Occupational blood exposure accidents in the Netherlands

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Background: To make proper evaluation of prevention policies possible, data on the incidence and associated medical costs of occupational blood exposure accidents in the Netherlands are needed. Methods: Descriptive analysis of blood exposure accidents and risk estimates for occupational groups. Costs of handling accidents were calculated. Results: Each year, an estimated 13,000–15,000 blood exposure accidents are reported in the Netherlands, 95% in occupational settings. Hepatitis B (HBV) vaccination is offered free of charge only to people in risk groups, the seroprevalence of HBV, hepatitis C (HCV) and human immunodeficiency virus (HIV) is low and few infections are related to blood exposure accidents. High-risk accidents occur mainly in hospitals. In nursing homes and home care settings, the majority of the accidents are low-risk. Limited data are available about occurrence of accidents in other occupational groups. Associated medical costs from occupational blood exposure accidents are mainly determined by the initial risk management. Conclusions: Accidents must be managed effectively to prevent infection and reduce anxiety in injured employees. While strategies to reduce HCV and HIV infection should be primarily aimed at reducing the occurrence of high-risk accidents, vaccination can prevent HBV infection and cut the costs of handling low-risk accidents. The implementation of vaccination strategies, safe working policies and the proper use of safe equipment should be monitored better.

Keywords: needle stick accident, blood exposure, occupational health, prevention, costs.

Introduction

Background

Blood exposure accidents are accidents in which human blood or other infectious body fluids of a person enter the body of another by piercing, cutting, splashing or biting. These accidents can result in infection with hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV). Therefore, preventive measures and response to blood exposure accidents are necessary. Prevention of blood exposure accidents involves safe working procedures. Employers are obliged to assess work places in order to determine the risk of infection by biological agents (Article 4.85 of the Working Conditions Decree). In order to prevent such risks, preventive measures, such as safety equipment, have to be implemented. Moreover, HBV vaccination has to be offered to any employee who is moderately at risk of becoming infected with hepatitis B.

If, despite preventive measures, an accident does happen, employers must provide adequate medical assistance in order to minimize the risk of infection. To facilitate the management of blood exposure accidents, the National Institute for Public Health and the Environment (RIVM) published a 'National Guideline on Blood exposure Accidents'. In this guideline, blood exposure accidents are qualified as either high-risk or low-risk. In a high-risk accident a relatively large quantity of blood is possibly transferred, requiring measures to prevent the transmission of HBV and HIV and diagnostic follow-up for HCV infection in the injured. In a low-risk accident, the possible amount of blood transmitted is minimal, in which case only measures to prevent infection of HBV are required.

Adequate handling of blood exposure accidents requires reporting of the accident by the victim. However, international research shows that only half of the blood exposure accidents are reported. Medical professionals in particular have the tendency to trivialize these accidents. On the other hand, reactions to blood exposure accidents can also be highly emotional and fearful, leading to serious psychological problems and long-term sick leave.

Because there is no central registration of blood exposure accidents in the Netherlands, there is no understanding of the exact scale of the problem. In order to formulate policy, data are needed on the amount and nature of blood exposure accidents in the different work settings. The objective of this study was to summarize the current available knowledge. This may serve as a basis for recommendations for policy making and practice in the different work settings.

Methods

To outline the extent of occupational blood exposure accidents in the Netherlands, three different sources of data were used.
Infections due to blood exposure accidents

Published data from the National Institute of Public Health and the Environment (RIVM) concerning HBV, HCV and HIV surveillance in the Netherlands were used to describe the incidence of these infections in the Dutch community and the number of these infections caused by blood exposure accidents. Furthermore, unpublished data from the national surveillance system on infectious diseases (Osiris) were used.

Blood exposure accidents per occupational branch

Numbers of employees in the different occupational sectors were collected via websites of the different occupational branches and data from the National Office of Statistics (CBS) (table 1). Data on incidence and nature of blood exposure accidents in different occupational settings were collected using records of local hospitals and Municipal Health Services and national and international publications on blood exposure accidents in different Dutch populations. The same sources were used to gather data on the HBV immunization status of employees in different occupational settings.

On the basis of collected data and comparable international studies, a risk assessment was formulated for each occupational group.

Costs

The medical costs of blood exposure accidents are those incurred for risk assessment, post-exposure-prophylaxis for HBV and HIV, and diagnosis and early treatment of HCV. We calculated direct costs per blood exposure accident, assuming that an adequate response to the accident gives the victim full protection against infection with HBV or HIV. For HCV, we calculated the costs of treating HCV infection for 1 year after such an accident, based on the probability of infection actually occurring.

For high-risk accidents we calculated the costs of initial risk assessment, the costs of post-exposure-prophylaxis HBV multiplied by the risk of a HBV positive source, the costs of post-exposure-prophylaxis for HIV, multiplied by risk for a HIV positive source and the costs of early diagnosis and treatment of HCV for 1 year multiplied by risk HCV positive source and risk of infection (3%).

For low-risk accidents, we calculated the costs of risk assessment, the costs of post-exposure-prophylaxis of HBV multiplied by risk of a HBV positive source.

The cost of assessment and laboratory tests were added to the costs of treatment of an infection with HBV, HCV and HIV, according to the risk in the corresponding risk category.

Results

Extent of the problem in the Netherlands

Extrapolations of data from registers kept by Municipal Health Services and hospitals showed that 13 000–15 000 accidents are reported each year. Most blood exposure accidents in the Netherlands occur in the healthcare sector. In the northeast of Noord-Brabant, for example, this sector accounted for 85% of them between 2003 and 2005. In addition, 10% of reports are received from the police, fire fighting forces and other non-medical sectors and 5% were non-occupational.

Infections caused by blood exposure accidents

Hepatitis B

About 1800 cases of hepatitis B infections are reported in the Netherlands each year, most of them resulting from sexual contact or transmission of the virus from mother to child. An average of 10 to 20 cases annually is reported as being caused by a blood exposure accident.

Hepatitis C

Until 2003, both acute and chronic hepatitis C infections were registered in the Netherlands. The incidence was about 500 cases a year, most of them caused by intravenous drug use or previous blood transfusions. Since 2003 only acute cases of hepatitis C infections have been registered, with a mean of 30 cases a year. In the Netherlands, only two cases of hepatitis C infections resulting from blood exposure accidents have been documented.

Occasionally, cases on acute hepatitis C infections are considered presumably to be caused by a blood exposure accident. In recent years, this has occurred on average once a year (Osiris, unpublished data).

HIV

In 2005, 1200 new HIV infections were reported, the majority of them caused by sexual contact. To our knowledge, no case of HIV infection has ever been reported that was the result of a blood exposure accident in the Netherlands. Data on worldwide numbers of HIV infections caused in this way are relatively limited.

Numbers and characteristics of blood exposure accidents in different work branches

Hospitals

About half of all occupational blood exposure accidents in the Netherlands, an estimated 6500 accidents annually, occur in hospitals. Van Wijk et al. found that 10 accidents per 100 FTEs per year occurred in their hospital. Statistics reveal that many of these accidents are likely to occur in operating theatres. Here, and in emergency wards, accidents are often categorized as high-risk. Relatively many high-risk accidents also occur in hospital laboratories and in dialysis wards. In absolute numbers, most accidents take place in nursing wards, although these often carry a low risk. Hospital employees indirectly involved with patient care (e.g. cleaning staff) may also be victims of blood exposure accidents.

Nursing and care homes, home care

Of all blood exposure accidents, 25% occur in nursing and care homes and the home care sector. Reported accidents are mainly low-risk, a high proportion involving insulin injections and lances to determine blood sugar levels in diabetes patients. Nursing and care staff run the highest risks of sustaining a blood exposure accident; in this group, one to two blood exposure accidents are reported for every 100 employees yearly. Vaccination levels for hepatitis B in this group of employees vary from 40 to 65%, those for larger institutions being higher than for smaller ones.

Mental healthcare

Special needs institutions, including addiction treatment centres. The number of blood exposure accidents reported by
<table>
<thead>
<tr>
<th>Year</th>
<th>Occupational sector</th>
<th>Number of institutions</th>
<th>Number of employees</th>
<th>Source</th>
<th>Number of exposures annually</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>General hospitals</td>
<td>88</td>
<td>176 000 employees, 113 000 involved in patient care</td>
<td><a href="http://www.nvz-ziekenhuizen.nl">www.nvz-ziekenhuizen.nl</a></td>
<td>10.6/100 FTE, 6500 in total estimated</td>
<td>Leentvaar et al.(^{21}), Regez et al.(^{22}), Van Wijk et al.(^{20})</td>
</tr>
<tr>
<td>2006</td>
<td>University hospitals</td>
<td>8</td>
<td>60 000 employees</td>
<td><a href="http://www.nfu.nl">www.nfu.nl</a></td>
<td>1.7/100 FTE</td>
<td>Vos et al.(^{23}), Van Wijk et al.(^{20})</td>
</tr>
<tr>
<td>2007</td>
<td>Nursing homes</td>
<td>324</td>
<td>400 000</td>
<td><a href="http://www.actiz.nl">www.actiz.nl</a></td>
<td>52/100 FTE</td>
<td>Vos et al.(^{23}), Van Wijk et al.(^{20})</td>
</tr>
<tr>
<td>2007</td>
<td>Care homes</td>
<td>960</td>
<td></td>
<td><a href="http://www.rivm.nl/vtv/object_map/o2174n35830.html">www.rivm.nl/vtv/object_map/o2174n35830.html</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nursing-cum-care homes</td>
<td>210</td>
<td>160 000</td>
<td><a href="http://www.ggzederland.nl">www.ggzederland.nl</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Home care institutions</td>
<td>248</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>Mental care institutions</td>
<td>165</td>
<td>135 000</td>
<td><a href="http://www.vgn.org/vgn/statpagina/showpagina.asp?pageid=2825wang=2&amp;style=1&amp;navitem=145">http://www.vgn.org/vgn/statpagina/showpagina.asp?pageid=2825wang=2&amp;style=1&amp;navitem=145</a></td>
<td></td>
<td>Unknown</td>
</tr>
<tr>
<td>2008</td>
<td>Psychiatric institutions</td>
<td>58</td>
<td>70 000</td>
<td><a href="http://www.ggzederland.nl">www.ggzederland.nl</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>specialised in addiction problems employing around persons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>Dental practices</td>
<td>8000</td>
<td>8000 dentists</td>
<td><a href="http://www.rivm.nl/vtv/object_document/o5550n20334.html">http://www.rivm.nl/vtv/object_document/o5550n20334.html</a></td>
<td>1.5/100 FTE</td>
<td>Van Wijk et al.(^{20}), Vos et al.(^{23})</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18 000 dental assistants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2000 oral hygienists</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2250 of which 500 work in hospitals</td>
<td><a href="http://www.nivel.nl/pdf/Cijfers-uit-de-registratie-van-verloskundigen-peiling-2007.pdf">www.nivel.nl/pdf/Cijfers-uit-de-registratie-van-verloskundigen-peiling-2007.pdf</a></td>
<td></td>
<td>Unknown</td>
</tr>
<tr>
<td>2008</td>
<td>Midwives' practices</td>
<td>1350</td>
<td>2250 of which 500 work in hospitals</td>
<td><a href="http://www.nivel.nl/pdf/Cijfers-uit-de-registratie-van-verloskundigen-peiling-2007.pdf">www.nivel.nl/pdf/Cijfers-uit-de-registratie-van-verloskundigen-peiling-2007.pdf</a></td>
<td></td>
<td>Unknown</td>
</tr>
<tr>
<td>2008</td>
<td>General practitioners' practices</td>
<td>4500</td>
<td>8400 doctors</td>
<td><a href="http://home-open2.lhv.nl/resources/AMGATE_10899_1_TICH_R7031031402998/">http://home-open2.lhv.nl/resources/AMGATE_10899_1_TICH_R7031031402998/</a></td>
<td>225–450 estimated</td>
<td>Van Wijk et al.(^{20})</td>
</tr>
<tr>
<td>2008</td>
<td>Pharmacies</td>
<td>2000</td>
<td>12 000 doctors' assistants</td>
<td><a href="http://www.nvda.nl/?page_id=9&amp;PHPSESSID=ae17c107d76b2a2e5079ed3d6b0a16791">www.nvda.nl/?page_id=9&amp;PHPSESSID=ae17c107d76b2a2e5079ed3d6b0a16791</a></td>
<td></td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5000 pharmacists</td>
<td><a href="http://www.sfk.nl/publicaties/2008denf.pdf">www.sfk.nl/publicaties/2008denf.pdf</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>23 000 pharmacy assistants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>Regional police forces</td>
<td>25</td>
<td>49 000</td>
<td><a href="http://www.politie.nl">www.politie.nl</a></td>
<td>0.68–0.81/100FTE</td>
<td>Sonder et al.(^{27}), Van Wijk et al.(^{20})</td>
</tr>
<tr>
<td>2008</td>
<td>Prison (penitentiaries)</td>
<td>85</td>
<td>18 000</td>
<td><a href="http://www.dji.nl/Organisatie/paragraph1">http://www.dji.nl/Organisatie/paragraph1</a></td>
<td>1.06/100 FTE</td>
<td>Van Wijk et al.(^{20})</td>
</tr>
<tr>
<td>2008</td>
<td>Fire fighting forces</td>
<td>27 000 persons.</td>
<td>About 4500 are employed professionally, the rest being volunteers</td>
<td><a href="http://www.brandweer.nl">www.brandweer.nl</a></td>
<td>1.06/100 FTE</td>
<td>Unkonwn</td>
</tr>
<tr>
<td></td>
<td>Regional</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Municipal</td>
<td>425</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FTE, Full time equivalent
mental care institutions is limited, i.e. 2.5% of all such accidents, most of these being low-risk.18,20 Van Wijk et al. concluded that behavioural problems and aggression can result in accidents involving biting and scratching. Furthermore, employees in mental care institutions often work with patients who have an increased risk of carrying HBV, e.g. patients with Down syndrome or patients who have an increased risk of carrying HBV, HCV or HIV, such as intravenous drug users.18,24 Levels of vaccination for employees are not optimal.14

Dental practices
About 3% of all blood exposure accidents in the Netherlands occur in dental practices.14,23 Activities that involve risk are the administering of injections and, to a lesser degree, cleaning dental instruments. The incidence of blood exposure accidents in the dental profession is not properly documented. In a regional study, Bekkers concluded that the level of HBV in employees in this sector is high.25

Midwives’ practices
About the incidence of blood exposure accidents in midwives’ practices, no exact figures are known, neither about the total number of blood exposure accidents nor the number of blood exposure accidents per FTE. Specific accidents in this sector are ones involving splashing during childbirth and blood exposure accidents that occur during episiotomies and stitching.26 The current level of vaccination among midwives is unknown.

General practitioners’ (GP) practices
No exact data are available about the total number of blood exposure accidents in these practices or the number of such accidents per employee.14 Given the nature of the work, accidents that occur in GP practices would be mainly low-risk.14 The level of vaccination among GPs and doctors’ assistants does not appear to be optimal.25

Other medical settings
Although accidental blood exposures may occur in other healthcare setting such as occupational health and safety services, vaccination centres for travellers, Municipal Health Services and pharmacies, these organizations are not listed separately in the registers, meaning that there are no figures available about the incidence of blood exposure accidents.

Occupational risks in non-medical sectors

Police
The police account for about 2% of all blood exposure incidents that occur in the Netherlands.14 Exposure is mainly the result of biting incidents (43%) and the blood of arrestees coming into contact with the eyes, mouth or open wounds of officers (36%). Only in 10% of cases are incidents caused by a needle or other sharp object.27 Aggression is often involved and officers often have to deal with persons who are at an increased risk of carrying HBV, HCV or HIV.14 The probability of a police officer having an accident during an arrest is estimated at 0.5–1% per year.27

Penitentiaries
The total number of blood exposure accidents in penitentiaries appears to be similar to that sustained by the police.14 The probability of a penitentiary employee having such an accident is estimated at 1% per year.14

Fire fighting forces
No data are available about blood exposure accidents among fire fighters. Accidents are reported occasionally, most of them involving resuscitation. International studies do not demonstrate any higher incidence of hepatitis B infections in fire fighters than among the general population.28,29

Cleaning staff and public gardening
An estimated 2% of all blood exposure accidents occur in these sectors, affecting cleaning personnel in particular.14 Blood exposure accidents occur to a large extent in healthcare institutions and, to a lesser extent, in public facilities. Typical for such accidents is that the needles in question have often been discarded, i.e. are part of waste matter, meaning that the source is nearly always unknown. This produces heightened anxiety—particularly when accidents occur in public facilities—given the possibility that the source may belong to a high-risk group for HIV. Responses to blood exposure accidents are not optimal in these settings.30

Body care (pedicure, manicure, beauty salons, piercings)
Although sharp instruments are applied to bodies in this sector, such accidents are scarcely reported.14

Costs of blood exposure accidents
Basic assumptions were made on the risk of positive sources for HBV, HCV and HIV in the Dutch population, these are 0.2, 0.25 and 0.05%, respectively,8,9,18 and the risk of transmission of one of these viruses with a high-risk accident with a positive source, these were estimated on 30, 3 and 0.3%, respectively.4,12 For low-risk accidents involving a vaccinated person, it is sufficient to assess the accident. The costs of a single consultation are estimated at €65. Assessing a low-risk accident involving an unvaccinated person is slightly more complicated. Following the initial assessment, measures are required to prevent hepatitis B infection. In practice, this almost always means vaccination followed by blood testing, resulting in of €240.

The estimated costs of a high-risk accident sustained by a vaccinated person are €317.40, if the source cooperates with testing. This includes the costs of assessing the accident and laboratory testing of the source (€310) and, taking into account the probability of the source being HIV-positive, the cost of post-exposure prophylaxis (PEP) to prevent HIV infection (€2.65) and, if necessary, the treatment of HCV (€2.50) and, taking into account the probability of the source being HCV-positive, the cost of follow-up testing for HCV (€2.50) and, if necessary, the treatment of HCV (€2.25). If the source does not cooperate or is unknown, the costs are considerably higher because follow-up testing for HCV and HIV is required twice. Moreover, if the source belongs to a high risk group for HIV, PEP also has to be initiated. For an unvaccinated victim there is also the cost of preventing HBV infection. If the source cooperates this is €25.60, for laboratory testing. If not, or if the source is unknown or HBV positive, it is €300, for administering HBIG and vaccination (table 2).

Discussion

General methods
As The Netherlands has no central system for registering blood exposure accidents, data on blood exposure accidents within most occupational sectors, except for hospitals, are limited. Different sources had to be used to estimate...
Occupational blood exposure accidents in the Netherlands

Table 2 Estimated medical costs of blood exposure accidents per accident in the Netherlands

<table>
<thead>
<tr>
<th>Kind of accident and measures*</th>
<th>Cost (€)</th>
<th>Total (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-risk accidents with successfully HBV immunized</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>In low-risk accidents with a successfully immunized injured only one consultation is needed</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>No additional measures for prevention of HCV en HIV are needed. Costs of intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-risk accidents with non HBV immunized injured</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>HBV vaccination plus lab testing titre</td>
<td>175</td>
<td></td>
</tr>
<tr>
<td>High-risk accidents with successfully immunized injured</td>
<td>317.40</td>
<td></td>
</tr>
<tr>
<td>Consultation and laboratory testing source: (2, 5 × consultation, lab testing HCV en HIV)</td>
<td>310</td>
<td></td>
</tr>
<tr>
<td>Risk for HBV infection is nil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCV-RNA costs for follow-up</td>
<td>2.50</td>
<td></td>
</tr>
<tr>
<td>HCV: calculation costs HCV infection</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td>HIV: calculation costs PEP</td>
<td>2.50</td>
<td></td>
</tr>
<tr>
<td>High-risk accidents with non HBV immunized injured</td>
<td>616.35</td>
<td></td>
</tr>
<tr>
<td>Consultation and laboratory testing source: (2, 5x consultation, lab testing HCV en HIV)</td>
<td>310</td>
<td></td>
</tr>
<tr>
<td>HBV: HBV immunoglobulines €125¹ plus HBV vaccination plus lab testing titre (€175);</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>HCV-RNA costs for follow-up</td>
<td>2.50</td>
<td></td>
</tr>
<tr>
<td>HCV: calculation costs HCV infection</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td>HIV: calculation costs PEP</td>
<td>2.50</td>
<td></td>
</tr>
</tbody>
</table>

**Kind of accident and measures*  

- a: Loss of productivity due to doctors visit or sickness were not taken into account. In this calculations, it has been assumed that the source of the accident is known because the prevalence is taken into account. In practice, the costs for HCV-RNA testing are also made in case of a high-risk accident with an unknown source
- b: According to Dutch guidelines in a low-risk accident post-exposure prophylaxis of hepatitis B consists of vaccination only while in a high-risk accident post-exposure prophylaxis of hepatitis B consists of HB Ig and vaccination
- c: Costs HCV-RNA follow up per accident: €500 × 2 × risk of HCV positive source (0.25%)
- d: Costs HCV infection per accident: €30 000 × risk positive source (0.25%) × risk transmission (3%)
- e: Costs PEP per accident: €5308 × risk HIV positive source (0.05%)
- f: If the source tests HBSAg negative, HBV immunoglobulines are not indicated

**Extent and infections**

Extrapolation of aggregated data by the National Hepatitis Centre show that 13 000–15 000 blood exposure accidents occur in the Netherlands each year. However, underreporting of accidents is not taken into account. In a study of Van Gemert *et al.*, 81% of the interviewed healthcare workers (HCW) said always to report an accident and believed 55% of their colleagues to report their accidents. In an unpublished Belgian study of Leens *et al.*, in an annual check-up by the occupational health practitioner, employees were interviewed how often they were injured that year. Based on these numbers, it was concluded that 50% of all blood exposure accidents were not reported.

The prevalence of blood-born viruses in the Dutch population is low. In the mid 1980s, standard HBV was introduced for persons enrolled in health care. As a result, the majority of people (aside from perhaps older employees) who are at risk of sustaining blood exposure accidents are protected against hepatitis B. Before the vaccination policy was introduced, blood exposure accidents resulted in a higher incidence of transmission of HBV. 31

Only a few cases of occupational HBV infections are reported each year, even fewer HCV infections. Occupational HIV infection has never been reported in the Netherlands. This is in contrast with other countries with a higher prevalence, where more infections after blood exposure accidents have been reported. 5

**Occupational branches**

The majority of and most high-risk blood exposure accidents reported in the Netherlands occur in the hospitals. Research of exposures in Dutch hospitals show that these data are comparable with studies in several other countries, 5,12,33

HBV levels in the hospitals are high. Given the high incidence of high-risk accidents, low threshold reporting and risk-assessment facilities are necessary 24/7. From the perspective of prevention, it is important that every hospital registers and regularly evaluates all blood exposure accidents, including descriptive epidemiologic data such as setting, profession of the HCW, and reasons that lead to the accident. In addition to providing general information about blood exposure accidents, studies have shown that such registers can be used to issue specific instructions for safer working practices, modify work organization and, where necessary, introduce safe equipment. 12,34 Periodic inspections of responses to accidents and analyses of accidents, with appropriate measures taken as a result, are recommended.

A quarter of all blood exposure accidents occur in nursing and care homes and in the home care sector. These are mostly low-risk accidents. Given the high number of blood exposure accidents with insulin injections and blood sugar needles, specific information about the associated risks is indicated. Literature suggests that the devices used for blood sugar testing could be improved with regard to safety. 23

Furthermore, the HBV level in this sector could be improved. This would reduce future costs of blood exposure accidents, since low-risk accidents sustained by vaccinated employees would warrant no further response.

In the mental healthcare sector as well as the police and penitentiaries, blood exposure accidents, like in other countries mostly result from aggression. 35,36 Since employees in these sectors are often in close contact with sources that belong to high-risk groups for HBV, HCV and HIV infection, 8,16,18 it is of upmost importance that these sectors receive proper information about the risk of infection (with HIV in particular) following a blood exposure accident and vaccination. Furthermore, any initial response to any such accident should also include attention to the aggression to
which the victim has been exposed.\textsuperscript{7} Although employees working in mental institutions and addicts are encouraged to be vaccinated against hepatitis B, levels of vaccination in these sectors are not yet optimal.\textsuperscript{14} Vaccination of patients themselves can also help reduce the risk of employees being infected with the HBV.\textsuperscript{36}

Data about blood exposure accidents in dental, midwives’ and GPs’ practices in the Netherlands are limited. Given the specific kinds of work done in these sectors, a better understanding is needed about the nature and circumstances of blood exposure accidents, so that information about safe working practices and work organization can be properly tailored to these professions. International studies in these sectors may help in finding solutions.\textsuperscript{26} Also, because of the sometimes hazardous actions required in these professions, employees should all be vaccinated, not only for their own protection but also to prevent their patients becoming infected.\textsuperscript{37}

In other areas of employment in which blood exposure accidents may occur, it is important that more data are gathered in order to properly identify the risks and, based on this, offer HBV.

**Costs**

We calculated a single blood exposure accident may cost between €65 and €20, assumed the source is tested for blood-borne diseases. Because blood exposure accidents result in relatively few infections, the resulting medical costs are mostly determined by the initial response and assessment. This was also found in other studies.\textsuperscript{38} Because circumstances and prices may differ, these costs are difficult to compare with other international studies. In our calculations, we also assumed HBV vaccination and PEP to be 100% effective, but this may not be the case. However, preventive vaccination makes dealing with low-risk accidents much simpler and thus cheaper. Conversely, high-risk accidents require no less than a comprehensive initial assessment including laboratory testing, followed if required by additional measures. Only the prevention of these high-risk blood exposure accidents—through safe working procedures and/or the use of safety systems—can bring about substantial cost savings.

Not included in the cost calculations is the employment time loss because of visits to doctors to deal with blood exposure accidents and incapacity for work as a result of HBV, HCV or HIV infection. Loss of employment time can be achieved by training skills, organizing work properly and using safer equipment. The impact of safe working devices and policies and the proper use of safe working devices should be monitored better.

**Conclusions and recommendations**

An estimated 13,000–15,000 of such accidents are reported in the Netherlands every year. The actual number is probably twice as high. Although the number of infections resulting from blood exposure accidents in the country is low, continued alertness to the prevention and adequate management of blood exposure accidents is still crucial. Apart from prevention of infection also the preservation from anxiety and uncertainty on the part of employees is important.

In order to prevent health damage through blood exposure accidents, proper information about safe working practices is extremely important. Hepatitis B can be prevented effectively through vaccination. This would eliminate the need for any response to low-risk accidents. As to high-risk accidents, the risk of infection with HCV and HIV can only be further reduced by lowering the occurrence of such accidents. This can be achieved by training skills, organizing work properly and using safer equipment. The impact of safe working devices in hospitals in the Netherlands should be further studied.

In all sectors it must be ascertained that timely and adequate attention is being paid to the above, if necessary followed by the measures indicated.

Adequate HBV vaccination strategies, together with 24/7 available reporting facilities, can reduce unnecessary delay and costs.

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**Key points**

- Ninety-five percent of reported blood exposure accidents in the Netherlands occur in occupational settings.
- Although few infections are related to blood exposure accidents, accidents must be managed effectively to prevent infection and reduce anxiety in injured employees.
- Limited data are available about occurrence of accidents in occupational non-healthcare related groups.
- Associated medical costs from occupational blood exposure accidents are mainly determined by the initial risk management.
- The implementation of vaccination strategies, safe working policies and the proper use of safe equipment should be monitored better.

**References**


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