An effective strategy to diagnose HIV infection: findings from a national audit of HIV partner notification outcomes in sexual health and infectious disease clinics in the UK

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ORIGINAL ARTICLE

An effective strategy to diagnose HIV infection: findings from a national audit of HIV partner notification outcomes in sexual health and infectious disease clinics in the UK

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ABSTRACT

Objectives Partner notification (PN) is a key public health intervention in the control of STIs. Data regarding its clinical effectiveness in the context of HIV are lacking. We sought to audit HIV PN outcomes across the UK.

Methods All UK sexual health and HIV services were invited to participate. Clinical audit consisted of retrospective case-note review for up to 40 individuals diagnosed with HIV per site during 2011 (index cases) and a review of PN outcomes for up to five contacts elicited by PN per index case.

Results 169/221 (76%) clinical services participated (93% sexual health/HIV services, 7% infectious diseases/HIV units). Most (97%) delivered PN for HIV. Data were received regarding 2964 index cases (67% male; 50% heterosexual, 52% white). PN was attempted for 88% of index cases, and outcomes for 3211 contacts were audited (from an estimated total of 6400): 519 (16%) were found not to be at risk of undiagnosed HIV infection, 1399 (44%) were informed of their risk and had an HIV test, 310 (10%) were informed of the risk but not known to have tested and 983 (30%) were not informed of their risk of HIV infection. Of 1399 contacts tested through PN, 293 (21%) were newly diagnosed with HIV infection. Regular partners were most likely to test positive ($p<0.001$).

Conclusions HIV PN is a highly effective diagnostic strategy. Non-completion of PN thus represents a missed opportunity to diagnose HIV in at-risk populations. Vigorous efforts should be made to pursue PN to identify people living with, and at risk of, HIV infection.

BACKGROUND

Effective HIV testing strategies are urgently required in the UK: in 2014, 17% of the estimated 103 700 people living with HIV infection were unaware of their status, and 40% of new diagnoses were made late (defined as a CD4 count of <350 cells/μL at diagnosis).[1]

By targeting exposed contacts, effective partner notification (PN) could reduce the undiagnosed fraction, diagnose people earlier in their infection and identify people at high risk of HIV for whom risk reduction interventions would be appropriate. Given recent evidence regarding the impact of HIV diagnosis on risk behaviour and the effectiveness of antiretroviral therapy in preventing onward infection,[2 3] HIV PN would also be expected to have a public health impact in terms of averting incident infections.

Modelling studies support the value of PN in controlling HIV at a public health level[4] and a meta-analysis of nine qualifying studies demonstrated a prevalence of newly diagnosed HIV in contacts of 20% overall[5]—an extremely high yield as a testing strategy. In practice, the vigorous PN strategies employed in Cuba are believed to have been instrumental in curtailing the nascent HIV epidemic.[6]

In the UK, the National Institute for Health and Care Excellence recommends that all services providing care for people with STIs should either provide PN or refer to services that do.[7] The British Association for Sexual Health and HIV (BASHH) has set minimum PN performance standards, for *Chlamydia trachomatis and Neisseria gonorrhoeae*.[8] However, there is a lack of evidence to support the use of these standards in the management of other STIs, including HIV. Indeed, the epidemiology and natural history of HIV with frequent lack of clarity on time of acquisition, long clinical latent period and lower risk of transmission per sex act is likely to mean that standards and outcomes would be different from those for acute bacterial STIs.

Data regarding HIV PN outcomes in the UK are limited to audit reports from individual centres, the majority of which are unpublished.[9] As a prelude to developing future PN outcomes and standards for use in the UK context, a national audit of HIV PN was undertaken jointly by BASHH and the British HIV Association (BHIVA) to provide baseline national level data of HIV PN performance and outcomes.

METHODS

All registered UK sexual health services and adult HIV clinical services (n=221) were invited to participate. The audit opened in March 2013 and ran for 8 weeks. It was in two parts:

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1. The policy questionnaire that collected information regarding the provision of PN at each site (methods of PN employed; content of any local written policies on PN)
2. The clinical audit that consisted of a retrospective case-note review. Inclusion criteria: adults (>16 years) newly diagnosed with HIV infection during the year 2011 (index cases), selected in reverse consecutive order from 31 December to 1 January, up to a maximum of 40 per site. This was a pragmatic maximum to ensure that large services were not overburdened and smaller clinics could be represented meaningfully. There were no exclusion criteria.

Clinical information was submitted electronically via web-based forms for index cases and for up to five contacts per index patient for feasibility reasons. For index cases, this included: current gender identity, ethnicity, age, HIV exposure risk, date of confirmatory HIV test, CD4 and HIV viral load at diagnosis, and likely duration of infection and how this was estimated (using clinical criteria such as symptoms of seroconversion, time since last negative HIV test, known date of possible exposure, serological test patterns (eg, evolving antibody response) and the use of the recent infection testing algorithm (RITA,[10]) where available). PN-related data included whether and by whom PN was performed and reason if not performed, date PN initiated, PN look back period and number of contacts elicited. Data relating to contacts included type of contact (sexual, injecting drug use, mother to child, other), type of partnership and nature of sex if sexual (regular, ex-regular, casual known, unknown, sexual behaviours and condom use), how much information for the contact was recorded (eg, first name, surname, telephone number), whether the contact was considered contactable, what PN action was agreed and PN outcome (including whether this was verified by a healthcare worker and dates this occurred and was recorded). Data relating to contacts derived from index case report and healthcare worker verification. For index cases reporting more than five contacts, participating centres defined the total number of contacts and then chose the five contacts for whom audit data were supplied.

Data were summarised in Microsoft Excel 2010 and statistical analysis was performed using *R*. (R: A Language and Environment for Statistical Computing; (2014) http://www.R-project.org)

Our main auditable outcomes comprised:

1. HIV PN initiation: the proportion of index cases (%) for whom a discussion about PN was undertaken
2. HIV PN completion: the proportion of elicited contacts (%) that were:
   (i) informed of their exposure to HIV infection
   (ii) attended a clinic for an HIV test as a result of PN (expressed as both patient report of attendance and healthcare worker verified report of attendance)
3. Prevalence (%) of newly diagnosed HIV infection in tested contacts

HIV PN outcome 2(ii) was used to calculate PN ratios to enable comparison with BASHH National PN Standards. In the absence of HIV-specific PN standards, comparison was made with the performance standard for index/contact/healthcare worker-reported chlamydial PN (at least 0.6 contacts per index case; for healthcare worker-verified PN it is at least 0.4 contacts per index case[10]):

1. Number of contacts per index case reported by the index, the contact or a healthcare worker as having attended a sexual health service for evaluation and testing as a result of PN
2. Number of contacts per index case verified by a healthcare worker as having attended a sexual health service for evaluation and testing as a result of PN

The ratios were calculated using aggregate data.

Finally, univariate analyses (χ^2 for categorical and t-test for non-categorical variables) were undertaken to identify associations between demographic variables in both index cases and contacts and the key outcomes of HIV PN completion and HIV prevalence in tested contacts.

RESULTS

Of the 221, 169 (76%) services responded to the initial invitation to participate.

Policy survey

Survey responses were received from 156/221 (70%) clinical services of which 73 (47%) described themselves as sexual health services, 70 (45%) as sexual health and HIV (±infectious diseases) services and 13 (7%) as infectious diseases/HIV units. All but four services (97%) reported that they delivered PN for HIV. Nearly all sites providing PN offered patient-initiated and provider-referral PN (98% and 96%, respectively). Contract PN was provided by 67%. Twenty-three clinics (15%) had access to the Gay Men Fight AIDS pilot online men who have sex with men (MSM) PN service (https://www.gmfa.org.uk/pn (accessed 15 April 2016)). Nineteen (12.2%) services had a formal written policy or standard operating procedure referring to PN for HIV, and a further 91 (58%) indicated that their policy was to follow national guidelines. Ten services (6%) had a policy regarding how long PN should be continued. Of these, three services would stop within 3 months, three within 6 months and one within 1 year. Twelve (8%) services had a policy on re-initiating PN in the event of a new sexual partner or STI diagnosis. Six (4%) had a written policy regarding patients who refused to meaningfully engage in PN or refused to disclose, and a further 109 (70%) had an agreed practice.

Clinical audit

Characteristics of the index cases

Audit responses were received from 169/221 (76%) services. Audit reports described 2964 index cases. These were as follows: 1987 (67.0%) male, 882 (29.8%) female, 3 (0.1%) transgender, 92 (3.1%) sex not stated; 1483 (50.0%) were exposed to HIV through heterosexual contact, 1252 (42.2%) through sex between men, 15 (0.5%) through injecting drug use, 214 (7.2%) other or unstated. The ethnicity of index cases comprised 1533 (51.7%) white, 984 (33.2%) black African, 335 (11.3%) other and 112 (3.8%) unknown. Of index cases, 72 (2.4%) were under 20 years, 679 (22.9%) 20–29 years, 997 (33.6%) 30–39 years, 736 (24.8%) 40–49 years, 299 (10.1%) 50–59 years, 113 (3.8%) 60 or over and 68 (2.3%) had no age reported. Time from infection to diagnosis could be estimated for 53.6% (n=1590) of index cases; 23.7% (n=377) of these individuals were recently infected (within 6 months) with supporting RITA data being supplied for 57 index cases (15.1%).

Partner notification processes for index cases

The PN process implemented per index case is summarised in figure 1. For 43 (1.5%) index cases, it was explicitly stated that PN was completed in another centre: these individuals are henceforth excluded from the denominator, leaving a PN denominator of 2921 index cases. In contrast, 59 index cases described as 'patient transferred care' and 19 described as

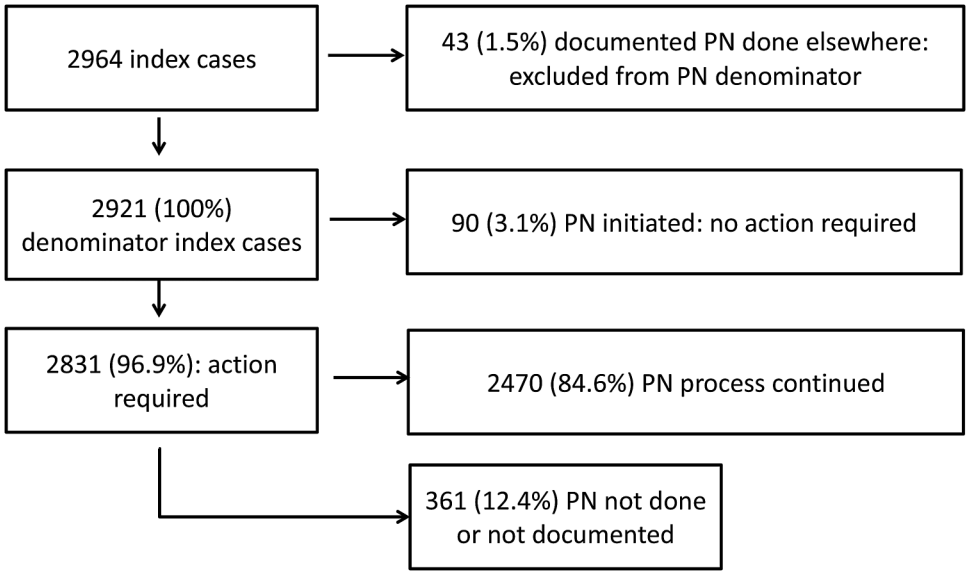

Figure 1 Partner notification processes per index case.

'patients routinely seen for HIV care elsewhere' were not excluded from the denominator, although it is possible that for some of these there may have been an agreement that PN would be done elsewhere.

Because of differing ways in which respondents reported index cases where the HIV risk status of elicited contacts was already known (eg, known already to be HIV positive, already tested, deceased, outside the UK/untraceable or deemed not at risk), we categorised index cases post hoc as shown in figure 1, as 'PN initiated: no action required' (90, 3.1% of denominator index cases), 'PN process continued' (2470, 84.6%) or 'PN not done or not documented' (361, 12.4%). Hence, overall PN was performed to some degree for 87.6% of denominator index cases.

Contacts elicited

We received audit forms regarding 3211 contacts derived from the 2470 index cases for whom PN was continued. The index cases were, however, estimated to have over 6400 contacts in total. There were a small number of contacts (n=54) for whom a form was not received because they were deemed not to be at risk of HIV infection (eg, their HIV status was already known, or they were deceased).

A total of 1051 index cases had only one contact, and 923 (87.8%) of these contacts were audited. The median number of contacts per index case was 2, but the distribution of number of contacts varied by sex and sexuality, with MSM reporting a higher number of contacts. Because total number of contacts per index case was categorised when above 5 (5–10, 11–15, 16–20, 21–25, 26 and above), we were unable to calculate a mean number of contacts by category.

PN process and outcomes for audited contacts

Outcomes for the 3211 audited contacts were as follows: 519 (16.2%) were found not to be at risk of undiagnosed HIV infection (most commonly because their status was already definitively known, or they were deceased); 1399 (43.6%) were informed of their risk and were either healthcare worker or patient verified as having attended a service for HIV testing as a result; 310 (9.7%) were informed of the risk but were not known to have attended for testing; 983 (30.6%) were not informed of their risk of HIV infection. Figure 2 summarises these outcomes in the form of a flow chart.

HIV prevalence in tested contacts

Of 1399 contacts tested as a result of HIV PN, 293 (20.9%) were newly diagnosed with HIV infection (see table 1). Nine index cases were associated with two newly diagnosed contacts, and none with more than two. Based on the characteristics of the index case, heterosexual acquisition of HIV, Black African ethnicity and contact type were associated with positivity in tested contacts. Regular partners were more likely to test positive than ex-regular ($p=0.002$) and casual known contacts ($p<0.001$). A wide range in prevalence in tested contacts was observed across UK BASHH regions (from 9.5% in the Northern England region to 29.4% in Wales).

Associations with non-completion of PN

The only statistically significant difference in proportion of at-risk contacts who were notified was according to contact type with 1292/1422 (90%) regular contacts, 339/577 (59%) of ex-regular contacts, 373/562 (66%) casual known contacts and 36/377 (9.6%) of casual unknown notified, respectively ($p<0.001$).

Time to completion of PN

Time to completion of PN was known for 1057 at-risk audited contacts: 949 (89.8%) attended for testing within 120 days after initiation of PN, 37 (3.5%) between 121 and 180 days, 45 (4.3%) between 181 and 365 days and 26 (2.5%) after more than 1 year.

Outcomes as defined by BASHH PN standards

HIV PN outcomes were calculated, with the following results:

0.45 contacts/index case were verified by healthcare worker as having attended a service for an HIV test

0.64 contacts/index case attended a service for an HIV test, including index case report

The total number of index cases (the denominator) for this calculation was 2921 (ie, all except those for whom it was documented that PN was done elsewhere). PN ratios showed minor variation when stratified by demographic variables of the index

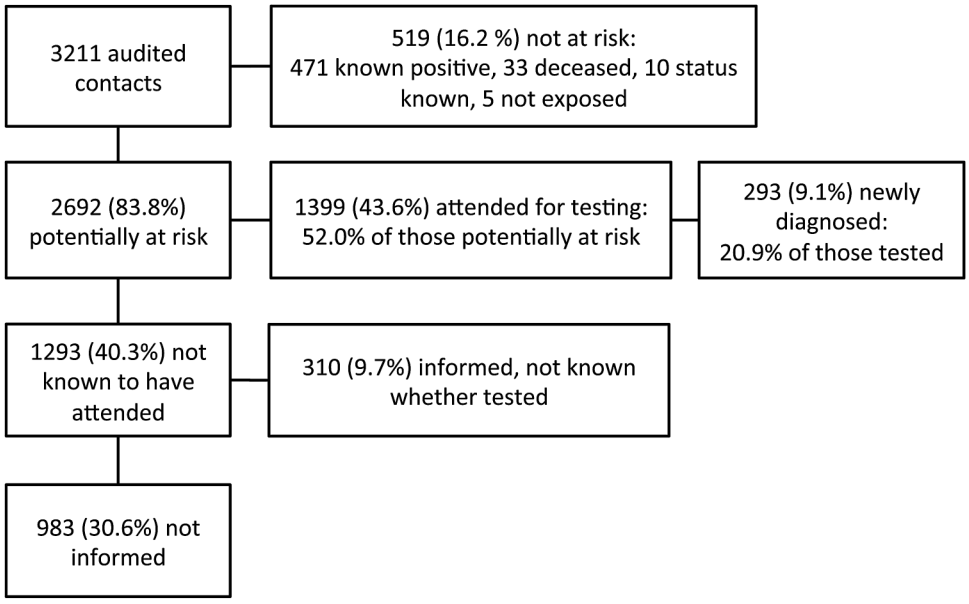

Figure 2 PN processes and outcomes for audited contacts (n=3211).

Table 1 Prevalence of newly diagnosed HIV infection in tested contacts by index patient characteristics, and by sexual contact type

	Number of contacts tested	Number testing HIV-positive (%, (95% CI))	p Value (univariate analysis)
All tested contacts	1399	293 (20.9 (18.77 to 23.03))	
Index patient characteristics			
Sex			
Male	944	190 (20.1 (17.6 to 22.9))	0.21
Female	425	99 (23.3 (19.4 to 27.7))	
Mode of HIV acquisition			
Heterosexual	694	163 (23.5 (20.4 to 26.9))	0.04
Homosexual	609	113 (18.6 (15.6 to 21.9))	
Ethnicity			
White	784	153 (19.5 (16.8 to 22.5))	0.05
Black African	419	103 (24.6 (20.6 to 29.0))	
Age			
Under 40	893	185 (20.7 (18.1 to 23.6))	0.60
40 or over	480	106 (22.1 (18.5 to 26.1))	
Timing of infection			
Recent (<6 months)	188	35 (18.6 (13.5 to 25.1))	0.38
Not recent	657	144 (21.9 (18.9 to 25.3))	
Contact characteristics			
Sexual contact type			
Regular	890	236 (26.5 (23.7 to 29.6))	<0.001
Ex-regular	176	24 (13.6 (9.1 to 19.8))	
Casual known	197	23 (11.7 (7.9 to 17.2))	

Table 2 Variation in partner notification (PN) outcome measure by characteristics of index case

Characteristics of index patient	PN ratio (contacts/index case attending a service for an HIV test, including patient report)
All	0.64
Male	0.66
Female	0.62
Heterosexual	0.63
Homosexual	0.69
White	0.72
Black African	0.56
Under 40	0.69
40 or over	0.58
Recently infected (within 6 months)	0.76
Not recently infected	0.71
Had audited regular partner	1.03
No audited regular partner	0.42

case (see table 2). Ratios were most improved if the index case reported a regular partner among audited contacts.

DISCUSSION

This is the first national audit of HIV PN outcomes and processes in the UK and it provides compelling data to support HIV PN as an effective diagnostic intervention. Of nearly 1400 patients tested as a result of HIV PN, 21% were themselves newly diagnosed with HIV infection (293 new HIV diagnoses from 2921 audited index cases—a ratio of 1:10). However, PN was performed for only 88% of index cases, and was completed for fewer than half of their estimated total number of contacts. This illustrates both the striking effectiveness of HIV PN and the considerable scope for improvement in its delivery in the UK.

The policy questionnaire demonstrated comprehensive (>97%) provision of HIV PN in sexual health and HIV services in the UK. The majority offered several PN approaches and followed national guidelines or a local written policy.

The 21% prevalence of HIV among contacts tested as a result of PN in our audit is consistent with a meta-analysis of HIV PN.[5] However, Sexual Health and HIV Activity Property Type (SHHAPT) surveillance reporting for 2014 indicates that

only 5.6% of 1830 individuals who attended sexual health clinics in England as HIV PN contacts tested HIV positive.[11] We believe that this discrepancy may reflect underuse of novel PN codes in the SHHAPT system. Biased sampling within our audit is also a possible factor (see Limitations below). HIV prevalence in tested contacts was higher in heterosexuals, regular and ex-regular partners, and black Africans. This likely reflects increased risk due to ongoing exposure in established relationships, confounding in terms of ethnicity and heterosexuality as a risk factor, and possible over-reporting of heterosexual contacts.

Initiation of PN nationally was 88%, which falls short of the closest applicable BASHH audit standard of 97% of index cases having the outcome of (an) agreed contact action(s), or the decision not to contact, documented for all contacts.[8] When expressed as a ratio of outcome/index case, the outcomes of 0.45 contacts/index case verified by healthcare worker as having attended a service, and 0.64 contacts/index case having attended a service including patient report meet the BASHH standards in use for *C. trachomatis* and *N. gonorrhoeae* PN outcomes. As a comparator, aggregate SHHAPT data in England in 2014 demonstrate that the number of tested contacts/index case was 0.54 for new diagnoses of HIV across all sexual health clinics.[11] There was significant centre-to-centre and regional variation in these outcome measures; however, analysis of the data suggests that case mix variation was not wholly responsible for this variance (data not shown). This suggests that some differences in performance are due to operational differences at sites. However, some outliers were likely to be artefactual due to small numbers of index cases submitted in smaller centres.

Nationally, 30% of elicited at-risk contacts were not informed of their risk of HIV infection. This compares with 37% (range: 3%–67%) in the meta-analysis previously described[5] and does suggest that non-completion of PN is commonplace. In our audit, failure to conduct PN varied significantly by contact type. Applying the observed prevalence figures of newly diagnosed HIV infection in each of the contact types, we estimate that non-completion of PN among harder to reach contacts such as ex-regular and casual known partners means substantial numbers of individuals are failing to be diagnosed with HIV infection by this method. Indeed, assuming the same prevalence by contact type among tested and untested contacts, 422 potentially contactable sexual contacts were infected with HIV: 293 (69%) were tested and diagnosed via PN and 129 (31%) remained undiagnosed, with more than half of this undiagnosed group deriving from ex-regular and known-casual contacts, despite observed prevalence being lower in these groups. The driving issue is, we feel, failure to pursue PN by healthcare workers, rather than a reluctance to disclose partners at risk by the index cases.

Limitations

There are data quality issues in the audit, which, while unlikely to affect the national observations and conclusions, may have impacted on the outcomes at individual sites.

The first is the definition of 'PN' itself. Some centres used the term to mean the elicitation of contacts and the evaluation of their risk even if none were at risk of undiagnosed HIV infection. Other centres used the term PN only for contacts that required testing. We consider that the former is correct. We therefore created post-hoc definitions to deal with this discrepancy, although we were unable to fully correct for this.

We believe that our sample of index cases was broadly representative of all new HIV diagnoses in the UK in 2011.[12] However, as we audited a maximum of five contacts per index case, we sampled only about half of all elicited contacts. Audited contacts were probably not representative of the entire population of contacts. Casual unknown contacts (or 'uncontactable') were undersampled, for example.

We did not collect data on type of PN used (eg, index-initiated, provider referral) and this would have been of value to detect any differences in efficacy and effectiveness.

Finally, the use of the BASHH PN standards to measure effectiveness and performance of HIV PN is problematic, as ratios developed for *C. trachomatis* and *N.gonorrhoeae* are unlikely to be directly transferable to HIV with its different epidemiology, natural history and transmission risk per exposure.

We would therefore propose developing new measures of HIV PN to measure both performance and effectiveness more sensitively, taking into account these specific features.

These concerns aside, this audit demonstrates that HIV PN is a highly effective strategy to diagnose HIV infection, and is a powerful tool when vigorously pursued. However, we found considerable scope for improvement in PN performance, suggesting that at-risk individuals are being denied the opportunity to test. A recent European Centre for Disease Control report suggests huge variability in the legal and clinical contexts for provision of PN in the management of STIs including HIV across the European region.[13] Many countries lack support and consistency in the delivery of PN. In the UK, we are in a privileged position with national clinical guidelines, and a legal and commissioning framework to mandate and support PN. Thus, poor performance should be challenged. All centres should examine their outcomes closely, and work as a clinical team and with their local stakeholders and commissioners to maximise HIV PN outcomes. Changes to the commissioning of sexual health and HIV services in some of the devolved nations of the UK, resulting in the possible fragmentation of the two, must not be to the detriment of health interventions such as HIV PN, which straddle the divide.

Key messages

- HIV partner notification (PN) is an effective strategy to diagnose undiagnosed HIV: 21% of audited contacts tested as a result of PN were newly diagnosed with HIV infection.
- PN was initiated for 88% of index cases, but fewer than half of all contacts elicited were known to have attended for an HIV test.
- PN was more likely to be completed for regular and ex-regular partners, who themselves were more likely to test positive for HIV infection.
- Failure to undertake effective PN denies at-risk populations the opportunity to test for HIV and benefit from earlier access to treatment and risk reduction interventions for those found to be HIV negative.

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Contributors All authors designed the audit, coordinated data collection and reviewed and analysed the data. MR drafted the article and all authors reviewed it. Members of the BASHH National Audit Group and BHIVA Audit and Standards Subcommittee contributed to the design, conduct and analysis of the audit.

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Notes