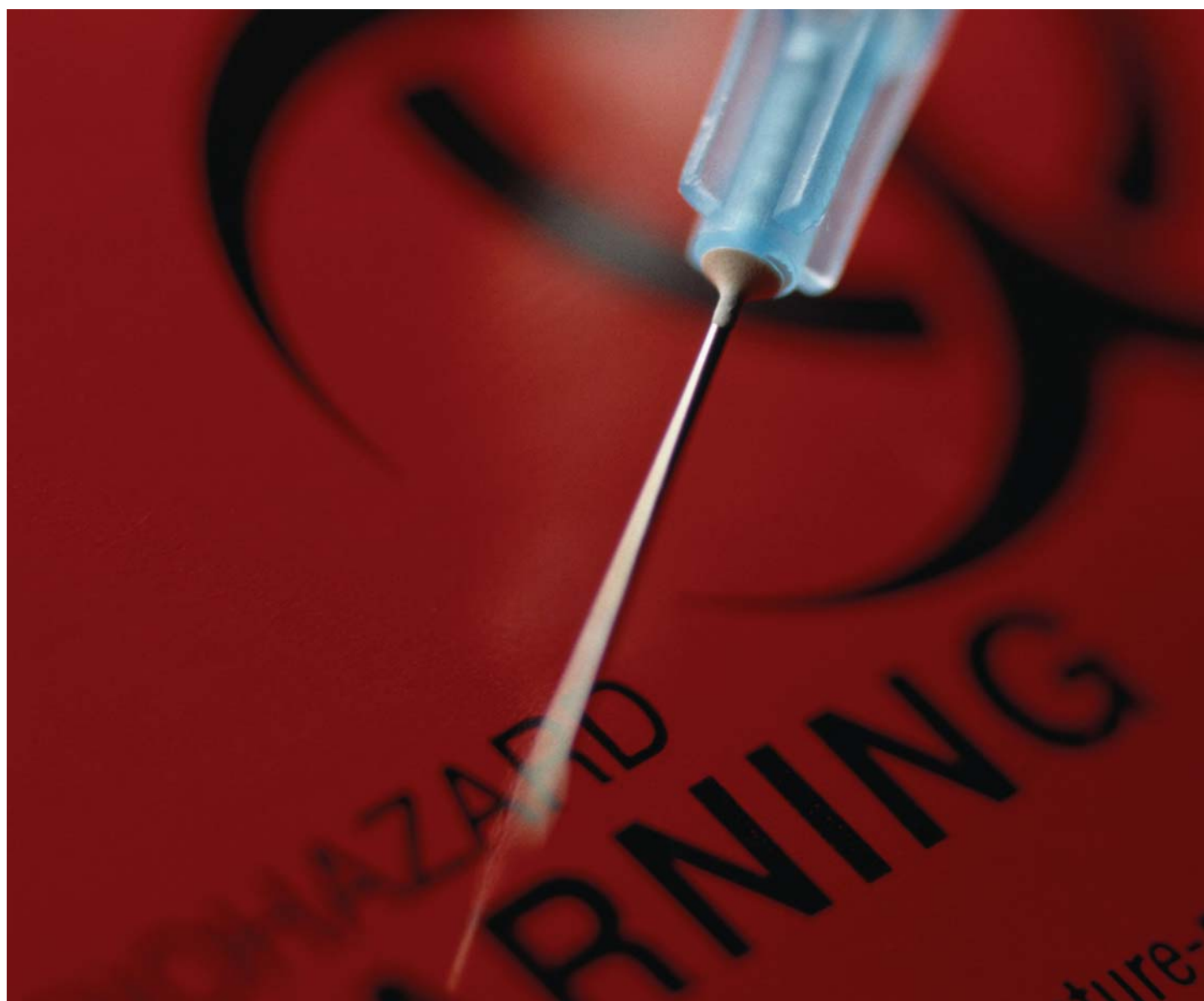


Eye of the Needle

Surveillance of Significant Occupational Exposure to Bloodborne Viruses in Healthcare Workers. Centre for Infections; England, Wales and Northern Ireland
Seven-year Report: January 2005



Objectives of Surveillance of Occupational Exposure to BBVs in HCWs:

1. To collect data on healthcare workers (HCWs) occupationally exposed to human immunodeficiency virus (HIV), hepatitis B (HBV) (HepBsAg), and hepatitis C (HCV) in England, Wales and Northern Ireland.
2. To identify the “risk factors” surrounding the transmission of bloodborne viruses (BBVs) to HCWs by understanding the factors necessary for seroconversion to occur.
3. To examine the types of exposures, the staff involved and circumstances surrounding exposure episodes.
4. To use data collected to inform the development of national prevention policies.
5. To monitor the implementation of the National HIV Post-Exposure Prophylaxis (HIV PEP) guidelines using data collected on reported incidents involving significant occupational exposures of HCWs to HIV.
6. To make available, in a timely and accessible format, data on HIV PEP to inform future HIV PEP policy.
7. To raise awareness of reports of occupational exposure and encourage all NHS Trusts and other healthcare providers, to take part.
8. To use data collected on HBV immunisation to monitor adherence to policy.

Enquiries on occupational exposures to bloodborne viruses (hepatitis B, hepatitis C and HIV)

Consultant Epidemiologist

Dr Fortune Ncube

E-mail: fortune.ncube@hpa.org.uk

Tel: 020 8327 6423

Senior Research Nurse

Jane Aston

E-mail: jane.aston@hpa.org.uk

Tel: 020 8327 7152

Scientist (Epidemiology)

Sarah Tomkins

E-mail: sarah.tomkins@hpa.org.uk

Tel: 020 8327 7095

Specific webpages on the surveillance scheme and related issues are available at the following link:

http://www.hpa.org.uk/infections/topics_az/bbv/bbmenu.htm

Advisory Committee

Dr Philip Atkinson, Blackpool Victoria NHS Trust
Ms Sheelagh Brewer, Royal College of Nursing
Ms Carole Fry, Department of Health
Ms Fiona Genasi, Health Protection Scotland
Prof David Goldberg, Health Protection Scotland
Mrs Beth Cullen, Health Protection Scotland
Dr Paul Grime, Royal Free Hospital
Dr Linda Lazarus, Department of Health
Dr Mary Ramsay, Health Protection Agency
Mr Bryan Robinson, Worthing & Southlands Hospitals
Ms Stella Sawyer, Chelsea & Westminster Hospital
Dr Manjula Sharma, Kings College Hospital
Dr Sian Williams, Royal Free Hospital

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1. Summary

- This report includes significant occupational exposure incidents reported to the HPA between 1st July 1996 and 30th June 2004 from reporting centres, currently 150, geographically scattered throughout England with four actively reporting centres in Wales and one actively reporting centre in Belfast in Northern Ireland.
- Percutaneous injury was the most commonly reported type of exposure [78% (1,664/2,140)], with nursing related professions representing 45% (962/2,140) of the initial reports and medical professionals (doctors and dentists) accounting for 37% (793/2,140). If this is compared to the numbers of nurses and doctors practising, it suggests that within their professional group, there are a greater number of reported injuries among doctors (who are reporting).
- Injuries sustained by HCWs during the procedure were dependent on the nature and complexity of the procedure, varied by location and occupation and were not generally easily amenable to prevention. Injuries occurring after the procedure and during disposal were predominately related to failure to comply with procedures for the safe handling and disposal of sharps and clinical waste and were mostly preventable.
- There were nine HCV seroconversions following significant occupational exposure over the seven year period, six reported in the 12 months between July 2003 and June 2004. The seroconversion rate for four of the cases where complete follow-up information was available was 1.5% (4/264). Six of the reported seroconversions involved male injecting drug user (IDU) source patients. All seroconversion cases followed percutaneous exposures mostly to fresh blood from hollowbore needle injuries. Of the nine seroconversions six occurred after the procedure and five of these were preventable and should not have occurred.
- Where HCV testing was undertaken following significant occupational exposure to an HCV positive source patient, only 30% (220/734) of HCWs had been tested according to national guidelines on when tests should be performed and 19% (141/734) had no information on testing at any of the recommended stages. At a minimum, HCV RNA should be tested at six weeks, with both HCV RNA and hepatitis C antibodies (anti-HCV) performed at 12 weeks, and anti-HCV at 24 weeks.
- The HIV seroconversion rate in the reported HCWs exposed to HIV positive source patients was 0.8% (1/122). Outcome of the six months follow-up of exposed HCWs is poorly reported; the small numbers may have overestimated the seroconversion rate.
- Most HCWs who experienced significant occupational exposures to known and unknown HIV source patients were commenced on HIV PEP within 24 hours of exposure [77% (501/651)], where a time interval to HIV PEP was reported, and 38% (190/501) of these were within one hour, consistent with national guidance.
- Where HCWs had initiated HIV PEP and were subsequently found to have been exposed to an HIV negative source patient, 90% (156/173) of the HCWs had been on HIV PEP for a week or less; with 54% (85/156) of these only on HIV PEP for one day. However, HCWs are still taking toxic drugs with unpleasant side effects inappropriately because of apparent delays in source patient HIV testing.
- Source patient testing information is not always reported for all incidents. The February 2004 UK Department of Health guidelines on HIV PEP state that it should be written in the Trust sharps policy that all source patients are consented and tested for HIV, and the risk of HBV and HCV considered. The outcome of source patient testing will inform appropriate HCWs management.

2. Background

The first documented case in the UK of a healthcare worker (HCW) seroconverting to human immunodeficiency virus (HIV) following an occupational exposure was in 1984.¹ Following this incident, a passive surveillance system of HCWs who have had significant occupational exposure to HIV in England, Wales and Northern Ireland was set up. Active surveillance was implemented in July 1997, and was expanded at the same time to include hepatitis B (HBV) and hepatitis C (HCV) exposures.² Health Protection Scotland runs the equivalent surveillance system for Scotland.

Prior to the initiation of active surveillance, there had been four documented cases of occupationally acquired HIV infections in HCWs in the UK; one case in 1984 and three cases in 1992/3.³ A further seven HCWs with probable occupational acquisition of HIV were diagnosed between 1984 and 1997. Although these HCWs had no risk factors other than an occupational exposure, as they did not have a baseline HIV negative test at the time of exposure, they were classified as 'probable rather than documented' occupational seroconversion cases. The majority of these HCWs had previously worked in countries of high HIV prevalence and all had worked in healthcare settings outside the UK and are presumed to have been infected outside the UK.

This seven-year report includes all occupational exposures to BBVs in HCWs **reported** to the enhanced surveillance system up to 30th June 2004 at the Health Protection Agency Centre for Infections.

2.1 Methods

Description of the surveillance system

Definitions

In the context of the surveillance system, the following definitions have been used in identifying cases for inclusion in the programme. An **occupational exposure** includes,⁴ percutaneous exposures, where the skin has been broken by a needle/other sharp object, human scratch or bite and mucocutaneous exposures, where the mucous membranes (mouth, nose or eyes), or non-intact skin have been contaminated. A **significant exposure** is a percutaneous or mucocutaneous exposure to blood or other body fluids from a source that is known to be, or as a result of the incident found to be, HBsAg, HCV, or HIV positive.

The surveillance of significant occupational exposures to bloodborne viruses (BBVs) in HCWs examines the types of exposures reported to the scheme and the situation surrounding the event. Both retrospective and prospective

reports on HCWs exposed to an HBV surface antigen (HBsAg), HCV or HIV positive source are sent to the Centre for Infections by participating centres, on a voluntary and confidential basis.

Centres also report occupational exposures where the viral status of the source patient is not known, but the HCW has been started on HIV PEP, according to national guidance. In 2000 the Expert Advisory Group on AIDS recommended that all HCWs, following a significant occupational exposure where the source patient is considered to be at high risk of HIV but the viral status was unknown (where the result of an HIV test has not or cannot be obtained for whatever reason), should be started on HIV PEP.⁵

Reports are sent to the Centre for Infections at three stages in the management of the HCW: at initial report, at six week and at six month follow-up. No names are collected because of the very sensitive nature of the data, however because information on occupation and reporting centre is held, the data are maintained strictly confidential in accordance with the Data Protection Act and Caldicott Guidelines. Approval under Section 60 of the Health and Social Care Act 2001 has been obtained through the Patient Information Advisory Group (Statutory Instrument 1438-2002).

Initial report

The initial report form contains questions on which BBV the HCW has been exposed to, the type of exposure sustained, including depth of injury, whether or not the sharp was visibly contaminated with blood, and the body fluid involved. Information is also sought on whether HIV PEP was prescribed, and the occupation of the HCW.

Six week follow-up report

Six week follow-up reports are sent out to reporting centres for all exposures involving an HCV and/or HIV positive source, or where the HCW has commenced HIV PEP (regardless of the source HIV status). In the six week follow-up report, further information is obtained on where the exposure took place, what procedure the HCW was performing at the time of exposure and, when in relation to the procedure, the exposure occurred (e.g. during/after the procedure or during/after disposal). Data are also collected on any factors that may have contributed to the exposure. Information on the immediate management of the exposure is sought (e.g. if the wound was bled and washed/irrigated, where applicable) and whether a baseline blood sample was obtained from the HCW and subsequently tested for the relevant virus where indicated.

Detailed information is collected on the use of HIV PEP, types of drugs prescribed, side effects, duration of HIV PEP and reasons for discontinuation of the regimen where HIV PEP has been stopped.

If the source patient was HCV and/or HIV positive, questions are asked about their disease stage, CD4 count, viral load, drug treatment, HIV drug resistance and risk factors for HCV infection.

At present we do not actively collect any follow-up data on HCWs who have been exposed to an HBsAg positive source, although this is presently under review. It is assumed that in the vast majority of cases the HCW will be immune from previous HBV immunisation.

Six month follow-up report

Six month follow-up reports are only sent out for those exposures involving an HCV and/or HIV positive source. These forms collect summary information on all post-exposure testing of HCWs, exposed to a source infected with HCV and/or HIV.

In accordance with the Health Protection Agency's recommendations, HCWs exposed to an HCV positive source should have blood samples taken at the time of the incident (baseline sample), six weeks, 12 weeks and 24 weeks post-exposure.⁴ These guidelines also recommend that HCV RNA (genome) testing should be performed on the six week and 12 week serum samples, and that testing for HCV antibodies (anti-HCV) should be carried out on the 12 week and 24 week sera.⁴ The stored baseline serum being tested if a positive result is found, to rule out HCV carriage at the time of exposure.

The rationale for the timing of the tests is that, HCV RNA is usually detectable before the antibodies to HCV develop in the event of a seroconversion and will be positive at six weeks following the exposure, remain positive whilst viral replication continues and disappear with spontaneous viral clearance or with sustained virologic response following treatment. Antibodies develop between 50-70 days and should be detectable on the 12 week serum sample. At 24 weeks only HCV antibodies are tested for because around 15% of patients will spontaneously clear the virus. Thus, not detecting HCV RNA at 24 weeks does not exclude HCV infection, only a negative HCV antibody test signifies no previous HCV infection.

2.2 Reporting centres

Currently the scheme has around 150 participating reporters including occupational health departments, GUM clinics, microbiologists, virologists and infection control nurses, (with some Centres having more than one contact). This number includes any contact that has reported at least once over the reporting period. Geographically, reporting centres are scattered throughout England, with four actively reporting centres in Wales and one actively reporting centre in Belfast in Northern Ireland.

2.3 Follow-up reports

A cumulative total of 2,140 initial reports (Figure 1) had been reported to the programme from 1st July 1996 to 30th June 2004. There were 1,597 (75%) six week follow-up reports returned out of the initial 2,140 reported incidents. Of these, only 1,066 [67% (1,066/1,597)] follow-up forms were received at six months follow-up. It is not known whether these HCWs may have been followed-up but the reporting centres did not return follow-up reports to the programme. Overall, six months follow-up reports were not received for 50% (1,074/2,140) of the initially reported incidents. Where the HCWs did not have any further follow-up, they remain unaware of the outcome of their BBV exposure.

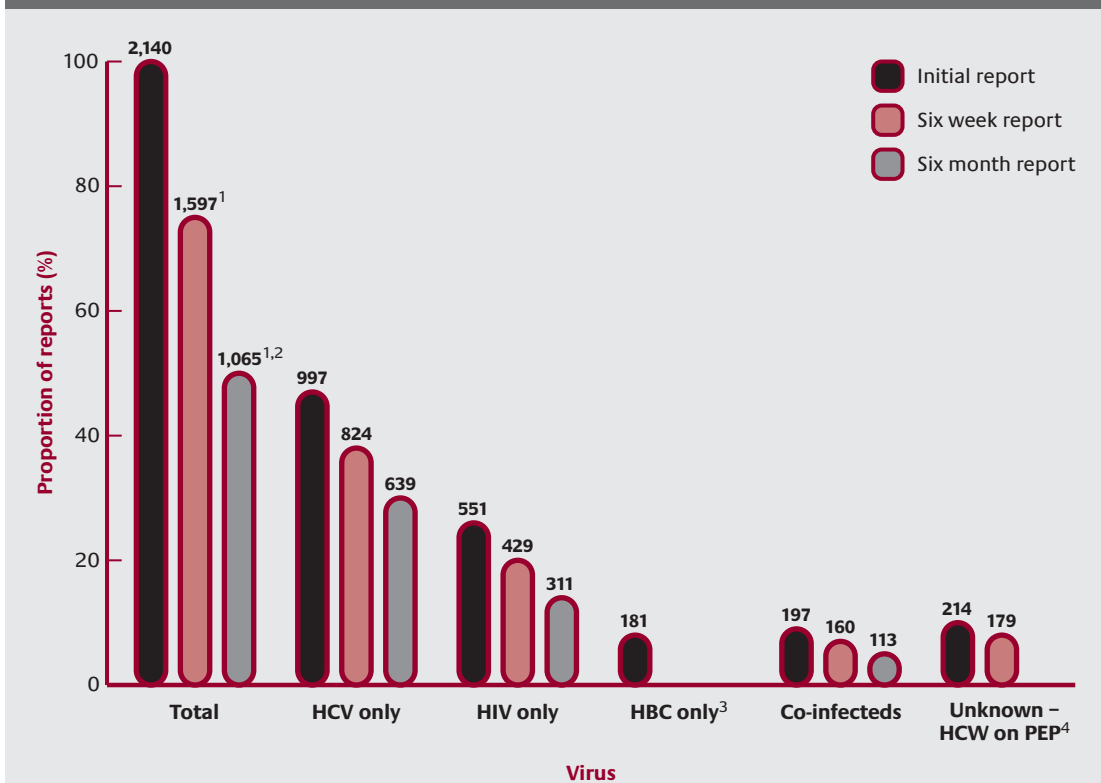
The majority of HCW exposures were to an HCV positive source (Figure 1), accounting for 47% (997/2,140) of all initial reports, with HIV reports accounting for 26% (551/2,140) and HBV for 9% (181/2,140). HCWs exposed to co-infected source patients (dual and triple infections), accounted for 9% (197/2,140) of the initial reports, 50% (98/197) of these being exposures to HIV and HCV co-infected source patients.

2.4 Follow-up of HCV-related exposures

Source patient HCV RNA testing:

During the period 1st July 1996 to 30th June 2004, 60% (957/1,597) six week follow-up reports returned concerned exposures to an HCV positive source (including those co-infected with other bloodborne viruses). Following exposure to an HCV positive source patient, the risk of HCV transmission only exists in source patients who are shown to be HCV RNA positive, signifying continued viral replication

Figure 1 Virus exposure, initial, six week and six month reports, 1996-2004



Proportion (%) = the number of reports received as a proportion of the overall number of initial reports received (n=2,140).

¹The number may rise as further reports are received.

²Total number of six month reports received is 1,066; however, one report does not have an initial or six week report in the database and was therefore excluded.

³HBV exposures are not followed-up unless the HCW has commenced HIV PEP. Only eight reports filled this criteria, and of these, five were reported [0.02% (5/2,140)] at the six week stage.

⁴Where the source is of unknown status for all three BBVs and the HCW initiates HIV PEP, only a six week follow-up report is requested.

and infectivity. Information on HCV viral status of the source patient was reported on 45% (426/957) of all HCV positive patients. Of these, 79% (335/426) were HCV RNA positive and thus infectious.

Where information was available, 70 reports concerned HCWs who were exposed to an HCV positive source patient following a percutaneous injury where the source patients were tested and found to be HCV RNA negative. Of these reports, 40% (28/70) of the HCWs tested negative to HCV antibodies at their six month follow-up.

HCV HCW follow-up blood tests:

Box 1 (see inside back cover) is the summary of the testing guidelines for HCWs exposed to an HCV positive source patient. Testing information is captured on the six week and six month forms. Where reported, on the six week follow-up reports, 74% (712/957) of HCWs exposed to HCV positive source patients (including those with dual or triple infections) had a baseline serum sample taken and stored but not tested and information was not available on the resting HCV status of any of these HCWs. No information was available on baseline testing in 10% (97/957) of the six

week reports. The remaining 148 [15% (148/957)] HCWs had a baseline sample tested for HCV. Of those tested, results were not available in 14 incidents and in four HCWs the baseline sample was HCV positive. Thus the HCW HCV seroprevalence rate in the baseline samples where results were available was 3% (4/134).

Of the 1,066 six month reports received, 69% (734/1,066) concerned exposures to HCV. Where reported, 30% (220/734) of HCWs had been tested at all three recommended post-exposure testing stages. However, not all these HCWs had the right tests at the right time, according to testing guidelines (Box 1, see inside back cover). Where reported, 19% (141/734) of HCWs were not known to have been tested at any of the recommended stages. Reasons for not testing included that the HCW had left the hospital or Trust, had failed to attend follow-up, declined to be tested, or were being followed-up elsewhere, or the department was unable to provide the information.

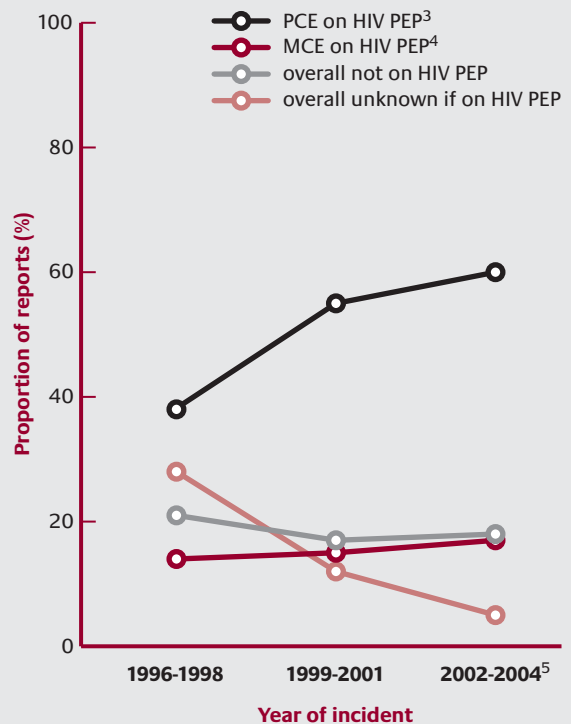
Where HCWs have been exposed to an HCV positive source patient, and have not been followed-up with the appropriate tests for HCV, they may remain unaware of the outcome of their exposure and some could have been infected.

2.5 Follow-up of HIV-related exposures

Table 1 shows data for all initial reports of significant occupational exposures to BBVs by virus, type of exposure and the year the incident occurred.

Overall (Table 2), 68% (466/687) of HCWs who had been exposed to an HIV positive source patient were started on HIV PEP, the majority of them, 77% (359/466) having sustained a percutaneous injury. The increase in the proportion of percutaneous reports seen in 1999-2001 is a reflection of increased reporting following changes in HIV PEP policy (Figure 2).⁵ The drop in reports where the HCW was not known to be on HIV PEP from 28% (47/170) in 1996-1998 down to 5% (11/216) in 2002-2004, is attributed to improved data recording and reporting, for the same reason as above. Mucocutaneous exposures accounted for 23% (107/466) of HCWs starting HIV PEP and exposed to an HIV positive source. Mucocutaneous exposures did not show the same jump in the number of reports in 1999-2001, but showed a marginal increase from 14% (23/170) in 1996-1998 to 17% (37/216) in 2002-2004. The proportion of HCWs known to have been exposed to an HIV positive source patient, who did not start PEP showed a downward shift from 21% (35/170) in 1996-1998 to 18% (38/216) in 2002-2004.

Figure 2 HIV PEP status of HCW after exposure to HIV+ve source¹, by type of exposure and year of incident, 1996-2004²



Proportion (%) = the number of incidents occurring as a proportion of the overall number of HIV positive exposure initial reports for that year.

¹These include reports of dual/triple-infected source patient.

²There was only one retrospective case reported that occurred in 1996; HCV exposure & HCW did not go on HIV PEP. Data up to 30th June 2004.

³PCE = percutaneous; these include injuries sustained by needles and other sharp instruments, human bites and human scratches.

⁴MCE = mucocutaneous; these include exposures to the mucous membranes (e.g. eyes, mouth) and non-intact skin (e.g. broken skin through cuts and abrasions or skin conditions).

⁵The number of incidents may rise as further reports are received.

For the period 1999 to 2004, exposures to source patients of unknown viral status and who on risk assessment are thought to be at high risk of HIV contributed to 10% (214/2,140) of all initial reports (Table 1). Of these, percutaneous exposures contributed the bulk, 90% (193/214) of the reports. Mucocutaneous exposures accounted for only 9% (20/214) of the reports (with one case of unknown type of exposure included in the denominator).

Some HCWs exposed to source patients shown to be HIV negative at the time of the exposure, but either HCV or HBV positive, went on HIV PEP because, based on the source patient's behaviour, there was a risk that the patient was in the window period and the HCWs were not prepared to take the very small risk of infection and decided to start HIV PEP instead. However, the numbers in this category are very small. Table 3 gives data on HCWs who were started on HIV PEP following occupational exposures to blood or other high-risk body fluid from source patients of unknown HIV status including those who were exposed to HCV and HBV. Percutaneous exposures in this group, accounted for 89% (307/347) of the related initial reports.

When HCWs are started on HIV PEP, the HIV status of the source patient is not always available. The six week follow-up report in the majority of cases contains the details on the HIV status of the source patient. Altogether, 827 reports were returned at six weeks, relating to HCWs who had been exposed to a potential risk of HIV infection (source patient known HIV positive, source patient unknown HIV status and source patient co-infected with another BBV and on risk assessment, the HCW believed to have been exposed to a risk of HIV infection). Of the six week follow-up reports, 84% (692/827) related to HCWs who went on HIV PEP. Where HIV PEP was commenced, HCWs exposed to an HIV positive source (inclusive of dual and triple co-infected source) contributed 58% (402/692) of the reports, with exposures to a source of unknown status for all three viruses accounting for 26% (179/692). Some HCWs who had been exposed to an HCV and/or HBV, but not HIV positive source were, on risk assessment, also started on HIV PEP. These incidents constituted 16% (111/692) of those HCWs initiating HIV PEP.

Of those exposed to the risk of HIV infection, 16% (135/827) of HCWs were known not to have subsequently taken HIV PEP. All these HCWs had been exposed to a known HIV positive source patient. Seventy two per cent (97/135) of these reports recorded reasons why the HCW did not initiate HIV PEP. The most frequently reported reason was that the exposure was perceived to be low-risk, followed by the HCW refusing HIV PEP and time delay.

2.6 Follow-up of HBV-related exposures

The surveillance programme does not currently seek specific follow-up information on HCWs exposed to an HBV positive source patient. It was assumed that all HCWs should now be vaccinated against HBV. Where HCWs are HBV vaccine non-responders, they are currently made aware of their ongoing risk and offered prophylaxis when they have been put at risk of exposure to HBV. However, the surveillance programme does not collect this information at present. Reports of HCW exposures to a HBV positive source are documented on the initial report form, but no six week or six month form is sent out. The only occasions where HCWs exposed to HBV-infected source patients are followed-up is in exposures to co-infected source patients, or where the HCW initiates HIV PEP. The vaccination policy of HCW in the NHS is now long standing, but there is no national programme for monitoring its implementation.

In consultation with the Advisory Group on Occupational Exposure of HCW to BBVs, an audit of HBV vaccination has been instituted. Data are now being collected on the HBV vaccination status of HCWs at exposure and the use of HBV post-exposure prophylaxis for all significant occupational exposures to any BBV. Recommendations on future follow-up of HBV exposures in the healthcare setting will depend on the findings of the audit.

2.7 Key points

Of all the initial reports, 47% (997/2,140) related to exposures to HCV positive source patients and 26% (551/2,140) to HIV.

Where baseline samples were tested and the information reported, four HCWs were found to be HCV positive at the time of their exposure, giving a seroprevalence rate of 3% (4/134) among HCWs with significant occupational exposures.

Some HCWs may not have been appropriately followed-up; 50% (1,074/2,140) of all incidents reported initially to the Centre for Infections did not have any further follow-up reports, and these HCWs may still be unaware of the outcome of their exposure and some could have been infected.

The majority of HCWs [77% (359/466)] exposed to HIV positive source patients through percutaneous injury are started on HIV PEP.

3. Occupational exposures to bloodborne viruses and their prevention

This section of the report focuses on general information relating to the types of exposures, occupation of the HCWs exposed, incident location in relation to occupation, type of procedure and timing of exposures, together with information on circumstances surrounding the incident and how exposures can be prevented.

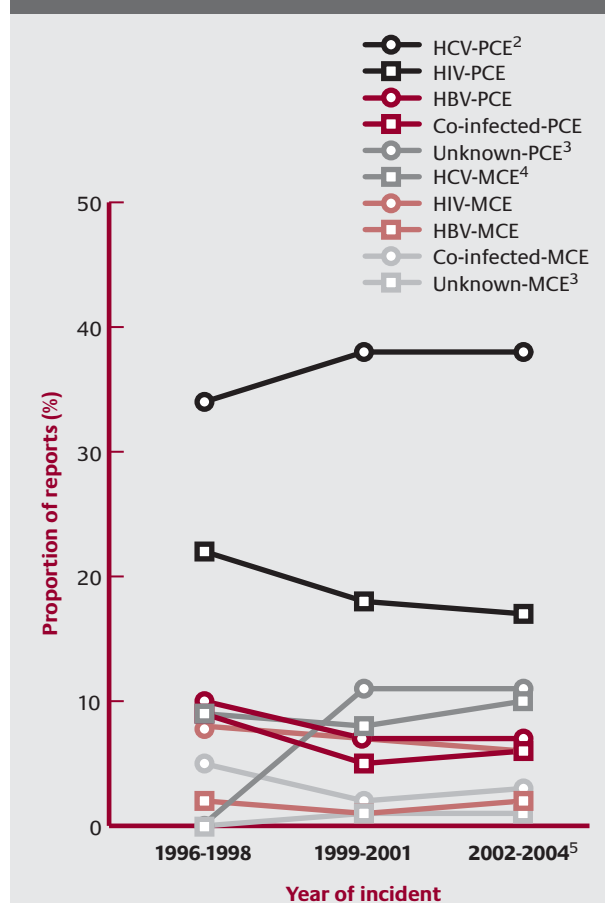
3.1 Type of exposures

The most common exposures to HCWs were percutaneous injuries [78% (1,664/2,140)], the majority [63% (1,056/1,664)] of these involving hollowbore needles. Most of the percutaneous exposures reported up to 30th June 2004 [48% (794/1,664)], resulted from exposures to HCV-infected source patients, followed by exposures to HIV-infected patients [24% (401/1,664)] (Table 1). Exposures to HBV and co-infected patients contributed 9% (144/1,664) and 8% (132/1,664) respectively, with exposures to source patients of unknown status for all three viruses accounting for 12% (193/1,664) of the reports. Mucocutaneous exposures accounted for 22% (461/2,140) of initial reports received.

Figure 3 and Table 1 show the proportions of different occupational exposures in HCWs by virus in the source patient and year of incident. The numbers are small, especially in the earlier years and should be interpreted with caution. However, the findings suggest that percutaneous injuries involving HCV positive source patients, as a proportion of annual initial reports, have on average shown a slight increase over time from 34% (141/418) in the period 1996-1998 to 38% (380/1,002) in 1999-2001 and maintained at this level for 2002-2004. In the same period, percutaneous exposures to HIV positive source patients have shown a gradual downward shift in the number of initial reports, from 22% (93/418) in 1996-1998 to 17% (124/711) in 2002-2004. Mucocutaneous exposures to all viruses, including co-infections, have shown very little change and have remained low when compared to percutaneous exposures. The upward shift seen in 2000 in percutaneous exposure reports to source patients of unknown viral status is a reflection of increased reporting due to a change in the HIV PEP policy.⁵

The proportional increase in percutaneous exposures to HCV positive source patients could be a reflection of the changing HCV disease burden in the population of patients attending hospitals for care, increasing the likelihood of a HCW caring for a patient infected with HCV.

Figure 3 Occupational exposure by virus, type of exposure and year of incident, initial reports, 1996-2004¹



Proportion (%) = the number of incidents occurring that year as a proportion of the overall number of initial reports for that year.

¹There was only one retrospective case reported that occurred in 1996; HCV exposure. Data up to 30th June 2004.

²PCE = percutaneous; these include injuries sustained by needles and other sharp instruments, human bites and human scratches.

³Unknown = source status is unknown for all three BBVs; these reports did not start to be collected until 2000.

⁴MCE = mucocutaneous; these include exposures to the mucous membranes (e.g. eyes, mouth) and non-intact skin (e.g. broken skin through cuts and abrasions or skin conditions).

⁵The number of incidents may rise as further reports are received.

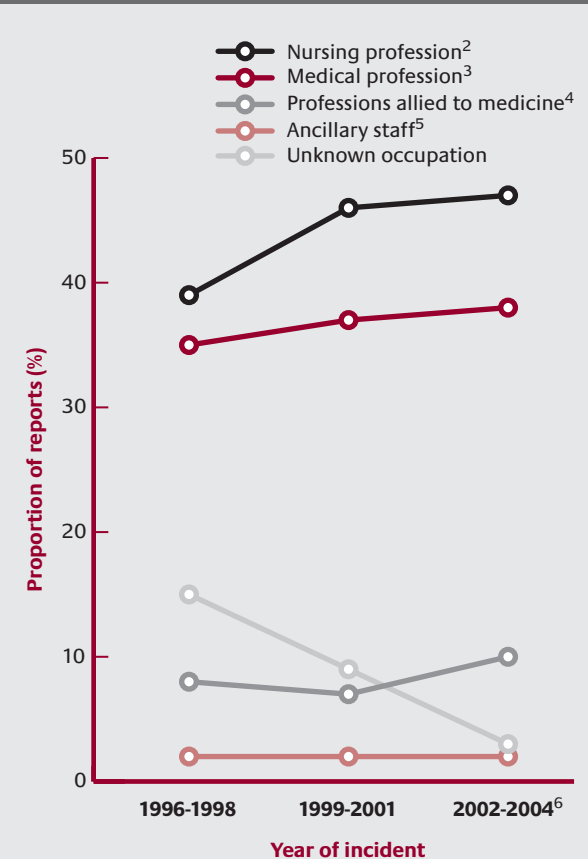
3.2 Occupation of healthcare workers

Most exposures involved nursing professionals, accounting for 45% (962/2,140) of reports received, followed by medical professionals with 37% (793/2,140). The proportions of nursing and medical professionals reporting exposures have remained high compared to other occupational groups, but have not shown a marked increase since 1996-1998 (Figure 4). Reports in professions allied to medicine and in ancillary staff are much lower and have not increased over time. However, the relative number of professionals in these groups should be taken into account. Importantly, it should be noted that 2% (39/2,140) of the exposures involved porters, security, and housekeeping staff, a group of staff who are not directly involved in patient care. The majority of exposures in ancillary staff involved injuries from needles in rubbish bins. Such injuries from inappropriately discarded sharps by other HCWs are a clear example of the consequences of non-compliance with universal precautions and safe disposal of clinical waste. In some cases however, ancillary staff are injured whilst directly helping in patient care, such as in restraining an agitated patient. Reports relating to unknown occupation have gone down from 15% (62/418) in 1996-1998 to 3% (24/711) in 2002-2004. This is attributed to better information processing and reporting at local level.

3.3 Incident location and occupation

Where reported, the most frequent location of exposures was the ward with 45% (713/1,597) of six week reports received, followed by operating theatres [15% (235/1,597)], A&E [11% (172/1,597)], and intensive care units with 8% (124/1,597). Together, these location areas accounted for 78% (1,244/1,597) of all six week reports returned. Exposures involving nurses and doctors contributed 82% (1,315/1,597) of all the six week reports. Of these 1,315 exposures in nurses and doctors reported at six weeks, 78% (1,026/1,315) were percutaneous. Figure 5 shows the distribution of percutaneous incidents by location and occupation for reports to 2004. Doctors reported a higher proportion of percutaneous incidents in operating theatres, A&E and intensive care than nurses, who reported a higher proportion of percutaneous exposures in the wards (than doctors). However considering all types of exposures, nurses sustained more exposures in the intensive care unit [52% (65/124)] than doctors [40% (49/124)].

Figure 4 Proportion of reports received by occupational group and year of incident, initial reports, 1996-2004¹



Proportion (%) = the number of incidents occurring in that occupational group as a proportion of the overall number of initial reports for that year.

¹There was only one retrospective case reported that occurred in 1996; doctor. Data up to 30th June 2004.

²Nursing profession = nurse, midwives, healthcare assistants/auxiliary nurses and dental personnel (dental nurses/hygienists).

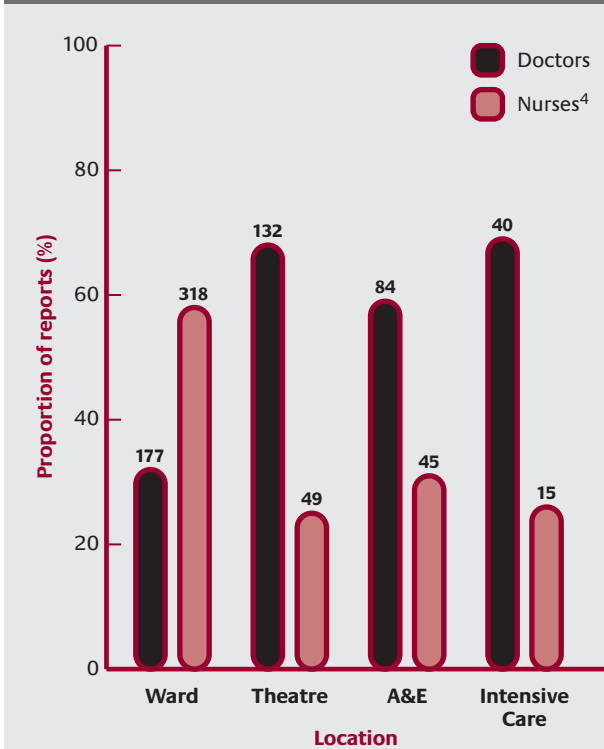
³Medical profession = doctors and dentists.

⁴Professions allied to medicine = including phlebotomists, laboratory workers, paramedics, radiographers, ODAs, physiotherapists, general technician, dialysis technician, embalmer/mortuary technician, NVQ/trainees.

⁵Ancillary staff = porters, security and housekeeping staff.

⁶The number of incidents may rise as further reports are received.

Figure 5 Percutaneous exposures¹, by location² and occupation³, six week reports, 1996-2004



Proportion (%) = the number of incidents occurring as a proportion of the overall number of six week reports for that location.

¹Percutaneous exposures = these include injuries sustained by needles and other sharp instruments, human bites and human scratches.

²Location = the four most commonly reported locations have been selected for this analysis.

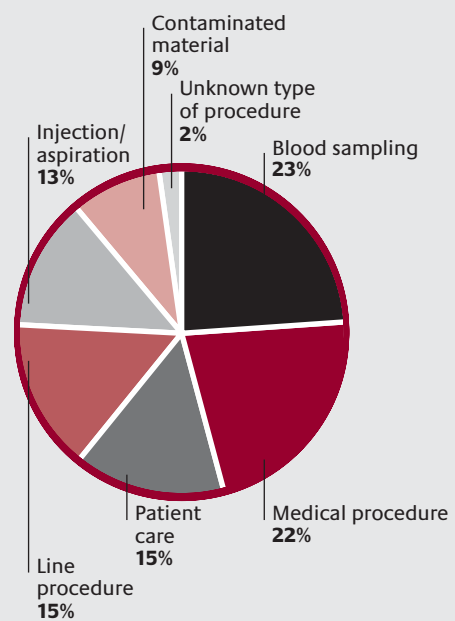
³Occupation = the two most commonly reported categories of HCW occupation have been selected for this analysis.

⁴Nurses = nurses, midwives and healthcare assistants/auxiliary nurses.

3.4 Procedure and timing of exposures

Based on information derived from six week follow-up reports, blood sampling and medical procedure categories accounted for 23% (374/1,597) and 22% (348/1,597) respectively, of procedures performed by HCWs at the time of the exposures (Figure 6). The most common reported individual procedure undertaken by HCWs was percutaneous venepuncture [17% (266/1,597)] followed by suturing [9% (142/1,597)].

Figure 6 Proportion of six week reports received by each procedure group, 1996-2004



Proportion (%) = the number of reports received as a proportion of the overall six week reports (n=1,597).

Line procedures; include inserting, connecting, flushing and removing lines (for example IV, CV and arterial lines).

Blood sampling; includes percutaneous venepuncture, arterial stab, and finger stick/heel stick.

Injection/aspiration; includes IM, subcutaneous and other injections, and aspiration procedures.

Medical procedures; include obtaining body fluids or samples, dialysis, and surgical and laboratory procedures.

Patient care; include procedures such as airway manipulation, internal examinations, changing dressings.

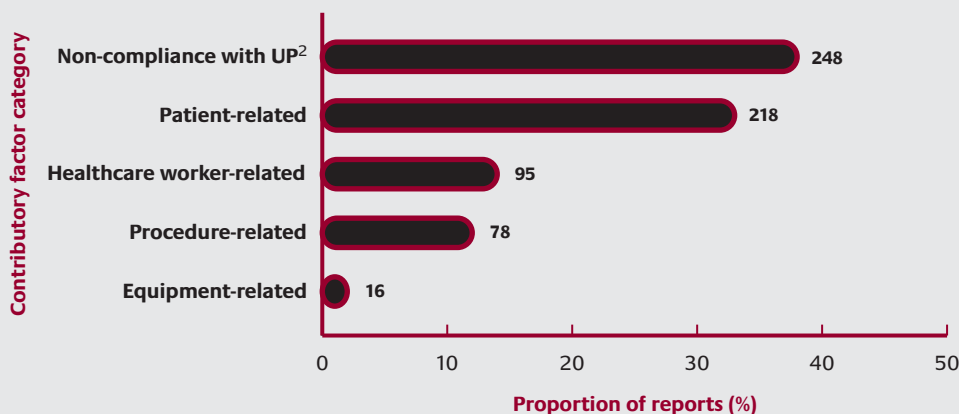
Contaminated material; includes transfer of blood/body fluids into culture bottles, manipulation of laboratory specimens, cleaning/transporting/processing contaminated material or instruments.

Exposures occurred most frequently during the procedure [58% (931/1,597)], where involvement of patient-related factors may be an issue. However, 37% (588/1,597) of exposures reported occurred after the procedure but before disposal, or during/after disposal. In operating theatres and the intensive care units around 80% of incidents occurred during the procedure. In A&E, incidents were one and a half times more likely to occur during rather than after the procedure. Operating theatres, intensive care and A&E are associated with more complex exposure prone procedures or procedures done under emergency conditions with increased probability of injury during the procedure. In the ward incidents occurred during and after the procedure with similar proportions, around 50%. Most procedures performed in the ward are related to patient care and would include injection administration, blood sampling and venflon citing, involving less complex manipulations with a reduced risk of injury during the procedure if performed properly. Thus, data presented here suggest that 45% (318/713) of the incidents in the ward, 38% (65/172) in A&E, 18% (22/124) in intensive care and 16% (38/235) in operating theatres, all occurred after the procedure had been performed.

3.5 Were any of the exposures preventable?

Many percutaneous injuries are preventable with adherence to standard or universal precautions, where every patient receiving medical care regardless of their presumed infection status, is treated as potentially carrying a BBV. The guidelines issued by the UK Health Departments in 1998, for clinical healthcare workers to protect them against exposures to BBVs, recommended the adoption of standard (universal) precautions.⁶ The risk of exposure can be reduced significantly by washing hands after every patient contact, wearing and changing gloves between patients, covering any skin lesions with waterproof dressing and the safe handling and disposal of sharps, using readily accessible and not overfilled puncture-resistant sharp containers, facilitating disposal of sharps immediately after use and not leaving clinical waste for others to clear. Furthermore, unnecessary injuries can be avoided by not re-sheathing needles and not manually dismantling disposable devices.

Figure 7 Contributory factors¹ to the procedure, six week reports, 1996-2004



Proportion (%) = the number of reports received as a proportion of six week reports where a contributory factor was attributed (n=655)

¹The database allows up to two contributory factors to be listed per incident, and these second factors have been included in the denominator this year (although they are relatively few in number). In addition, the definition of patient-related contributory factors used previously did not include all incidents involving patient movement, spitting, coughing, etc. Therefore it has been broadened out to include all cases that did not record a patient related contributory factor, where the specific subcategories for the timing of the exposure in relation to the procedure were 'patient moved, spat, and coughed, etc.' and 'restraining patient'. This resulted in the addition of 52 records to the denominator.

²UP = universal precautions.

Table 1 Occupational exposure to blood or other high-risk fluid by virus, type of exposure, and by year of incident (initial reports)

Virus exposure	Type of PEP	1996-1998 ¹		1999-2001		2002-2004 ²		Year unknown		Total	
		No	%	No	%	No	%	No	%	No	%
Hepatitis C (HCV)	Percutaneous³	141	34%	380	38%	270	38%	3	33%	794	37%
	Mucocutaneous	37	9%	28	3%	74	10%	0	0%	139	6%
HIV	Percutaneous	93	22%	23	2%	124	17%	2	22%	242	11%
	Mucocutaneous⁴	33	8%	66	7%	45	6%	2	22%	146	7%
Hepatitis B (HBV)	Percutaneous	41	10%	69	7%	33	5%	1	11%	144	7%
	Mucocutaneous	9	2%	15	1%	12	2%	0	0%	36	2%
Co-infecteds	Percutaneous	36	9%	51	5%	45	6%	0	0%	132	6%
	Mucocutaneous	21	5%	22	2%	20	3%	0	0%	63	3%
Unknown & HCW on HIV PEP (status for all three viruses not known)											
	Percutaneous	0	0%	113	11%	80	11%	0	0%	193	9%
	Mucocutaneous	0	0%	14	1%	6	1%	0	0%	20	1%
All exposures	Percutaneous	311	74%	795	79%	552	78%	6	67%	1,664	78%
	Mucocutaneous	100	24%	202	20%	157	22%	2	22%	461	22%
	Unknown type of exposure⁵	7	2%	5	0%	2	0%	1	11%	15	1%
	Total	418	100%	1002	100%	711	100%	9	100%	2,140	100%

Proportion (%) = the number of incidents occurring that year as a proportion of the overall number of initial reports for that year.

Table 2 Occupational exposure to blood or other high-risk fluid from patient known to be HIV positive by year of incident (initial reports)

Type of exposure	Use of PEP	1996-1998 ¹		1999-2000		2002-2004 ²		Year unknown		Total	
		No	%	No	%	No	%	No	%	No	%
Percutaneous³	PEP started	65	38%	164	55%	130	60%	0	0%	359	52%
	PEP not started	22	13%	28	9%	18	8%	0	0%	68	10%
	Unknown if on PEP	32	19%	23	8%	8	4%	2	50%	65	9%
Mucocutaneous⁴	PEP started	23	14%	46	15%	37	17%	1	25%	107	16%
	PEP not started	13	8%	23	8%	20	9%	0	0%	56	8%
	Unknown if on PEP	11	6%	12	4%	3	1%	1	25%	27	4%
All types of exposure⁶	PEP started	88	52%	210	71%	167	77%	1	25%	466	68%
	PEP not started	35	21%	51	17%	38	18%	0	0%	124	18%
	Unknown if on PEP	47	28%	36	12%	11	5%	3	75%	97	14%
	Total	170	100%	297	100%	216	100%	4	100%	687	100%

Proportion (%) = the number of incidents occurring as a proportion of the overall number of HIV positive exposure initial reports for that year.

Table 3 Occupational exposure to blood or other high-risk fluid from source of unknown HIV status by year of incident (initial reports)

Type of exposure	Use of PEP	1996-1998 ¹		1999-2001		2002-2004 ²		Year unknown		Total	
		No	%	No	%	No	%	No	%	No	%
Percutaneous³	PEP started	11	92%	160	88%	136	88%	0	0%	307	88%
Mucocutaneous⁴	PEP started	1	8%	21	12%	17	11%	0	0%	39	11%
All types of exposure⁷	Total started on PEP	12	100%	181	100%	154	100%	0	0%	347	100%

Proportion (%) = the number of reports where the HCW commenced PEP as a proportion of the overall number of exposures to a source of unknown HIV status for that year.

¹There was only one retrospective case reported that occurred in 1996; HCV exposure & HCW did not go on HIV PEP.

²Data up to 30th June 2004.

³Percutaneous; these include injuries sustained by needles and other sharp instruments, human bites and human scratches.

⁴Mucocutaneous; include exposures to the mucous membranes (e.g. eyes, mouth) and non-intact skin (e.g. broken skin through cuts and abrasions or skin conditions).

⁵These reports were not included in the above sub-categories.

⁶Includes five records where the type of exposure was unknown, therefore not all of the proportions in the above categories add up to 100%.

⁷Includes one record where the type of exposure was unknown, therefore not all of the proportions in the above categories add up to 100%.

Table 5 Seroconversions in HCW exposed to HCV positive source patients

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Year of exposure	1996 ¹	2000	2001	2003	2003	2004	2004	2004	2003
Occupation	Junior Doctor	Surgeon	Dentist	Nurse	Junior Doctor	Nurse	Nurse	HCA	Domestic
<i>Exposure:</i>									
Elective or emergency	Emergency	Elective	Elective	Emergency	Elective	Emergency	Elective	Elective	Elective
Procedure	Resuscitation	Suturing	Injection	Venepuncture	Venepuncture	Resuscitation	Cannulation	Venepuncture	Cleaning
Material involved	Fresh blood	Blood stained	Fresh blood	Fresh blood	Fresh blood	Fresh blood	Fresh blood	Fresh blood	NK
Place	A & E	Theatre	Dental surgery	A & E	Ward	A & E	Ward	Ward	GP Surgery
Type of exposure	Percutaneous	Percutaneous	Percutaneous	Percutaneous	Percutaneous	Percutaneous	Percutaneous	Percutaneous	Percutaneous
Site	Nail bed	Thumb	NK	Hand -palm	Hand-palm	Leg	Finger	Hand	Leg
Sharp object	Needle	Needle	Needle	Needle	Needle	Needle	Needle	Needle	Needle
Hollow/solid object	Hollow	Solid	Hollow	Hollow	Hollow	Hollow	Hollow	Hollow	Hollow
Gauge of sharp object	NK	NA	NK	NK	NK	NK	18	21	NK
Depth of injury	Moderate	Moderate	Deep	Moderate	Moderate	Superficial	Deep	Moderate	Moderate
HCW wearing gloves	No	Yes	Yes	NK	Yes	N/A	No	No	N/A
Timing of procedure	After (stabbed)	During	During	During	After	After	After	After	After
HCW originator or sharp	No	Yes	Yes	Yes	Yes	No	Yes	No	No
Visible contamination of sharp	NK	Yes	Yes	NK	NK	Yes	Yes	Yes	NK
<i>Source patient:</i>									
Sex/age	NK/NK	NK/NK	NK/NK	Male/>60	Male/50-59	Male/NK	Male/40-49	Male/20-29	NK/NK
Risk category	IDU	IDU	NK	IDU	IDU	IDU	Surgery abroad	IDU	NK
BBV co-infection	No	No	HIV	No	No	HIV	No	No	NK
Time since HCV diagnosis	Pre incident	At incident	Pre incident	At incident	Pre incident	Pre incident	35 years	At incident	NK
Symptomatic for HCV	NK	No	No-yes to HIV	NK	NK	NK-died query cause	Acute hepatitis	NK	NK
Genotype	NK	NK	NK	NK	1	1b	3	3	NK
Antiviral therapy	NK	No	NK	No	No	NK	No	No	NK
HCV status known to HCW at time of incident	Yes	No	Yes	No	Yes	No	Yes	No	Source NK
<i>Incident management:</i>									
Time from incident to reporting	Same day	Same day	1 day	Same day	Same day	1 day	Same day	Same day	Same day
First positive HCVRNA test (weeks)	16 ²	8.3	4	8	7.1	6.1	6.7	7.7	6.3
First positive HCV antibody test (weeks) (last neg/first pos)	Baseline/17.4	Baseline/8.3	Baseline/12	Not done/8	Baseline/7.1	Baseline/6.1	6.7/12	Baseline/7.7	Baseline/6.3
Symptoms at diagnosis	NK	NK	NK	None	NK	Jaundice	None	Raised LFTs	None
Genotype of HCW	NK	NK	NK	NK	1a	1b	3a	3	1a
Treatment commenced	NK	Yes	NK	No	Yes	Yes	Yes	Yes	Yes
Duration of treatment	NK	Yes	NK	N/A ³	6 months	12 months	6 months	6 months	6 months
Outcome	Cleared virus	Cleared virus	Cleared virus	Cleared virus	Cleared virus	Treatment ongoing	Cleared virus	Cleared virus	Cleared virus
Other treatment (eg HIV PEP)	None	None	PEP for 4/52	PEP for 1 day	None	PEP for 4/52	None	None	None

NK = not known

N/A = not applicable

¹First reported in 1997 in the enhanced surveillance period.

²HCW was not tested prior to 16 weeks post-exposure.

³HCW referred to specialist but treatment not required.

In the data presented, non-compliance with universal precautions where reported, was identified as the commonest contributing factor cited in 38% (248/655) of the incidents (Figure 7). Under non-compliance with universal precautions, the reasons given in reports for incidents occurring in the ward after the procedure but before disposal included injuries sustained whilst re-capping the needle, disassembling the device, items left on or near disposal containers and in transit to the rubbish disposal and cleaning area. Incidents that occurred during or after disposal included injuries sustained while putting items into disposal containers, clearing devices left on the floor, table or bed, items protruding from inappropriate waste disposal and items piercing side of sharps boxes. Injuries sustained after disposal were commonly caused by being stuck by an item protruding from over filled sharps containers or from rubbish bags. All these incidents were preventable with proper adherence to procedures for the safe handling and disposal of sharps and clinical waste.

Patient-related [33% (218/655) of the contributory factors], HCW-related [15% (95/655)], procedure-related [12% (78/655)] and equipment-related [2% (16/655)] factors were the other contributory factors reported. These factors relate more to incidents occurring during the procedure. Such incidents are an indication of the complex manipulations involved during the procedure. In surgical procedures, the risk of percutaneous injury is associated with the type and duration of the procedure and the use of fingers rather than instruments to hold tissues whilst suturing. Some of the incidents occurring during the procedure may be preventable but it is less easy to be sure of this or of what percentage. However, even though they may not be so easily amenable to prevention, identifying them and understanding why and how they occurred, affords the opportunity to introduce intervention strategies that could lead to their reduction.

3.6 Key points

Percutaneous injuries accounted for 78% (1,664/2,140) of exposures reported, 63% (1,056/1,664) of these were by hollowbore needles and the most likely reported contributing factor was non-compliance with universal precautions.

Forty five percent (967/2,140) of reported initial reports of significant occupational exposures were in nurses followed by doctors accounting for 37% (793/2,140) of the reports.

Doctors reported a higher proportion of percutaneous incidents in operating theatres, A&E and intensive care than nurses who reported a higher proportion of percutaneous exposures in the wards.

Thirty eight percent of incidents could have been prevented with adherence to procedures for safe handling and disposal of sharps and clinical waste.

4. Management and outcome of exposures to known HCV positive source patients

4.1 HCV seroconversion rate

There have been nine reported HCWs who have seroconverted to HCV following significant occupational exposure. Six of these were reported in the 12 months between July 2003 and June 2004; with three reported in the first two months of 2004.

Table 4 details HCWs who were exposed to an HCV positive source patient following a percutaneous injury where HCWs had a corresponding six month follow-up report. These HCWs would have been followed-up and tested at six months post-exposure and remained HCV antibody negative, indicating that they had not been infected following their exposure. The seroconversion rates for each year, where the denominator is the six month reports received for that year including the seroconversions are also shown. Incidents and seroconversions occurring in 2004 were excluded in the calculation of the seroconversion rate because they would not have been followed-up for the full six months at the time of data extraction. Also, the retrospective case that occurred in 1996 was not included since there would have been no corresponding denominator data. The HCW who seroconverted in 2003 (case 9) following exposure to an unknown source patient was excluded from the seroconversion rate calculation since they did not meet the case definition of exposure to a known HCV positive source patient. The cumulative seroconversion rate for this group of HCWs was 1.5% (4/264). The high rate of 3.7% (2/54) seen in 2003 could be a reflection of the small sample size involved and may not be a true estimate of the HCV seroconversion rates in HCWs exposed occupationally. However, the observed annual seroconversion rates in this surveillance programme lie within the range of 0-22.2% reported in reviews of published studies and the cumulative rate is consistent with the observed combined rate of 1.9% for the studies reviewed.⁷

4.2 HCV seroconversion cases

4.2.1 Description of healthcare worker seroconversions

All of the HCWs reported to the programme who seroconverted to HCV following injuries were exposed to percutaneous injuries, six involving a hollowbore needle and one surgeon injured whilst suturing by a solid suture needle visibly contaminated with fresh blood (Table 5). All the exposures involving a hollowbore needle were to fresh blood, with the needle visibly contaminated with blood in four cases, six were of moderate depth, two were deep and one was a superficial scratch to the leg, but broke the skin. Details on the occupation of the HCW and the site of the injuries are given in Table 5.

Three of the incidents occurred in A&E, one during the procedure, another after the procedure whilst a nurse was clearing up after someone else and in the other the HCW was stabbed by the patient with a hollowbore needle following resuscitation. The three injuries that occurred in the ward, all happened after the procedure and were related to non-compliance with universal precautions with one involving a healthcare assistant disposing of clinical waste on behalf of another member of staff. One incident involved a needle protruding through a rubbish bag. In six cases where gloves could have been used, only two HCWs were documented to have been wearing gloves at the time of the injury. Thus, six out of the nine seroconversions occurred after the procedure and excluding the HCW stabbed by a patient, five out of nine of these seroconversions were preventable and ought not to have occurred at all.

Table 4 Number of six month forms with a corresponding initial report form for percutaneous exposures to HCV positive source patients, and number of HCV seroconversion cases that year, by year of incident, received up to 31/12/2004:

	Year of incident							
	1997	1998	1999	2000	2001	2002	2003	Total
Number of six month forms	18	29	32	52	46	31	52	260
Number of HCV seroconversions	0	0	0	1	1	0	2	4
Number of cases	18	29	32	53	47	31	54	264
Transmission rate (seroconversions/number of cases)	0	0	0	1.9%	2.1%	0	3.7%	1.5%

4.2.2 The risk factors of the source patient

Risk factor information on the source patient was poorly reported at the time of the incident (Table 5). In general, injecting drug use is the main risk factor in the transmission of HCV. In the reported seroconversions, six of the incidents involved mostly older male injecting drug users. Two HCWs were exposed to source patients who were co-infected with HIV. These HCWs were put on HIV PEP and remained HIV negative after treatment. The status of the source patient was not known to the HCW at the time of the incident in five cases, including the incident involving a needle in a rubbish bag. The genotype of the source patient was available in four of the cases, two genotype 3s, one genotype 1 and one 1b. Three of the source patients were not known to be HCV positive and were diagnosed as a result of the incident. Three source patients had lived with HCV infection for a long time, 35 years in one case and this information was known by the HCW at the time of the incident. The source patient who had been diagnosed 35 years ago, was receiving clinical care for exacerbated hepatitis and would have been very infectious. Unfortunately, there were no data on viral load levels. Information on treatment was only reported in these three source patients and none of them gave a history of past or current treatment. Information on HCV diagnosis status was not reported for two source patients.

4.2.3 Management of HCWs who seroconverted to HCV

All but one of the HCWs reported their injury either immediately, on the same day or within a day of the incident (Table 5). Two HCWs reported seroconversion symptoms, one with jaundice and the other with abnormal liver function tests. Three had no symptoms and no information was given in the remaining three. The median time interval to the first positive HCV RNA test, as evidence of infection was seven weeks for all the cases, with a range of 4-16 weeks (Table 5). All HCWs had a baseline HCV RNA test done together with an HCV antibody test, except one HCW who did not have a baseline sample tested, but presented with jaundice and had an identical genotype to that of the source patient. Six HCWs had HCV antibody tests repeated around six weeks and were found to be positive. The recommended HCV testing protocol for a HCW following an exposure to an HCV infected source patient appears not to be adhered to, with unnecessary testing carried out at the wrong time during the incubation period for HCV.

The genotype of the HCW was available in five incidents, two genotype 1a, a genotype 1b, 3 and 3a, and in two of these, the HCWs' genotypes matched those of the source patients, 1b and 3 (Table 5). In the remaining cases, in one incident, the genotype of the source patient was 1 and that of the HCW was 1a and in the other, the source genotype was 3 and that of the HCW was 3a. Phylogenetic analysis had not been performed to link the source patient to the HCW's seroconversion definitively. However, in both these cases, the baseline samples from the HCWs were negative, the HCWs had no other risk factors for HCV infection other than occupational exposure and their first positive HCV PCR tests were consistent with transmission having occurred following their needlestick injuries.

Following confirmation of seroconversion, six HCWs were reported to have started on antiretroviral therapy (Table 5). The HCW with genotype 1b went on combination therapy with pegylated interferon and ribavirin for 48 weeks and their treatment is still ongoing. The two genotype 3 cases went on treatment for 24 weeks and cleared the virus. Two other HCWs with genotype 1a went on treatment for only 24 weeks, but cleared the virus. The recommended length of treatment for genotype 1 is normally 48 weeks. It is interesting that these patients were able to clear their infection with only 24 weeks of treatment. Treatment details were not available for two HCWs who had sustained needlestick injuries in 1996 and 2001 but on follow-up they were found to be PCR negative, suggesting viral clearance. One HCW cleared the virus spontaneously and was not started on any treatment.

4.3 Key points

There have been nine seroconversions to HCV, eight between 1997- 2004 and one in 1996. Most of these involved percutaneous injuries of mostly moderate depth from hollowbore needles contaminated with fresh blood from source patients who were mostly IDUs. Two, including one following a scratch to the leg, were exposed to IDUs co-infected with HIV and HCV.

Almost two thirds of the seroconversions were preventable since they resulted from injuries caused by non-compliance with universal precautions.

Eight of the nine HCWs with occupationally acquired HCV infection showed evidence of having cleared the virus, six following early treatment with anti-retrovirals.

5. Management and outcome of exposures relating to HIV

5.1 HIV seroconversion rate

Only one HCW had a documented HIV seroconversion between 1996-2004, due to a needlestick injury, and this was despite triple HIV PEP being administered. The seroconversion occurred as a result of a percutaneous exposure from a hollowbore needle. The source patient had AIDS, and the HCW tested positive for HIV 90 days after the exposure. Further case details have been described elsewhere.⁸ Percutaneous deep injuries involving a hollowbore needle that has been in the vein or artery of an HIV positive source patient, especially with late stage disease and a high viral load, are associated with increased risk of HIV infection following a needlestick injury in HCWs⁹. To establish that HIV has not been transmitted following occupational exposure, HCWs should be tested at six months post-exposure. In the surveillance programme, where reported, 122 HCWs exposed to an HIV positive source were followed-up and tested for infection at approximately six months post-exposure. Of these, 121 of them were reported to be HIV negative. This gives a seroconversion rate of 0.8% (1/122). This rate is higher than that reported in the literature. This result needs to be interpreted bearing in mind the small numbers involved and the fact that not all HCWs were followed-up, thus possibly reducing the denominator of the HIV negative HCW at six months and overestimating the seroconversion rate.

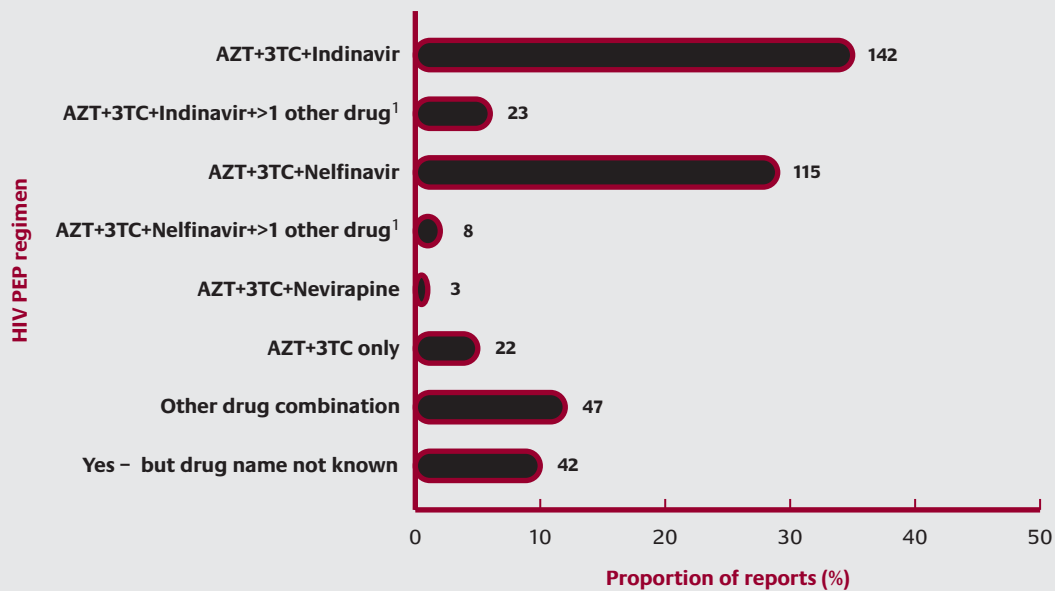
A further seven HCWs with possible occupational acquisition of HIV have been diagnosed in the UK, during the time period. Although these HCWs have no other risk factors than an occupational exposure, they do not have a baseline HIV negative test at the time of exposure and are therefore not classified as documented cases. The majority of these HCWs had previously worked in countries of high HIV prevalence and all had worked in healthcare outside the UK and are presumed to have been infected outside the UK.

5.2 HIV PEP regimens and side effects

In February 2004, Expert Advisory Group on AIDS (EAGA) revised guidance on HIV post-exposure prophylaxis, recommending a change in antiretroviral drugs for HIV PEP starter packs from indinavir to nelfinavir, together with zidovudine (AZT) and lamivudine (3TC) (Box 2, see inside back cover)¹⁰. The recommended duration of treatment remains at four weeks. In HCWs exposed to an HIV positive source, 41% (165/402) went on an indinavir-based regimen and 31% (123/402) were on a nelfinavir-based regimen (Figure 8). Of the HCWs who started PEP and the source patient was HIV positive, 16% (66/402) stopped all or some of their drugs due to side effects. In those HCWs who experienced side effects, there were 451 instances where side effects were reported with some HCWs experiencing more than one side effect. The main side effects reported were nausea and vomiting [37% (165/451)], diarrhoea [13% (58/451)], loss of energy and fatigue [9% (40/451)] and headaches [7% (30/451)].

The effects of the new HIV PEP guidance would not be expected to be fully realised in this data extraction, which is only up to the end of June 2004. However, comparing the six year to the seven year data, differences have been noted in the proportion of reports where the HCW has been prescribed indinavir-based regimens compared to nelfinavir-based regimens. Looking at AZT+3TC+indinavir the proportion prescribed this in the seven year extraction is 33% versus 39% in the six year extraction, and 31% versus 23%, respectively for AZT+3TC+nelfinavir.

Figure 8 HIV PEP regimens prescribed where source HIV positive, six week reports, 1996-2004



Proportion (%) = the number of reports received as a proportion of six week reports where the HCW has commenced HIV PEP (n=402).

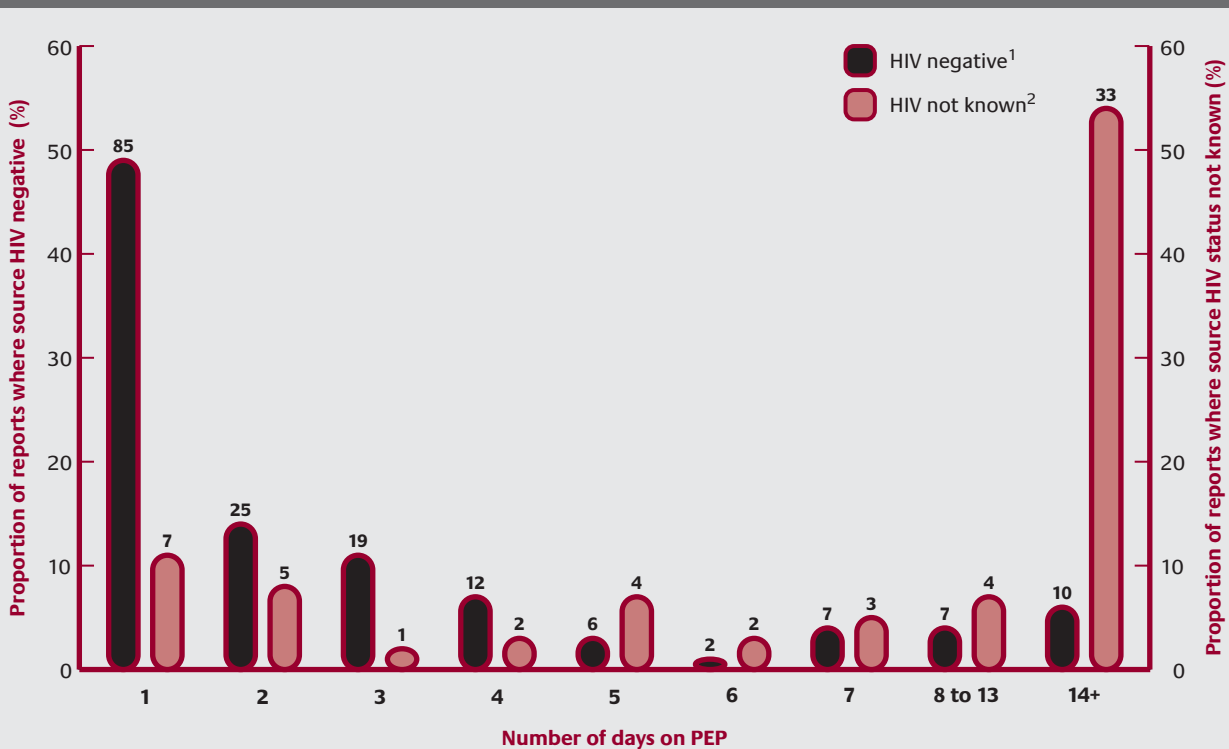
¹These include records where the original regimen prescribed was subsequently amended and all drugs taken have been included in this category.

5.3 Length of time on HIV PEP, source HIV negative

Of the 290 HCWs exposed to a source patient of unknown HIV status, 81% (234/290) stopped or completed their course of HIV PEP and of these, where reported, 173 HCWs were subsequently found to have been exposed to an HIV negative source patient. Ninety percent (156/173) of the HCWs discontinued their PEP within seven days of commencement, with the majority of these [54% (85/156)] stopping within a day (Figure 9). In the remaining 17 cases, four HCWs completed the course. The reasons given in these cases were that the source patient was co-infected and an injecting drug user who was sharing needles up to the time of the HCW's exposure. Five cases stayed on HIV PEP for between 14 and 21 days because of source patient testing delay.

Other reasons given for staying on HIV PEP when the source is HIV negative, included source patients from countries where HIV was endemic (i.e. risk of being in the window period of infection). The above information is a basic measure of how soon a source HIV test was performed after the exposure and as HIV PEP drugs can have at times distressing side effects, timely testing of the source patient is essential to minimise unnecessary treatment and anxiety. Where reported, in 21% (61/290) the HIV status of the source remained unknown and these HCWs stayed on HIV PEP, with the majority [61% (37/61)] remaining on HIV PEP for eight days or more. No follow-up information on HIV PEP discontinuation was reported for 19% (56/290) of the exposed HCWs.

Figure 9 Number of days on HIV PEP where source HIV negative or of unknown HIV status, six week reports, 1996-2004



¹Proportion (%) = the number of reports received as a proportion of six week reports where the HCW had initiated HIV PEP, exposed to an HIV negative source and a time on PEP was provided (n=173).

²Proportion (%) = the number of reports received as a proportion of reports where the HCW had initiated HIV PEP, exposed to a source of unknown HIV status and a time on PEP was provided (n=61).

5.4 Time interval between exposure to initiation of HIV PEP

The EAGA guidelines on HIV post-exposure prophylaxis recommend that for 'optimal efficacy', HIV PEP should be commenced 'as soon as possible after the incident and ideally within the hour'.¹⁰ There were 692 six week follow-up reports where HIV PEP was initiated. This number includes six week reports of exposures with an unknown time interval from exposure to the commencement of HIV PEP, but where there was sufficient information, based on date of incident and date of starting HIV PEP, to assign a time interval as a proxy measure. Thus, if the date of starting HIV PEP was the same as that of the incident, 24 hours post-exposure was the maximum time difference assumed between the incident and initiation of HIV PEP; where the date of starting HIV PEP was the day after the incident, 48 hours was used. Using this proxy measure, of the 167 reports that originally had an unknown time to HIV PEP, 126 could be assigned a proxy time interval. Almost all fell between 24 and 48 hours post-exposure (only three had a time interval of >48 hours). Reports of exposures where there was no information on dates of incident and starting HIV PEP were excluded for the purposes of this analysis. Seventy-seven percent (501/651) of HCWs had initiated HIV PEP within 24 hours of exposure, of these 38% (190/501) were within one hour. The relatively small numbers of HCWs starting HIV PEP after 24 hours post-exposure is encouraging.

5.5 Key points

The observed seroconversion rate to HIV in HCWs sustaining significant occupational exposure to HIV positive source patients was 0.8% (1/122).

The majority of HCWs are started on HIV PEP within 24 hours of their exposure.

The proportion of HCWs on nelfinavir-based triple combination therapy, the recommended regimen in the UK for HIV PEP has increased relative to the 2003 reporting period.

6. Conclusions

Percutaneous exposures mostly with hollowbore needles, are the commonest injury sustained by HCWs reported to this surveillance scheme, with nurses carrying the largest burden of exposures, followed by the medical profession, in the occupational setting. These findings are consistent with observations in other European countries.^{11, 12}

There are still **too many** preventable occupational exposures occurring in the healthcare setting. Most of the exposures occurred in the ward, theatre, intensive care unit and A&E. The majority of these, such as exposures sustained whilst recapping needles or clearing clinical waste, are preventable with adherence to procedures for the safe handling of sharps and the disposal of clinical waste. Exposures in theatres and intensive care units, because of the complexity of procedures performed, tend to affect doctors disproportionately and injuries occur mainly during the procedure. These exposures may not be as easily preventable, but understanding the circumstances surrounding them affords the opportunity for developing effective targeted interventions and control measures over time.

The reported baseline sero-prevalence of 3% (4/134) for HCV among HCWs in the surveillance programme, is much higher than previously reported in the literature (0.21%¹³, 0.28%^{14,15}) and is likely to be an overestimate of the true background sero-prevalence. These data from the surveillance programme were based on a small sample and could have been looking at a different cohort of HCWs to those published in the literature.

This report has highlighted that seroconversions in HCWs **do** occur. Far from becoming complacent in the light of no further reported transmissions of HIV in the last five years, the importance of urgent reporting of any significant occupational exposures should continue to be stressed to HCWs and those providing occupational exposure management. Risk assessment of the incident, consent for testing of the source patient and appropriate management of the HCW are essential to protecting HCWs from HIV or HBV infection once an occupational injury has occurred. In the case of HCV, there is currently no vaccine or chemoprophylaxis. As a minimum, **appropriate** testing at the **correct** time intervals is important in facilitating the early detection of HCV infections, and prompt referral for specialist advice. It has been shown that HCWs who have recently seroconverted and are started on early treatment, within six months of their infection, go on to clear the virus and do not progress to chronic HCV.¹⁶

The European case control study on risk factors for HCV transmission after occupational exposure in HCW found a statistically significant association with deep injuries sustained with a hollowbore needle that had been placed in the source patient's vein or artery¹⁷.

The observations reported in the surveillance are consistent with the above risk factors. Most of the seroconversions involved hollowbore needles visibly contaminated with blood and percutaneous injuries.

There are still a high proportion of six week and six months forms where testing details are either not available or testing has been inappropriately managed. This lack of accurate data on testing runs the risk of missing HCWs who have been infected following their exposure, denying them the opportunity to benefit from early treatment. The fact that there have now been a total of nine HCV seroconversions reported demonstrates the importance of the appropriate management of occupational exposures to BBVs.

The term "significant" occupational exposure as used in the surveillance scheme relates to those injuries where the likelihood of transmission of BBVs following an injury is relatively high, such as in a penetrating injury with a sharp device, particularly a hollowbore needle. However, the definition of "significant" is subjective, varying from person to person and this may have an impact on the type of incidents that HCWs will report and also the way that departments who manage the incident will respond and report the incident to the surveillance system. By classifying injuries as "significant", could lead to misclassification of serious injuries as insignificant, risking a seroconversion going unnoticed, as a seroconversion illness is not always apparent.

The voluntary data collected through the surveillance system lacks the capacity for determining the risk factors necessary for a seroconversion to occur, such as viral load, genotype and the current health status of both the source and the HCW, especially in exposures to HCV-infected source patients. Further, the surveillance system as it stands does not take into account all those HCWs that are exposed to BBVs in the course of their employment in the healthcare system. This lack of denominator data (where the denominator is defined as the number of all occupational exposures to BBVs) makes it difficult to calculate the incidence and prevalence of all exposures to BBVs within the occupational health setting. A comprehensive sentinel surveillance system integrated into current occupational

and infection control Trust policies, based in a few Centres where every occupational exposure with the potential of exposing HCWs to BBVs, is reported, would provide valuable information for understanding the significance and burden of occupational exposures to the healthcare system. This information is vital in guiding the development of appropriately targeted intervention procedures in the prevention of exposures of HCWs to BBVs and possible seroconversions in the healthcare setting.

There are still injuries occurring which could be prevented with proper adherence to universal precautions and adequate education and training. HCWs should know the current protocols and guidance on what to do to avoid exposures and manage them when they occur. Employers have an obligation to provide easily accessible services to meet this. Further, exposures occurring during procedures could be reduced by the introduction of safety devices. Trusts have a duty to scan the market and be familiar with new technological advances in this area and to make use of them. Audit tools and the use of data generated by national surveillance of occupational exposures to BBVs in HCWs, play an important part in continually improving the quality of services provided at local level and in monitoring the implementation of national guidance. Some Centres have already developed and use their own audit tools, while several occupational health database companies have developed needlestick audit tools, now available to Centres.

7. Recommendations

The Health Protection Agency to proactively continue to improve data collection by encouraging better reporting by existing Centres, recruiting new Centres and forging closer links with virology and microbiology colleagues, especially on testing and reporting of results at local and national levels, and alerting the surveillance programme of any potential BBV seroconversions.

The Health Protection Agency to investigate the establishment of a sentinel surveillance system, designed to gain robust denominator data on occupational exposures to BBVs, initially through a pilot sentinel surveillance system supported by a full-time research nurse working in collaboration with the infection control team, the occupational health department and the virology services, in developing a model that would be rolled out to more Centres at the end of the pilot. There is currently no national system that runs a sentinel type surveillance system for collecting information on all occupational exposures in HCWs.

The current surveillance system is missing the opportunity of determining the risks of HCV seroconversion in HCWs following occupational exposure. It is believed that a comprehensive sentinel surveillance scheme would provide the opportunity to collect more detailed and specific risk information on all exposures as they occur, giving the surveillance system more facility for undertaking robust epidemiological studies on the risks of BBV transmission in the healthcare setting.

The prevention of exposures occurring during procedures is currently poorly understood. It is recommended that there should be improved data collection targeted at these injuries, to help in our understanding of the mechanisms involved and in developing better tools for intervention, such as safety devices. A robust sentinel surveillance system would be a powerful tool in also evaluating the effectiveness of such devices in the prevention of injuries to HCWs.

8. References

- ¹ Anon. Needlestick transmission of HTLV-III from a patient infected in Africa. *Lancet* 1984; **ii**: 1376-7
- ² CDSC. Surveillance of health care workers with occupational exposure to bloodborne viruses. *Commun Dis Rep CDR Wkly* 1998; **8**: 65, 68
- ³ Heptonstall J, Gill ON, Porter K, Black MB, Gilbert VL. Health care workers and HIV: surveillance of occupationally acquired infection in the United Kingdom. *Commun Dis Rep CDR Rev* 1993; **3**: R147-53
- ⁴ Ramsay ME. Guidance on the investigation and management of occupational exposure to hepatitis C. *Commun Dis Public Health* 1999; **2**: 258-62
- ⁵ HIV Post-Exposure Prophylaxis: Guidance from the UK Chief Medical Officers' Expert Advisory Group on AIDS. Department of Health, July 2000
- ⁶ Expert Advisory Group on AIDS and the Advisory Group on Hepatitis. Guidance for clinical health care workers: protection against infection with bloodborne viruses. London: UK Health Departments; 1998.
- ⁷ Henderson DK. Managing Occupational Risks for Hepatitis C Transmission in the Health Care Setting. *Clin Micro Rev* 2003; **16**: 546-68
- ⁸ Hawkins DA, Asboe D, Barlow K, Evans B. Seroconversion to HIV-1 following needlestick injury despite combination post-exposure prophylaxis. *J Infect* 2001; **43**: 12-5
- ⁹ Cardo DM, Culver DH, Ciesielski CA, Srivastava PU, Marcus R, Abiteboul D, et al. A Case-Control Study of HIV Seroconversion in Health Care Workers After Percutaneous Exposure. *N Engl J Med* 1997; **337**:1485-90
- ¹⁰ HIV Post-Exposure Prophylaxis: Guidance from the UK Chief Medical Officers' Expert Advisory Group on AIDS. Department of Health, February 2004
- ¹¹ Puro V, De Carli G, Petrosillo N, Ippolito G. Risk of exposure to bloodborne infection for Italian healthcare workers, by job category and work area. *Infect Control Hosp Epidemiol* 2001; **22**: 206-10
- ¹² Viazov S, Ross S. Hepatitis C virus infection in medical settings. *Viral Hepatitis* 2004; **12**: 20-2 (Viral Hepatitis Prevention Board).
- ¹³ Neal KR, Dornan J, Irving WL. Prevalence of hepatitis C antibodies among healthcare workers of two teaching hospitals. Who is at risk? *BMJ* 1997; **314**: 179-80
- ¹⁴ Thorburn D, Dundas D, McCrudden EAB, Cameron SO, Goldberg DJ, Symington IS, Kirk A, Mills PR. A study of hepatitis C prevalence in healthcare workers in the West of Scotland. *Gut* 2001; **48**: 116-20
- ¹⁵ Zuckerman J, Clewley G, Griffiths P, Cockcroft A. Prevalence of hepatitis C antibodies in clinical health-care workers. *Lancet* 1994; **343**: 1618-20
- ¹⁶ Jaeckel E, Cornberg M, Wedemeyer H, et al. Treatment of acute hepatitis C with interferon alfa-2b. *N Engl J Med* 2001; **345**:1452-7
- ¹⁷ Yazdanpanah Y, De Carli G, Miguères B, Lot F, Campins M, Colombo C, et al. Risk Factors for HCV Transmission after Occupational Exposure in Health Care Workers: A European Case-Control Study. Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC); Chicago, September 2003: poster no. 1087

Box 1 HCV exposure follow-up testing guidelines⁴

Known HCV infected source:	<ul style="list-style-type: none"> ● Obtain baseline serum for storage from healthcare worker ● Obtain serum/EDTA for genome¹ detection at six and 12 weeks ● Obtain serum for anti-HCV² at 12 and 24 weeks
Source known not to be infected with HCV:	<ul style="list-style-type: none"> ● Obtain baseline serum for storage from healthcare worker ● Obtain follow-up serum if symptoms or signs of liver disease develop
HCV status of source unknown:	<ul style="list-style-type: none"> ● Obtain baseline serum for storage from healthcare worker ● Designated doctor to perform risk assessment: <ul style="list-style-type: none"> – High-risk: Manage as a known infected source – Low-risk: Obtain serum for anti-HCV at 24 weeks

Source: Ramsay ME. Guidance on the investigation and management of occupational exposure to hepatitis C. *Commun Dis Public Health* 1999; 2: 258-62

¹Genome: HCV RNA reflects infectivity and the presence of replicating virus, this appears early on in the seroconversion phase, as early as 10 days.

²Anti-HCV: HCV antibodies reflect that the individual has been exposed to HCV but gives no information on infectivity or viral replication, and they appear 50-70 days following exposure.

Box 2 Summary of the Revised HIV Post-Exposure Prophylaxis Guidance from the UK Chief Medical Officers' Expert Advisory Group on AIDS (February 2004)

Headings	Key Points
Sharps Policy & Protocol: (24-hour cover)	Risk assessment Immediate access to advice on HIV PEP 24 hours, 7 days a week Baseline HCW serum stored for 2 years
Source patient	Universal approach to source patient testing for antibodies to HIV Consented and a blood sample obtained, and consider risk for HBV and HCV
Factors influencing transmission	Deep injury Visible blood on the device Needle from source patient's artery or vein Terminal HIV-related illness in source patient
Transmission rate: Low (from HIV +ve source)	3:1000 percutaneous <1:1000 mucocutaneous No risk where <i>intact</i> skin is exposed to HIV-infected blood
Drugs: (starter pack [3 days] of Triple therapy HIV PEP)	Zidovudine 250 or 300 mg b.d. Lamivudine 150 mg b.d. Nelfinavir 1250 mg b.d. (or 750 mg tds) <i>No antiretroviral drug has been licensed for HIV PEP, so must be prescribed on an 'off-label' basis only</i>
Timing of HIV PEP:	Ideally within an hour, but still consider if longer period (up to 2 weeks) has elapsed since incident
Follow-up:	HIV blood test six months after cessation of HIV PEP

Health Protection Agency

Centre for Infections
61 Colindale Avenue
London NW9 5EQ
United Kingdom

Tel +44 (0)20 8200 6868

Fax +44 (0)20 8200 7868

email: HIV/STI@hpa.org.uk

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