents reporting a history of receptive anal sex*

Excludes the transgender respondents (N=10)

p-Values are from Chi-square tests, and bold p-values are significant at p<0.05

Table 3 – Multivariable analysis of return of samples

	OR_{adj} (95% CI)	p-Value
Kit Type*		**<0.001**
Female - Design A	-	-
Female - Design B	0.96 (0.74 - 1.24)	0.736
Male STI	0.63 (0.55 - 0.72)	**<0.001**
MSM STI	1.06 (0.86 - 1.30)	0.593
Place of Delivery		**<0.001**
Home	-	-
Clinic	0.84 (0.71 - 1.00)	**0.048**
Pharmacy	0.53 (0.44 - 0.63)	**<0.001**
Any Symptoms Reported	0.77 (0.67 - 0.89)	**<0.001**
2015 IMD Rank (x10,000)**	1.08 (1.01 - 1.15)	**0.029**

Results are from a multivariable binary logistic regression model, using a forwards stepwise approach. All factors in Tables 2a/2b were considered for inclusion, as well as patient age. The questions regarding sexual infections, symptoms and statements about sexual and drug history were dichotomised into yes/no responses. The 10 transgender respondents and the 39 cases where the IMD was not available were excluded.

OR_{adj} = adjusted odds ratio, CI = confidence interval

**Female Design B is for respondents reporting a history of receptive anal sex*

***The odds ratio represents the increase in the odds of sample return associated with an increase of 10,000 ranks of the IMD.*

Bold p-values are significant at $p<0.05$

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
		A cohort study of factors associated with return of home sampling kits for sexually transmitted infections requested online
		Page 2: Objectives: To investigate factors associated with the return of home sampling testing kits for sexually transmitted infections (STI) testing kits. Setting: online STI testing service offered to the residents of Birmingham. Participants: all patients requesting home sampling STI testing kits via Birmingham Umbrella sexual health service website between July 15th and December 14th 2016. The service is available to residents of Birmingham only. Interventions: the service issues different testing kits to different sex groups. Data on online registration and return of STI home sampling kits at the Umbrella sexual health clinic in Birmingham between 15th July and 14th December 2016 were reviewed. Results: a total of 5,310 (61% for female testing) kits were requested, of which 3,099 (58.4%) were returned to the medical microbiology laboratory. Women and men who have sex with men had equally higher likelihood of return of their testing kits. Heterosexual men were significantly less likely to return their testing kits (OR: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. females). Patients reporting symptoms were also less likely to return kits, (OR 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients). Requests made in less economically deprived neighbourhoods were more likely to return the kits (OR 1.08, 95% CI: 1.01 – 1.15, p=0.029). Conclusion: Improved instructions for groups less likely to return their testing kits would be beneficial. Further research in improvement of return rate of the testing kits among individuals with those factors would be beneficial. Trial registration: Registered with R&D department at University Hospitals Birmingham; CARMS-13551 239 words
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
		Page 4: The advent of new technologies has provided opportunities for expansion of screening for sexually transmitted infections (STI) and HIV in general population. Home sampling kits for STI testing take advantage of the features of nucleic acid amplification tests (NAAT) for detection of chlamydia and gonorrhoea. The high sensitivity and specificity of the tests allows for testing of ano-genital specimens obtained by self-collecting procedures. New laboratory based HIV assays can operate on small volume of blood samples that can be obtained through a finger prick, and collected in a small blood tube that fits inside a small box or envelope. Specimens for

NAAT can be stored at in room temperature whilst being transported to the laboratory.

Home sampling STI and HIV testing provides optimal privacy, and the choice of being tested on any occasion. The service is perceived to have a number of limitations such as not being able to talk to a doctor about test results [1]. Over the past two decades several studies have reported on acceptability of home sampling for chlamydia and gonorrhoea home testing [2-6]. Studies have also investigated the success of internet based home sampling services for chlamydia testing [7,8]. In England, 76,842 individuals aged between 15 and 24 years were tested for chlamydia using internet services in 2015 [9].

Following the tendering process of sexual health services in England, many services are now expected to offer home sampling kits for STI screening. Improving return rates of home sampling kits would improve the cost-effectiveness of these services, whilst potentially enhancing the success of the services in reducing the incidence of STI.

Studies reporting on the return rates of internet registered home sampling kits have focused on the use of kits for chlamydia and gonorrhoea testing or on HIV screening and only on specific sex groups; men who have sex with men (MSM) or women [7,8,10,11]. Limited data currently exist on the return rates of internet registered home sampling kits for STI and HIV screening in general population.

Objectives	3	State specific objectives, including any prespecified hypotheses Page 4; last paragraph: The aim of this cohort study was to investigate the rate of return of home sampling testing kits after registration with an online health website in the city of Birmingham, UK. To the best of our knowledge, this is the first report on return rate of home sampling testing kits for chlamydia, gonorrhoea, HIV, and syphilis screening offered to all patients at the same time.
Methods		
Study design	4	Present key elements of study design early in the paper Page 6: *Study design* This was service evaluation cohort study of factors associated with return of STI testing kits requested online after registration in Umbrella Health website.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Page 5 and 6: Following the tender of the services by Birmingham and Solihull local governments, the new sexual health service (Umbrella Health) was formed in August 2015. This offers an online service for requesting home sampling testing kits for STI and HIV. The use of service is limited to addresses within Birmingham and Solihull areas. *Requesting testing kits* The service allows for individuals' self-registration on Umbrella Health website (https://umbrellahealth.co.uk/our-services/self-sampling-kits). The registration process includes provision of information on sexual orientation and presence of ano-genital symptoms. Individuals with ano genital symptoms are advised to attend one of several community umbrella health clinics across Birmingham and Solihull. They are still able to request home testing kits for STI screening. The service offers four types of testing kits depending on the individual's risk group; women without history of receptive anal sex (Design A), women with history of receptive anal sex (Design B), heterosexual men, and men who have sex with men

(MSM).

After registration with the service, the individual can choose to receive their home testing kits at their address of choice or to collect it from one of 66 locations in partnership with Umbrella Health including 24 local pharmacies and 24 community sexual health clinics across Birmingham and Solihull.

Contents of testing kits
The home sampling testing kits include the swabs and manufacturer's transport media for chlamydia and gonorrhoea testing on Aptima Combo. Urine samples for male urethral testing, and swabs for volvo-vaginal, ano-rectal and throat specimens are included in the testing kits where appropriate. Each swab is paired with a single specific transport medium according to the manufacturer's guidelines.

Sterile disposable lancets with tiny blood bottles for blood specimens required for serology testing for HIV and syphilis are also added to each testing kit. Blood specimens are obtained by finger prick with disposable lancets. Blood drops are then collected into sterile plastic tiny tubes for a minimum of 400 µmL for HIV and syphilis testing.

All women provide a vulvo-vaginal swab for chlamydia and gonorrhoea testing, and a blood sample for HIV and syphilis. Women who report history of receptive anal sex also receive an additional swab for ano-rectal swab for chlamydia and gonorrhoea testing (Design B kit).

Heterosexual men provide urine samples for chlamydia and gonorrhoea testing and blood specimens for HIV and syphilis screening. Men who have sex with men (MSM) provide additional ano-rectal and throat specimens using the two extra swabs provided in their testing kits.

Testing kits contain pictorial information and guidance on how to obtain the appropriate sample for each test. They also hold an envelope pre-addressed to the medical microbiology laboratory at Queen Elizabeth Hospital Birmingham. The packaging of the kits complies with Royal Mail standards requiring three layers of packaging. This includes a watertight leak-proof container for the sample, packed with enough porous material to absorb all fluids in case of breakage, which is enclosed in a second watertight leak proof container. The two layers of packaging are then enclosed in a third outer package, to protect against external damage during the delivery of the specimens.

Testing of samples
On receipt of specimens from the home testing kits, their unique number is entered in the medical microbiology laboratory registry system. Individuals' details are then automatically retrieved from the web-booking database. The specimens are simultaneously registered in the sexual health service's electronic patients' system.

The specimens are then processed according to UK medical laboratory standards (UKAS). Chlamydia and gonorrhoea tests are carried out on an Aptima Combo assay and platform. HIV serology is carried out on Abbott's 4th generation ELISA HIV assay, and the EIA IgG assay is used for syphilis screening

Patients were informed of their test results by a text message to their mobile phones within one hour of their authorisation by the laboratory.

Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed
		Page 4; first paragraph: Participants: all patients requesting home sampling STI testing kits via Birmingham Umbrella sexual health service website between July 15th and December 14th 2016. The service is available to residents of Birmingham only.

Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Pages 6 and 7: *Data collection* Data were collected on patients requesting STI and HIV testing kits from Umbrella Health website between 15th July and 14th December 2016. We investigated the factors associated with the return of the STI testing kits to our laboratory. Information on patients' demography, the responses to questions relating to drug usage, sexual history and symptoms were recorded. The final question of the online registration asked the patients if they have had unprotected sex with someone born or raised outside of the following 16 countries:: Austria, Belgium, Czech Republic, Denmark, Faroe Islands, Finland, France, Germany, Iceland, Ireland, Luxemburg, The Netherlands, Norway, Sweden, Switzerland and the UK (which will be subsequently referred to the "EU" for brevity). A negative response to this question revealed a second question, asking whether the patient was born or raised outside of the countries listed. As such, the two parts of the question were combined in the analysis to give three groups of patients: those that answered "Yes" to the first part, those that answered "Yes" to the second part of the question, and the remainder that answered "No" to each part of the question that was displayed to them. Temporal factors relating to the day and time that the request for testing kits was placed were also available. All individuals were required to provide a postcode, which was converted to a 2015 Index of Multiple Deprivation Score (IMD), based on the data from the Department For Communities and Local Government [12]. For 39 cases, the given postcodes were not available in the IMD database, hence these cases were excluded from the analysis of IMD score. The medical microbiology laboratory system was then interrogated, to identify which of the individuals requesting testing kits actually returned samples.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Page 6, data collection section: Demographical and laboratory information for all patients registered on the Umbrella Health website for an STI home sampling testing kit were abstracted and included in the study. We carried out a cross sectional analysis to understand the factors associated with the return of the testing kits within the group of patients registered to receive the testing kits.
Bias	9	Describe any efforts to address potential sources of bias Page 7, penultimate paragraph: The study is retrospective and may have suffered from some unaccounted bias. We have included all patients within the study period to minimise any possible bias in our conclusions.
Study size	10	Explain how the study size was arrived at Page 7, penultimate paragraph:

		We included all patients using the service within a three month period. At present there is very little data on our study group to draw any hypothesis on primary endpoint (return rate of testing kits).
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Page 4; requesting testing kits, page 6, Table 1a and Table 1b : Online registration of patients require minimum data set before dispatch of the appropriate testing kit. We therefore had complete data set for all applications within the study period. We investigated a number of possible factors in return of the testing kits: age, gender, sex group, time of the day the kits were requested, day of the week the kits were requested, ethnicity, financial deprivation index of the neighbourhood from where the application was made, sex with partners of countries with high prevalence of HIV, and presence of genitourinary symptoms. The groups were chosen to investigate their possible roles in the return of testing kits to the laboratory. We included significant factors in univariate analysis in the multivariate model as described below.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding (*b*) Describe any methods used to examine subgroups and interactions (*c*) Explain how missing data were addressed (*d*) If applicable, explain how loss to follow-up was addressed (*e*) Describe any sensitivity analyses Page6 and 7: statistical analysis: Initially, the proportions of STI kits where a sample was returned were compared across the factors using Chi-square tests or Mann-Whitney tests, as appropriate. Continuous variables were expressed as medians and interquartile ranges (IQRs). For some of the questions in online registration, a different set of answers was displayed, depending on the gender of the respondent. In these cases, the analyses were performed separately for males and females, with the small number of transgender respondents excluded. A multivariable binary logistic regression model was then produced, to identify significant independent predictors of the return of samples. The transgender respondents were also excluded from this analysis, due to the small number of cases, as were those cases where the IMD score was unavailable. A forwards stepwise approach was used to select factors for inclusion in the model. All analyses were performed using IBM SPSS 22 (IBM Corp. Armonk, NY), with $p<0.05$ deemed to be indicative of statistical significance throughout. This is a study on an already operational service. We used anonymised data for analysis. Our report is a service improvement analysis. We did not seek approval of ethics committee approval.
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram

		Page 8, Results, Table 1a and Table 1b: 5310 requests were included in the study; 3099 were returned to the microbiology laboratory. Comparisons were made between different demographical and clinical features of 3099 patients who returned their kits and 2211 patients who did not return their kits. The proportions of the following factors were not significantly different between the two groups: Day of the week of request, time of the day of request, and history of sex with someone with an STI in the past six months. The following factors were associated with non-return of the STI testing kits on multivariable analysis: heterosexual men, having genitourinary symptoms, being from economically deprived neighbourhoods, and use of recreational substances (in male participants only).
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) Summarise follow-up time (eg, average and total amount) Page 8, Results, Table 1a, Table 1b: Please see above (section 13) for the details.
Outcome data	15*	Report numbers of outcome events or summary measures over time Page 8, results, Table 1a, 1b, 2: Distribution of the participants and their features (tables 1a, 1b) Multivariable analysis (Table 2) to identify independent predictors of the return of the samples. The rates of return were similar for females without or with history of anal sex (OR: 0.96, 95% CI: 0.74 – 1.24, p=0.736) and the MSM kit (OR: 1.06, 95% CI: 0.86 – 1.30, p=0.593). However, patients requesting the heterosexual male STI kit were significantly less likely to return samples than those requesting the other kit types (OR: 0.63, 95% CI: 0.55 – 0.72, p<0.001 vs. female without history of anal sex). The place of delivery of the testing kits was also a significant independent predictor of the return of samples (p<0.001), with those delivered to the pharmacy the least likely to be returned (OR: 0.53, 95% CI: 0.44 - 0.63, p<0.001 vs. home). Patients reporting symptoms were also less likely to return kits, (OR 0.77, 95% CI: 0.67 - 0.89, p=0.001 vs asymptomatic patients). Decreasing deprivation was associated with an increased chance of the return of kits. For each increase of 10,000 ranks in the IMD score (i.e. becoming less deprived), the likelihood of kits being returned increased with an odds ratio of 1.08 (95% CI: 1.01 – 1.15, p=0.029).
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period Page 8, results, Table 2

In our analysis, heterosexual men were 37% less likely to return their testing kits compared with women. Patients opting to collect their testing kits from their local pharmacy or one of our sexual health clinics were 47% and 16% less likely to return their testing kits respectively. Patients with any genitourinary symptom were 23% less likely to return their testing kits. Decrease in the deprivation index by each 10,000 point improved the likelihood of the return of the testing kits by 8%. All the above factors were independent and statistically significant in multivariate analysis.

	OR (95% CI)	p-Value
Kit Type*		**<0.001**
Female - Design A	-	-
Female - Design B	0.96 (0.74 - 1.24)	0.736
Male STI	0.63 (0.55 - 0.72)	**<0.001**
MSM STI	1.06 (0.86 - 1.30)	0.593
Place of Delivery		**<0.001**
Home	-	-
Clinic	0.84 (0.71 - 1.00)	**0.048**
Pharmacy	0.53 (0.44 - 0.63)	**<0.001**
Any Symptoms Reported	0.77 (0.67 - 0.89)	**<0.001**
2015 IMD Rank (x10,000)**	1.08 (1.01 - 1.15)	**0.029**

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses As per section 16.
Discussion		
Key results	18	Summarise key results with reference to study objectives Page 10, Discussion We identified a number of factors associated with return of STI and HIV testing kits. Women and MSM were more likely to return their testing kits, as were patients who requested delivery of their kits to their home. However, patients requesting from neighbourhoods with higher socioeconomic deprivation or with genitourinary symptoms were found to be less likely to return their testing kits.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Page 10, last paragraph: Our study suffered from a number of limitations. We assumed all requested kits were delivered to the patients. We do not know how many of the testing kits were actually received by the patients. A number of online requests for the testing kits may have not been genuine and the applicant could have used false delivery address when registering online. Finally, it is likely that some patients struggled with obtaining all the required specimens for STI and HIV testing and decided not to return kits containing incomplete specimens.

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Page 11: Home sampling for STI and HIV testing is rapidly becoming a standard of care. Return of samples for testing is crucial for the success of the service. We identified a number of factors that were associated with non-return of the testing kits. Improved instructions for groups less likely to return their testing kits would be beneficial. Further research in improvement of return rate of the testing kits among individuals with those factors would be beneficial.
Generalisability	21	Discuss the generalisability (external validity) of the study results As per section 20.
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based None to declare.

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.