BMJ Open Quality

Improving detection of undiagnosed HIV through routine screening in a central London emergency department

Matilda Fox ,[1] Rosie Pettit,[1] Ernest Mutengesa,[1] Alice Harper,[1] Maria Nakhoul,[2] Anu Mitra[3]

To cite: Fox M, Pettit R, Mutengesa E, *et al*. Improving detection of undiagnosed HIV through routine screening in a central London emergency department. *BMJ Open Quality* 2022;**11**:e001799. doi:10.1136/bmjoq-2021-001799

► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/bmjoq-2021-001799).

EM and AH contributed equally.

MF and RP are joint first authors.

Received 9 January 2022
Accepted 2 October 2022

[1]Emergency Department, Charing Cross Hospital, London, UK
[2]Bioinformatics Software Engineer, Dana-Farber Cancer Institute, Boston, Massachusetts, USA
[3]Imperial College NHS Healthcare Trust, London, UK

Correspondence to
Dr Rosie Pettit;
rosie.pettit@nhs.net

ABSTRACT

HIV is a global public health issue. Routine testing for HIV should be performed on all 16–59 years old attending emergency departments (EDs) in high-prevalence areas in the UK.

In August 2020, Charing Cross Hospital ED, situated in an 'extremely high-prevalence' area, had no formal guidelines on HIV testing. We aimed to increase HIV testing in 16–59 years old attending our ED to 25% by August 2021 through a quality improvement project, based on the Methodology for Improvement Model, performing six Plan–Do–Study–Act cycles over a 12-month period.

An initial ED staff survey revealed 55% (n=22/40) of respondents were unsure of national HIV testing guidelines. Barriers to good testing practice included: lack of clarity on protocols for consent and indication, cost and perceived stigmatisation of patient groups. Interventions were employed at regular intervals, including employment of an HIV nurse advocate, inclusion of HIV tests in a blood test careset during ED triage, and updated trust guidelines that reflect national guidelines.

Overall, we did achieve our original 12 month aim, with an average testing rate of 28% of our target group between September 2020 and August 2021. Extending the project to January 2022 has resulted in continued improvements in monthly testing rates, reaching 44% in December 2021. Further analysis revealed interventions led to a statistically significant and sustained increase in monthly testing rates on seven occasions.

Valuable lessons were learnt in sustaining improvements in a busy department, changing long-held beliefs regarding consent for testing, and education around HIV care in the UK. Project write-up was formatted using the Revised Standards for Quality Improvement Reporting Excellence (SQUIRE) template.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Since 2016, National Institute for Health and Care Excellence (NICE) has recommended routine HIV testing in all emergency departments (EDs) in high-prevalence areas.

⇒ Despite efforts to increase HIV testing across health services, NICE standards are still not being met by many EDs.

⇒ Previous studies showed the ED was an optimal testing area. Improved testing and early diagnoses would have individual, public health and economic benefits.

WHAT THIS STUDY ADDS

⇒ This study investigated new ways of increasing blanket testing in the ED. Our study emphasised the importance of involvement of nursing staff to improve sustainability of change. Blood test 'caresets' in an electronic system were particularly successful in improving testing behaviours.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study gives practical and realistic examples of how to change practice in a busy ED department to increase HIV testing in a cost-effective manner. These changes have resulted in multiple new HIV diagnoses being made. We would argue that these changes could be implemented in any ED in a high-prevalence area.

PROBLEM

HIV is a global public health issue. If diagnosed, people with HIV can receive effective treatment and a life expectancy comparable to a seronegative person.[1] HIV testing is essential for diagnosis, and emergency departments (EDs) offer an opportune setting for performing tests. The National Institute for Health and Care Excellence (NICE) and British HIV Association (BHIVA) recommend routine testing on all patients aged 16–59 attending EDs in areas of high (above two cases per 1000 population) and extremely high (above 5 cases per 1000 population) diagnosed prevalence.[2 3]

Charing Cross Hospital (CXH) is part of Imperial College Healthcare NHS Trust and serves a diverse population. CXH ED consists of three main areas: majors, urgent care and ambulatory emergency care. Staff include: doctors and nurses of varying grades, healthcare assistants, registered mental health nurses and ED assistants.

CXH is situated within Hammersmith and Fulham, an extremely high-prevalence area for HIV, with 7.95 cases per 1000 population.[4 5] Therefore, all ED patients aged 16–59

years should be routinely tested for HIV.[2 3] However, in August 2020, CXH ED staff had no HIV screening guidelines.

Our SMART (specific, measurable, achievable, relevant and time-bound) aim[6] was to perform HIV tests on 25% of CXH ED attendees aged 16–59 from September 2020 to August 2021.

BACKGROUND

The HIV epidemic is a globally recognised public health challenge with the virus having caused 36.3 million deaths to date.[7] Public health guidance focuses on early diagnosis which enables the commencement of effective treatments and viral load suppression, preventing transmission.[7] Since 2017, the UK has reduced the number of undiagnosed individuals living with HIV; however, it is becoming increasingly challenging to identify those remaining.[8] Current NICE and BHIVA guidelines recommend routine testing in multiple healthcare settings, depending on local diagnosed prevalence.[2 3] All 16–59 years old patients presenting to an ED in high or extremely high-prevalence areas should be screened for HIV.

In 2019, 4139 people in the UK were newly diagnosed with HIV, 10% of diagnoses were made in EDs and of these, 46% were late diagnoses.[8 9] Late diagnosis increases likelihood of individual poor health, premature death and onward transmission.[9] In 2020, 53% of heterosexuals were diagnosed late, compared with 29% of MSM (men who have sex with men), highlighting the importance of population, rather than targeted, screening.

A London-based study in 2016 demonstrated routine testing in ED was feasible and efficacious, concluding improved staff leadership and training could instil testing behaviour.[10] A further study reported the impact of routine ED testing, identifying new diagnoses and encouraging treatment engagement.[11] Preconfigured blood order sets, regular staff education and feedback were thought to improve testing rates. These studies demonstrate individual, public health and economic benefits of testing and early diagnosis.

Screening for infectious diseases in patients attending an ED was implemented in the 1990s. Kirsch *et. al* screened for tuberculosis in ED attendees and found this feasible and cost-effective.[12] Other London EDs have published experiences of routine HIV testing. Closest geographically, Chelsea and Westminster hospital achieved an average testing rate of 16% over 30 months but found sustaining this change challenging.[13] Of note, they predicted 140 ED attendees per annum had undiagnosed HIV.

Our study provides an updated example of challenges faced to create sustainable change in a busy ED, including use of technology (via electronic health records) to improve consistency and longevity.

MEASUREMENT

Our outcome measure was the percentage of ED attendees aged 16–59 years tested for HIV per calendar month. This was defined as the number of patients aged 16–59 for whom a HIV test was ordered through CXH's electronic health system, out of the total number of patients aged 16–59 attending ED during one calendar month. This outcome measure illustrates percentage change over time following intervention implementation throughout the year. We predicted that monthly measurements would allow sufficient time for staff to react to an implemented change and compensate for alternating shift patterns. Prior to September 2020, no formal testing guidelines existed, and tests were sporadically ordered and clinician-dependent. We agreed our baseline measure of change should be the mean HIV testing rate from August 2019 to August 2020, before any interventions were implemented, and accounting for seasonal variability. This revealed an average testing rate of 8% of attendees aged 16–59.

Our aim of 25% was informed by a literature review of similar London-based projects. In 2013, Chelsea and Westminster hospital achieved a mean testing rate of 14% after implementing changes over 30 months.[13] In 2016, St George's hospital achieved a 48% average testing rate,[10] and Guy's and St Thomas' an impressive 70%,[11] although both were completed in under 12 months. Using 'SMART aims' guidance,[6] we believed a testing rate of 25% was realistically sustainable after 12 months.

Data were collected periodically from CXH's electronic health record, Cerner Millennium. This stores clinical details of every CXH ED patient encounter. Raw data for the number of patients aged 16–59 attending each month, and the number who had HIV tests ordered, was extracted by the trust's analytics team. All HIV tests are ordered through and results published on Cerner, minimising risk of missing data. Data were electronically distilled by the analytics team, minimising risk of human error.

Data collected also included the raw number of HIV tests ordered for 16–59 years old per calendar month. Due to risk of numerator/denominator bias, this was not used as an outcome measure, but did allow us to review the change in an absolute number of tests ordered. Mean average number of tests ordered for attendees aged 16–59 was 163 per calendar month at baseline.

To demonstrate the positive effect of increased ED testing rates, the number of positive HIV tests per month from ED was individually extracted by the analytics team lead from a pooled list of the trust's monthly positive tests on Cerner Millenium. Alongside identifying positive tests performed in ED, data were categorised into known positives, new positives or lost to follow-up.

DESIGN

We based our quality improvement (QI) project on the Methodology for Improvement Model,[14 15] performing

multiple successive Plan–Do–Study–Act (PDSA) cycles over 12 months.

Successive interventions were informed by knowledge gained from previous cycles to meet our SMART aim.

Interventions were focused around two areas. First, targeted education of ED staff, and second, ensuring easy and memorable methods of ordering tests was available to all staff. Our process map (online supplemental material 1) highlights key steps and stakeholders to ensure project success.

Our population of interest was based on NICE and BHIVA guidelines. We encouraged ED staff ordering bloods to consider both patient age and HIV status. If a patient was 16–59 years old with an unknown HIV status and no HIV test result in the preceding 3 months, they met testing criteria.

We hoped our QI team members including four junior doctors, a nurse champion and the departmental QI lead consultant, reflected ED staff involved in ordering bloods. Recruiting four junior doctors enabled project continuity during job rotations. Inclusion of a nurse champion encouraged effective and sustainable change within the nursing team, who frequently request ED bloods. The QI lead consultant added valuable experience for executing our project timeline and implementing interventions.

Our team met on the 2–4 weeks basis to discuss updates and new ideas, allowing flexible and reactive improvement practice. We assumed this frequency would allow an iterative monthly approach. Change ideas were based on behavioural insights, using the EAST framework[15] to implement Easy, Attractive, Social and Timely interventions, maximising success through high-yield actions.

We contacted nearby hospitals where similar projects had been conducted, to gather ideas on sustaining observed changes. Advice was sought from both Emergency and Genitourinary Medicine colleagues ensuring a multifaceted approach. Ethical approval was not required as no patient-identifiable information was included in the results.

STRATEGY

Our initial focus was to collect baseline data, gather ED staff ideas and create hypotheses for change. We created a driver diagram,[16] to identify factors driving ED testing behaviours. In late August 2020, we commenced PDSA cycle 1, distributing an anonymous survey to all ED staff attending morning handovers in a single week. We aimed to capture day-to-day challenges and identify barriers to effective HIV screening, hoping findings would inform future interventions. 'Survey Monkey', a free online platform, was used to collect survey data but limited responses to a maximum of 40.[17] A QR code displayed at daily handovers prompted immediate staff responses.

Data were analysed in Excel. 42.5% (n=17) of respondents were nursing staff (15 triage nurses) and 57.5% (n=23) doctors (11 senior house officers (SHOs), 5 registrars, 7 consultants). Common response themes were lack of understanding around consent and lack of test order prompts. The survey also revealed most tests were ordered by nurses, highlighting a key target group. Incidentally, survey promotion helped raise project awareness and build momentum for change ideas but we also observed increased testing behaviours. PDSA 1 highlighted the importance of staff involvement and project promotion.

In November 2020, we instigated PDSA cycle 2; a 20 min teaching session for all ED doctors to raise awareness of guidelines and discuss impact of similar successful London-based projects. We hypothesised this would increase the number of tests ordered by attending doctors. The teaching, designed and delivered by our QI team SHOs, involved reviewing current guidance and sharing examples from local projects. Informal feedback was positive. PDSA2 reminded ED doctors to order tests in the short-term; however, many were already aware of guidelines and reported ordering fewer tests than nurses. Future cycles were targeted at nurses.

In December 2020, we appointed a 'HIV advocate nurse' for PDSA cycle 3. Our staff survey and informal discussions aided the identification of potential candidates. We hypothesised our advocate would improve intervention strategy success, providing 'on the ground' encouragement, and acquiring nurse testing behaviour feedback. In addition, our advocate compiled excel data and searched results of departmental HIV tests. This continuous monitoring of colleagues' testing behaviour, alongside day-to-day observations, provided valuable insight. PDSA 3 emphasised the importance of nurse involvement in further interventions.

Due to the second wave of COVID-19, PDSA cycle 4 was delayed until March 2021. Staff members were redeployed and clinical pressures took priority. HIV tests were included in 'COVID-19 bloods careset', which likely resulted in skewed data. For PDSA 4, we created order prompt posters and displayed them around ED, for example, near triage computers. The aim was to consistently remind staff to order tests during triage. This intervention was less effective and we reflected that the high quantity of departmental posters may have contributed. Active verbal prompting and encouragement seemed more successful.

In April 2021, we conducted PDSA cycle 5, focusing on permanent members of nursing staff. Using the EAST framework,[15] we designed a 'gamified' teaching session for ED nurses. We provided project information and gave each participant a project promotion role. Each nurse had five stickers and gifted one to another staff member after teaching the testing policy. The first three participants to gift all five stickers won a prize. We aimed to teach nurses the new policy in a fun and memorable way. We hypothesised that inclusion would improve adherence and longevity in project momentum.

Our final PDSA cycle was a change idea from the staff survey. Nurses highlighted that a predetermined 'careset' of bloods was ordered during triage. We aimed to add HIV tests to the triage careset, making testing routine. We

hypothesised the ease and timeliness of ordering predetermined caresets would improve testing rates. We applied to change Cerner caresets and created a business case outlining trust cost savings if testing followed NICE and BHIVA recommendations.[2 3] The proposal was submitted in March 2021 and the careset updated in July 2021. Delay was due to trust board approval process, which required approval of trust testing position, funding confirmation, and approval of software updates. We; therefore, extended our measurement period to December 2021 to give a better reflection of improvements in testing rates. It also allowed assessment of longevity and sustained improvement.

Statistical analysis was performed to assess if interventions had a statistically significant impact on testing rates and sustainability of change within ED. All analyses were conducted in R V.3.6.1. Tests of proportion were performed on month-to-month testing changes to assess differences in monthly testing proportions throughout our measurement period (August 2019–December 2021). A p value was considered significant. Tests were performed each month with respect to the previous month to determine if there was an increase or decrease in testing rates.

We also assessed the impact of our interventions on the total number of ED attendees aged 16–59 tested for HIV. Comparison was made:

1. Between preintervention (August 2019–July 2020) and postintervention (August 2020–July 2021).
2. Between two distinct 5-month testing periods at the start of our intervention period and a year later: period 1 (August 2020–December 2020) and period 2 (August 2021–December 2021). Significance was again determined at the level of p value and χ^2 tests were used to assess differences between testing proportions preintervention and postintervention, and between period 1 and period 2.

RESULTS

Fifty-five per cent (n=22) of staff survey respondents (n=40) were unsure of local and national HIV testing guidelines. Each respondent was encouraged to select unlimited relevant testing barriers, with uncertainty around consent (n=16) and indications for testing (n=13) most commonly selected (figure 1). 'Free-text' responses triggered a valuable change idea; using predetermined caresets.

During PDSA 1, there was a 12% rise in HIV testing rates between August and October 2020.

Implementation of PDSA 2 and PDSA 3 saw a further 8% rise in testing by late December 2020. Figure 3 displays this information as a run chart on a monthly basis.

Alongside QI efforts, consideration should be given to external factors, including COVID-19. Increasing numbers of 'COVID-19 positive' patients from November 2020 to January 2021, prompted new caresets for symptomatic ED attendees, including HIV tests. Lockdown measures altered attendee demographics, with less 'walking well'. We speculate these factors could correlate with observed increases in raw tests sent in all ages (figure 2). No new interventions were implemented, and staff were less engaged with the project, which may explain the 13% drop in testing rates over this period.

In March 2021, efforts were reignited with PDSA 4 but impact on testing appeared minimal, with no change in rate by April 2021. This correlated with informal staff discussions on the low impact of departmental posters.

PDSA 5 showed another small increase in testing rates by 3% during May 2021. This was surprisingly low and we hypothesised contextual factors impacted this intervention. The nursing rota does not include formal teaching time, which made teaching recruitment challenging. Our HIV advocate relocated in March 2021, removing our 'on the ground' prompting during April and May.

PDSA 6 was delivered later than anticipated, with official trust guidelines updated in June 2021, and implementation of the new careset in early July 2021. New guidance was emailed to all ED staff, stimulating a surge of interest. Preliminary project results were presented at Grand Round and ED QI Dragon's Den. Despite lack of formal intervention implementation, a 10% rise in testing

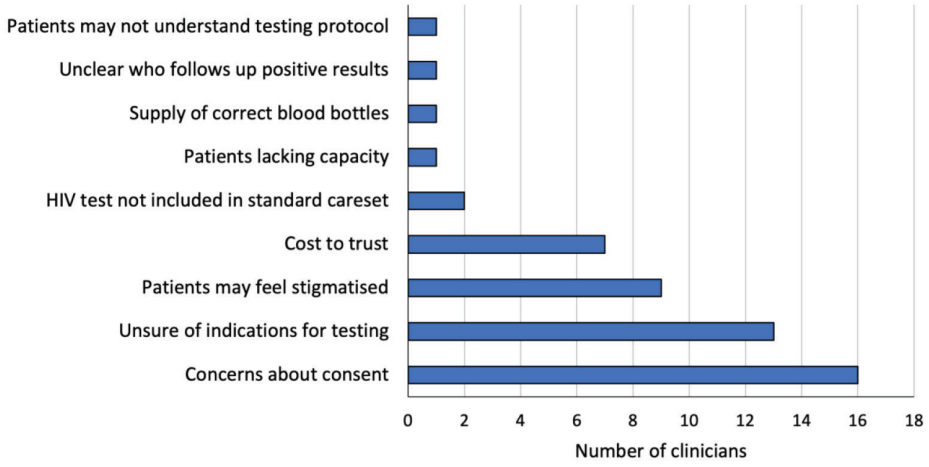

Figure 1 Barriers to HIV testing selected by ED staff (n=40) in an anonymous survey. ED, emergency department.

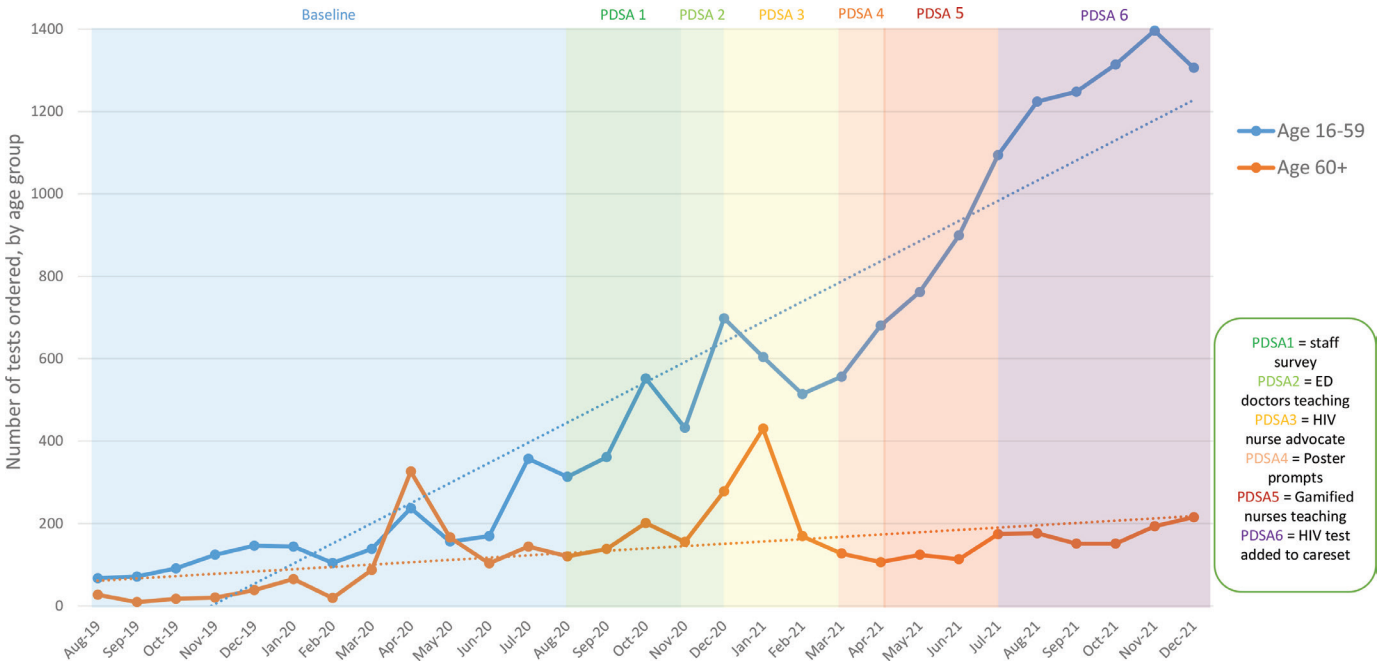

Figure 2 Run chart showing the raw number of HIV tests performed on charing cross ED attendees in each age group per calendar Month. ED, emergency department; PDSA, Plan–Do–Study–Act.

was observed between May and July 2021. Following careset implementation there was a gradual 4% improvement in testing rates between July and October 2021. This gradual rise may reflect ED staff project fatigue, but suggests a sustainable stable behaviour change which has been maintained until December 2021.

Overall, absolute number of HIV tests ordered per calendar month in our target group, increased from 163 at baseline to 1306 by December 2021. Figure 2 shows monthly changes in absolute number of tests, defined as the number of tests ordered through Cerner per calendar month for ED attendees aged 16–59. Despite not being used as a primary outcome measure, it signified improvement in the local population's awareness of their serostatus and increases in staff testing.

The proportion of 16–59 years old tested for HIV during the study period increased from 8% at baseline to an average testing rate of 28% between September 2020 and August 2021. Figure 3 shows the upward trend in testing rates with significant transient reductions in

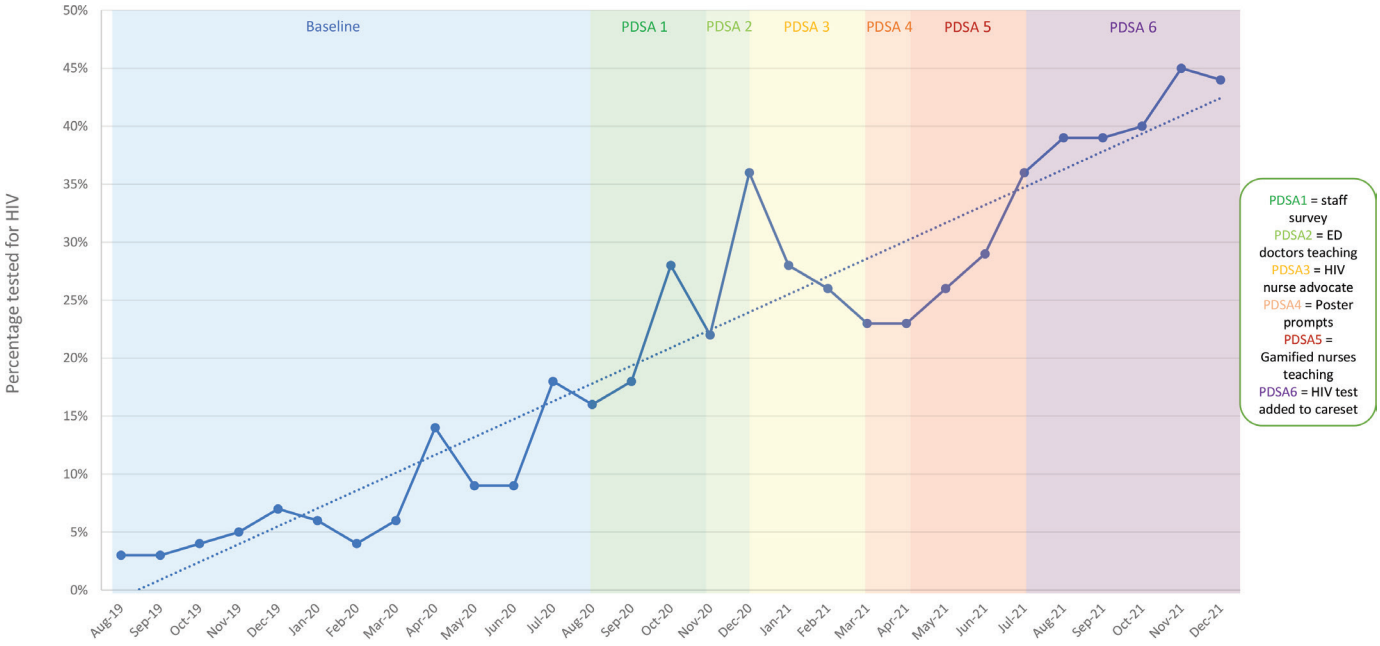

Figure 3 Run chart showing the percentage of total ED attendees aged 16–59 who were tested for HIV per calendar Month. ED, emergency department; PDSA, Plan–Do–Study–Act.

Table 1 Month-to-month HIV testing comparison for charing cross emergency department (ED) attendees aged 16–59 years between August 2019 and December 2021

Month-year	Following month-year	No of 16–59 years old ED attendees tested for HIV per month	No of 16–59 years old ED attendees tested for HIV per following month	Total no of 16–59s year old ED attendees per month	Total no of 16–59 years old ED attendees per following month	P value
19–August	September-19	67	71	2200	2197	0.362
19–September	October-19	71	91	2197	2431	0.172
19–October	November-19	91	124	2431	2406	0.00866
19–November	December-19	124	146	2406	2241	0.0237
19–December	January-20	146	144	2241	2562	0.903
20–January	Feb-20	144	104	2562	2353	0.973
20–February	Mar-20	104	138	2353	2176	0.00203
20–March	Apr-20	138	237	2176	1680	<0.001
20–April	May-20	237	156	1680	1734	1.000
20–May	June-20	156	169	1734	1848	0.439
20–June	July-20	169	357	1848	1945	<0.001
20–July	August-20	357	313	1945	1983	0.984
20–August	September-20	313	361	1983	2029	0.0445
20–September	October-20	361	552	2029	2004	<0.001
20–October	November-20	552	432	2004	1921	1.000
20–November	December-20	432	698	1921	1920	<0.001
20–December	January-21	698	604	1920	2134	1.000
21–January	February-21	604	514	2134	1944	0.909
21–February	March-21	514	556	1944	2400	0.994
21–March	April-21	556	680	2400	2972	0.598
21–April	May-21	680	762	2972	2879	<0.001
21–May	June-21	762	899	2879	3079	0.00942
21–June	July-21	899	1094	3079	3075	<0.001
21–July	August-21	1094	1224	3075	3100	<0.001
21–August	September-21	1224	1248	3100	3220	0.723
21–September	October-21	1248	1314	3220	3288	0.160
21–October	November-21	1314	1396	3288	3120	<0.001
21–November	December-21	1396	1306	3120	2998	0.824

January and February. This could be attributed to departmental changes during the pandemic. Considering the extended measurement period, the final testing rate in December 2021 was 44% and average testing rate from September 2020 to December 2021 was 31%.

Statistical analysis is summarised in table 1. Thirteen months had a significant increase in testing in comparison to the previous month ($p<0.05$). Of these 13, 7 months fell within our intervention period. The longest sustained increase was between April and August 2021, coinciding with PDSA 5 and PDSA 6.

We found a significant increase (14.11%, $p<0.001$) in the total number of patients tested preintervention (6.59%, n=2825/42809) and postintervention (20.7%, n=9600/46375). We also found a significant difference ($p<0.001$) between the total number of patients tested following our interventions, with a proportional increase of 10.4% more patients being tested between period 1 (19.5%, n=3248/16 654) and period 2 (29.9%, n=7374/24 636).

Although the number of new HIV diagnoses was not a specific aim, it is a pertinent outcome of this project. From August 2020 to August 2021, 74 tests ordered on ED attendees were positive. Of these, 63 were known positives, 8 were new positives, 1 had a reactive test and 2 died during admission preventing tracing of prior knowledge of serostatus. Positive results are automatically flagged to the HIV team for review and followed up, ' ensuring safety-netting. In addition, those who were known positives were rung if the HIV team were not able to trace where their specialist care was being given, allowing an opportunity for re engagement where necessary. New positives were referred to local specialist teams. All results (positive/negative/reactive) are automatically sent to the ordering clinician (through Cerner Millenium) and departmental head for further safety-netting.

A cost analysis was conducted to pitch to the business department for funding approval, summarised here. One HIV test costs approximately £6.50– £7.00.[18 19] In 2020, the mean average number of CXH ED attendees aged 16–59

was 2013 per calendar month. Applying our aim to test 25% of these attendees, our average monthly testing cost would be £3397, and annual costs of £40 764. Assuming a new diagnosis rate of 3–10 per 1000 16–59 year olds tested,[20] we would hope to discover 0.8–2.5 new HIV diagnoses per 1000 attendees, when consistently testing 25% of them. If we met this aim, using our average attendees during 2020, 503 patients aged 16–59 would be tested per month, yielding 0.4–1.3 new diagnoses per month, and 5–16 new diagnoses per annum. Using NICE's estimated annual cost difference of £14 000 between HIV patients diagnosed early vs those diagnosed late,[3] 25% testing rates could equate to potential annual savings of £70 000–£224 000 for the trust. Looking at the eight new diagnoses discovered during our study period, yielded from an average testing rate of 28% over the 12 months, the trust has made potential savings of £112 000 per annum. Consideration is not given to savings implicated by reduced transmission rates and prevalence.

LESSONS AND LIMITATIONS

Conducting this project highlighted the importance of team continuity. Due to the nature of foundation programme training, ED SHOs regularly rotated jobs, creating loss of momentum. We realised we needed to appoint 'on the ground' team members. The ED consultant facilitated allocation of an SHO each rotation, ensuring continuity. Our 'nurse advocate' ensured further continuity, spanning across multiple disciplines to prevent loss of momentum. Unfortunately, our original nurse advocate changed trusts in March 2021, reducing ad hoc encouragement of testing until appointment of a new advocate in June 2021.

Participation in our department's 'QI Dragon's Den' in July 2021 gave us the opportunity to present our project to colleagues, reigniting momentum and increasing awareness among new staff. Our project won first prize, further promoting our aim and validating interventions made by ED staff.

The 'EAST' framework, based on principles of Nudge Theory as applied to change management,[15] was a useful tool to guide change ideas and focus on small implementations with big impacts. Departmental feedback suggested that changes encouraging team playing and rewards for good testing behaviours were most beneficial and memorable.

We discovered several project limitations. The major issue encountered was confirmation of trust funding. Many senior team members supported our proposed aim, but change ideas were often met with uncertainty due to lack of clarity on the trust's HIV screening position. Initial results from our staff survey posed the benefit of adding HIV tests to Cerner caresets; however, this required funding approval, which was delayed by several months due to the pandemic.

Important confounding factors to consider largely surround the COVID-19 pandemic and changes to service delivery. Staff energies were focused on infection control and managing vast numbers of patients attending ED. Many staff members were redeployed or had clinical duties altered. Any work not strictly related to the pandemic was held, delaying any new interventions between[8] December 2020 and March 2021. The introduction of the 'COVID-19 Bloods Careset', which included an HIV test, meant most patients attending ED with CVOID-19 symptoms had an HIV test ordered, confounding our results.

Another project limitation was difficulty quantifying staff project awareness. The project was well advertised and regularly discussed, which likely improved testing behaviour. In addition, the overseeing ED consultant occasionally gave ad hoc teaching on our HIV testing protocol at morning handovers. Due to the unplanned nature of this teaching and variability of informal staff discussions, it is difficult to quantify impact on outcomes. We additionally did not receive formal feedback from the teaching sessions we delivered. A preteaching and post-teaching questionnaire would have been beneficial to allow quantification of the impact of teaching.

The final issue that will need addressing further is that of consent. There is no need for verbal or written consent, and 'opt-out' testing in the UK is acceptable. This was emphasised throughout all PDSA cycles to staff; however, this may not have addressed all staff's concerns or reached those unable to attend teaching.

CONCLUSION

In conclusion, we achieved our target HIV testing rate of 25% of ED attendees aged 16–59 by August 2021. There was a sustained gradual increase in testing rates between September 2020 and our extended project deadline of December 2021; we achieved a mean average testing rate of 31% during the entire study period. We recognise initial rises in testing may reflect confounding due to the inclusion of HIV tests in COVID-19 caresets. However, improvements were sustained and continued to increase following step-down of COVID-19-related departmental changes. Statistical analysis revealed a sustained increase in month-on-month testing, particularly between April and August 2021, and suggests sustainability of the project beyond our study period.

Rayment *et al* concluded the most effective and sustainable interventions for improving HIV testing rates in a London-based ED included incorporation and engagement of nursing staff.[13] For teams who undertake similar projects, we recognise nursing involvement to be one of the most high-yield project aspects, particularly due to medical staff rotations. Although we did not change our initial aim, successive cycles focused us on sustaining change, recognising intervention implementation challenges and potential solutions, for example, allocating a nurse advocate. The addition of HIV tests to our electronic health record caresets may have been most effective at outset and, unfortunately, this was delayed.

Rayment *et al* also involved sexual health department staff in weekly meetings, fostering positive motivation for ED staff in maintaining this relationship beyond their initial project.[13] We could have better collaborated with HIV/sexual health services despite them not being based on-site at CXH.

The cost-saving implications of this project are important to note. Early detection of HIV cases is of utmost financial as well as medical importance. Eight new patients were aware of their serostatus due to our ED screening.

The above demonstrates that the project is cost-effective, and could have further positive public health outcomes.

Correction notice This article has been corrected since it first published. Author 'Anu Mitra' has been added in the author-byline.

Acknowledgements Marcus Wright, Dr Anu Mitra, Mark Carder (non-author contributors).

Contributors MF and RP contributed equally to this paper as joint first authors. They conducted the planning, execution, analysis and reporting of this work. MF is listed as guarantor. EM and AH supported the execution of change ideas, and the writing of this manuscript.Bioinformatics Software Engineer, MN, performed statistical analysis on this work and contributed to the writing of the revised manuscript. RGN Marcus Wright conducted data collection and analysis, and encouraged staff engagement. Emergency Medicine consultant, Dr Anu Mitra, supervised this project, providing senior clinical guidance. Mark Carder, admin manager, obtained and reviewed results on positive HIV tests to include in our revised manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Database for results is available on request from the corresponding author.

ORCID iD
Matilda Fox http://orcid.org/0000-0003-2710-8057

REFERENCES

1 Pebody R. Life expectancy for people living with HIV Aidsmap; 2018. https://www.aidsmap.com/about-hiv/life-expectancy-people-living-hiv [Accessed 06 Oct 2021].
2 British HIV association. British HIV association adult HIV testing guidelines, 2020. Available: https://www.bhiva.org/file/5f68c0dd7aefb/HIV-testing-guidelines-2020.pdf
3 National Institute for Health and Care Excellence. HIV testing: increasing uptake among people who may have undiagnosed HIV. Clinical guideline [NG60], 2016. Available: https://www.nice.org.uk/guidance/ng60
4 UK Health Security Agency. Hiv testing, new HIV diagnoses, outcomes and quality of care for people accessing HIV services: 2021 report; 2021. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1037215/hiv2021report.pdf
5 Public Health England. Sexual and reproductive health profiles - Hammersmith and Fulham, 2019. Available: https://fingertips.phe.org.uk/profile/sexualhealth/data#page/1/gid/8000057/pat/6/par/E12000007/ati/202/are/E090000 1 3/cid/4/tbm/1/page-options/ovw-do-0
6 NHS England and NHS Improvement. Developing your aims statement. Available: https://www.england.nhs.uk/wp-content/uploads/2021/03/qsir-developing-your-aims-statement.pdf [Accessed 19 Mar 2022].
7 World Health Organisation. HIV/AIDS, 2021. Available: www.who.int/newsroom/fact-sheets/detail/hiv-aids [Accessed 10 Oct 2021].
8 Public Health England. Hiv testing trends, new diagnoses and people receiving HIV related care in the UK: data to the end December 2019, 2020. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/959330/hpr2020 [Accessed 04 Jun 2021].
9 Public Health England. HIV in the United Kingdom: Towards Zero Transmissions by 2030. (2019 Report- data to end 2018). London; 2019. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/965765/HIV_in_ the_ UK_2019_towards_zero_HIV_transmissions_by_2030.pdf
10 Hempling MC, Zielicka-Hardy A, Ellis JP, *et al*. Routine HIV testing in the emergency department: feasible and acceptable? *Int J STD AIDS* 2016;27:1267–74.
11 Hunter LJ, Lojo Rial C, Larbalestier N, *et al*. Routine HIV testing in an inner city emergency department. *Emerg Med J* 2016;33:905.1–905.
12 Kirsch TD, Chanmugam A, Keyl P, *et al*. Feasibility of an emergency department-based tuberculosis counseling and screening program. *Acad Emerg Med* 1999;6:224–31.
13 Rayment M, Rae C, Ghooloo F, *et al*. Routine HIV testing in the emergency department: tough lessons in sustainability. *HIV Med* 2013;14 Suppl 3:6–9.
14 Institute for Healthcare Improvement. How to Improve, 2021. Available: http://www.ihi.org/resources/Pages/HowtoImprove/default.aspx [Accessed 10 Oct 2021].
15 Service O. East: four simple ways apply behavioural insight The Behavioural Insights Team; 2015.
16 Institute for Healthcare Improvement. Driver Diagrams. Available: http://www.ihi.org/resources/Pages/Tools/Driver-Diagram.aspx [Accessed 10 Oct 2021].
17 Pettit R. HIV Testing in the ED. [online data collection survey via Survey Monkey]. Available: https://www.surveymonkey.com/r/MKZVYDQ
18 National Institute for Health and Care Excellence. Putting NICE guidance into practice. HIV testing: increasing uptake around people who may have undiagnosed HIV (NG60), resource impact report; 2016.
19 Public Health England. Evidence and resources to Commission expanded HIV testing in priority medical services in high prevalence areas, 2012. Available: https://webarchive.nationalarchives.gov.uk/20140714095639/http://www.hpa.org.uk/expandedhivtesting2012 [Accessed 13 Oct 2021].
20 Public Health England. Sexual and Reproductive Health Profiles - Data - PHEFingertips.phe.org.uk; 2021. https://fingertips.phe.org.uk/profile/SEXUALHEALTH/data#page/0/gid/8000057/pat/6/ati/202/are/E09000013/iid/90 742/ age/1/sex/4/cid/4/tbm/1 [Accessed 18 Oct 2021].