ORIGINAL ARTICLE

Registration of Blood Exposure Accidents in the Netherlands by a Nationally Operating Call Center

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OBJECTIVE. Healthcare providers and other employees, especially those who do not work in a hospital, may not easily find help after the occurrence of a blood exposure accident. In 2006, a national call center was established in the Netherlands to fill this gap.

METHODS. All occupational blood exposure accidents reported to the 24-hours-per-day, 7-days-per-week call center from 2007, 2008, and 2009 were analyzed retrospectively for incidence rates, risk assessment, handling, and preventive measures taken.

RESULTS. A total of 2,927 accidents were reported. The highest incidence rates were reported for private clinics and hospitals (68.5 and 54.3 accidents per 1,000 person-years, respectively). Dental practices started reporting incidents frequently after the arrangement of a collective financial agreement with the call center. Employees of ambulance services, midwife practices, and private clinics reported mostly high-risk accidents, whereas penitentiaries frequently reported low-risk accidents. Employees in mental healthcare facilities, private clinics, and midwife practices reported accidents relatively late. The extent of hepatitis B vaccination in mental healthcare facilities, penitentiaries, occupational health services, and cleaning services was low (<70%).

CONCLUSION. The national call center successfully organized the national registration and handling of blood exposure accidents. The risk of blood exposure accidents could be estimated on the basis of this information for several occupational branches. Targeted preventive measures for healthcare providers and other employees at risk can next be developed.

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Healthcare providers and other employees who are susceptible to blood exposure accidents, such as needle stick, cutting, biting, or spatter accidents, run a risk of contracting blood-transmittable disorders, such as hepatitis B virus (HBV) infection, hepatitis C virus (HCV) infection, and human immunodeficiency virus (HIV) infection.[1-3] Inadequate care after a blood exposure accident can raise concerns and, in some cases, can have severe medical consequences.[1-5] The Dutch guideline for the handling of blood exposure accidents was published in 2007 and describes the risks associated with blood exposure accidents and the necessary medical interventions.[6] In addition to estimation of the risk of transfer of a blood-transmittable disorder, laboratory blood testing may be necessary for the person involved as a potential source. Crucial points in this process are letting the injured individual know when action is required and where he or she can turn for this. Obtaining permission from the source, performing blood testing, and conducting preventive measures in a timely manner all require professional support, because it may be difficult to organize these activities within time limits, especially for people outside of the hospital setting.[7,8]

Blood exposure accidents are usually work related and should therefore, strictly speaking, be covered by social legislation and not regular care.[7] Hospitals, where approximately 50% of blood exposure accidents occur, often have their own protocols for the handling of such accidents.[9] However, even in the Netherlands—and despite the presence of the necessary facilities, which include a laboratory with 24-hour service and expertise—the quality of the treatment for blood exposure incidents is not always adequate or consistent.[9] For those accidents that occur outside of the hospital, moreover, the necessary facilities are not always available.[9]

To provide the necessary support for individuals who experience blood exposure accidents outside of the hospital, a call center for blood exposure accidents was established in 2006 by a nationally operating occupational health service. On the basis of the Dutch national guidelines, the staff at this center provide a risk estimate, advice, and guidance with regard to the measures to be taken by the injured individual.[6] The national guidelines make an arbitrary distinction between low- and high-risk accidents. For low-risk accidents with no visible amount of blood, only protection from HBV is ad-

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vised. For high-risk accidents that involve a significant amount of blood exposure and a corresponding risk of transmission of HBV, HIV, and HCV, in contrast, a much more elaborate approach is required.[6] Depending on the severity of the risk, additional healthcare personnel located in the same region as the injured individual may be requested to draw blood or administer postexposure medication. In this article, the registration and handling of incidents by the call center during the period 2007–2009 is reported.

METHODS

The call center, which began operation in 2006, involves a team of occupational nurses who are available on a 24-hours-per-day, 7-days-per-week basis. The staffs of affiliated institutions are informed of the blood exposure accident policy of the center, which is in accordance with the Dutch protocol (Tables 1 and 2). Risk estimation, the handling of accidents, the registration procedure, and the follow-up on accidents are all part of the center's protocol for the handling of blood exposure accidents.[6] The nurses at the call center are supported by a backup team of medical microbiologists. For both accidents that cannot be handled in accordance with the protocol and accidents that require medical intervention, this backup team is consulted. Postexposure prophylaxis (PEP) is prescribed by the medical backup team after consultation with an HIV treatment specialist. Arrangements are also made with HIV treatment specialists for follow-up with this group of injured individuals. Local agreements are made with laboratories and emergency services in the different regions of the Netherlands to be able to draw blood, conduct laboratory analyses, and administer prophylactic vaccination or treatment (hepatitis B vaccination, hepatitis B immunoglobulin [HBIg], and PEP). Hepatitis B vaccination is administered to immune-competent persons as protection after an incident if the HBV status of the source is unknown and to improve vaccination coverage in healthcare workers with a recurrent risk. HBIg is administered to persons with reduced reactivity to the vaccine, such as persons greater than 50 years of age, after an accident in which the HBV status of the source is unknown (Table 2).

Source patients are asked to undergo blood tests in cases involving low-risk incidents in which the source patient cannot be protected by vaccination; in cases involving high-risk incidents, source patients are asked to undergo additional testing for HCV and HIV. When necessary, follow-up arrangements are also made for the injured individual through the occupational health service or a general practitioner to monitor possible seroconversions of blood-borne diseases. All

TABLE 1. Risk Assessment Based on the Nature of the Injury

	Risk of transmission			
Risk accident	Overall estimate	HBV	HCV	HIV
Blood on intact skin	None	None	None	None
Blood stain on superficially damaged skin (eg, active eczema and fresh scrapes)	Low	Low	Negligible	Negligible
Blood in open wounds (eg, stab wounds and cuts)	High	High	Low	Low
Blood or blood-contaminated fluid on mucous membrane	High	High	Low	Low
Other potentially infectious fluid on mucous membrane	Low	Low	Negligible	Negligible
Bite wounds, risk for the person bitten (saliva of perpetrator in the wound of the person bitten)	Low	Low	Negligible	Negligible
Bite wounds occurring during a fight, risk for the person bitten (saliva mixed with blood)	High	High	Low	Low
Bite wounds, risk for perpetrator (blood of the person bitten on mucous membrane of the mouth of the perpetrator)	High	High	Low	Low
Superficial skin injury of the victim with no visible blood (scratch)	None	None	None	None
Injury involving a needle used for subcutaneous injection (insulin/heparin)	Low	Low	Negligible	Negligible
Injury involving a needle used for intramuscular injection (without visible blood from the source)	Low	Low	Negligible	Negligible
Injury involving a needle used for intramuscular injection (with visible blood from the source)	High	High	Low	Low
Injury involving a suture needle used for an intracutaneous or subcutaneous procedure (with visible blood from the source)	Low	Low	Negligible	Negligible
Injury involving a suture needle used for a procedure other than those specified above or involving a suture needle when blood from the source is visible	High	High	Low	Low
Injury involving needle or lancet used for a finger prick test (glucose test)	High	High	Low	Low
Percutaneous injury other than those specified above (eg, infusion needle and operating room equipment)	High	High	Low	Low

NOTE. Summary of the Dutch national guideline on needle stick injuries.[6] HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus.

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TABLE 2. Measures to Be Taken to Protect Individuals Who Experience Blood Exposure Accidents

Virus, accident classification	Source tested positive	Serostatus source unknown and high risk of a seropositive source	Serostatus source unknown and low risk of a seropositive source	Source tested negative
HBV				
High-risk accident	Administer HBIg and vaccination;[a] test anti-HBs titer after vaccination	Administer HBIg and vaccination;[a] test anti-HBs titer after vaccination	Administer vaccination;[b] test anti-HBs titer after vaccination	No actions required[c]
Low-risk accident	Administer vaccination;[b] test anti-HBs titer after vaccination	Administer vaccination;[b] test anti-HBs titer after vaccination	Administer vaccination;[b] test anti-HBs titer after vaccination	No actions required[c]
HCV				
High-risk accident	Test for HCV RNA at months 1 and 3[d]	Test for HCV RNA at months 1 and 3[d]	Test for HCV RNA at months 1 and 3[d]	No actions required
Low-risk accident	No actions required	No actions required	No actions required	No actions required
HIV				
High-risk accident	Administer PEP and test for antibodies to HIV at months 3 and 6	Administer PEP and test for antibodies to HIV at months 3 and 6	No PEP indication; test for antibodies to HIV at months 3 and 6	No actions required
Low-risk accident	No actions required	No actions required	No actions required	No actions required

NOTE. Summary of the Dutch national guideline on needle stick injuries.[6] Anti-HBs, anti–hepatitis B surface antigen; HBIg, hepatitis B immunoglobulin; HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus; PEP, postexposure prophylaxis.

[a] In a known nonresponder, HBIg must be administered twice with a 1-month interval instead of vaccination.

[b] In cases of increased risk of nonresponse to vaccination (eg, immunocompromise, age greater than 50 years, or increased risk of noncompliance), HBIg must be administered once in addition to vaccination. In known nonresponders, HBIg must be administered instead of vaccination.

[c] Even if a source has test results negative for hepatitis B surface antigen, there is an indication for vaccination as a preventive measure. In nonoccupational situations, vaccination can be considered in case of a recurrent risk for the exposed individual.

[d] If HCV RNA testing is not possible for practical reasons, this can be replaced by testing for HCV antibodies in months 3 and 6.

accidents are evaluated by a staff member for the correctness with which they are handled one week after registration of their occurrence.

The call center can be approached by any affected employee on an ad hoc basis or on the basis of earlier contract. The costs are declared to the employer. For the results presented in this article, the number of accidents recorded by the call center for the years 2007, 2008, and 2009 were used.

For those institutions that were already affiliated with the center via a contract, the incidence numbers per occupational group (ie, branch) were calculated in terms of the number of reported blood exposure accidents and the estimated number of employees placed at risk. As part of the contract, affiliated institutions have to present data on the number of persons at risk at the institution.

Annual overall costs of the call center and costs per accident were calculated in Euros. The data were analyzed using SPSS software, version 17 (SPSS).

RESULTS

A total of 2,927 cases were registered and found available for analysis over a period of 3 years, including 547 cases in 2007, 1,125 cases in 2008, and 1,255 cases in 2009. Across the years, the frequency of reporting per occupational group was relatively constant, with the exception of accidents reported by dental practices. After the establishment of a collective agreement with the Dutch Dental Society, the number of registered cases increased from 95 in 2007 to 391 in 2008 and 386 in 2009. The absolute highest frequency of registered cases came from nursing and convalescent homes.

In Table 3, the total number of reported accidents along with the percentages of accidents by risk estimate, hepatitis B vaccination, and report within 4 hours of accident are presented. High-risk accidents were reported mostly by the employees of ambulance services, private clinics, midwife practices, occupational health services, hospitals, and general practices. Employees in the areas of care for the disabled, public health organizations, and midwife practices reported an incident relatively late; for these groups, less than 70% of the registrations were received within 4 hours. The degree of vaccination for hepatitis B was low in the areas of care for the disabled, pharmacies, penitentiaries, occupational health services, and cleaning services (<70%).

In Table 4, the estimated incidence figures for those at risk per occupational group are presented. The highest estimated incidence was for private clinics and hospitals, with 68.5 and

TABLE 3. Overview of Total Number of Accidents Reported and Number (%) of Accidents by Risk Assessment, Vaccination Coverage, and Reporting within 4 Hours

Occupational branch	Total no. of accidents	Risk estimate			HBV vaccination	Report within 4 hours
		High	Low	No risk		
Nursing homes	1,100	45 (4)	1,012 (92)	43 (4)	852 (77)	899 (82)
Dental offices	800	140 (18)	640 (80)	20 (3)	716 (89)	628 (79)
Mental institutions	246	35 (14)	184 (75)	27 (11)	191 (78)	193 (78)
Care for disabled	221	17 (8)	169 (76)	35 (16)	133 (60)	152 (69)
Hospitals	121	41 (34)	77 (64)	3 (2)	111 (92)	112 (93)
Home health care	107	2 (2)	102 (95)	3 (3)	82 (77)	83 (78)
Pharmacies	84	2 (2)	71 (85)	11 (13)	11 (13)	72 (86)
Penitentiaries	38	4 (11)	24 (63)	10 (26)	26 (68)	31 (82)
Municipal health care	32	1 (3)	31 (97)	0 (0)	30 (94)	28 (88)
General practitioners offices	30	9 (30)	21 (70)	0 (0)	28 (93)	29 (97)
Police force	25	5 (20)	16 (64)	4 (16)	18 (72)	20 (80)
Funeral care	23	1 (4)	22 (96)	0 (0)	21 (91)	21 (91)
Ambulance service	23	16 (70)	7 (30)	0 (0)	22 (96)	23 (100)
Occupational health care	18	7 (39)	8 (44)	3 (17)	11 (61)	14 (78)
Private clinics	16	8 (50)	8 (50)	0 (0)	14 (88)	11 (69)
Other professions[a]	14	2 (14)	9 (64)	3 (22)	2 (14)	10 (71)
Municipal institutions	10	1 (10)	9 (90)	0 (0)	1 (10)	6 (60)
Midwives	8	4 (50)	4 (50)	0 (0)	7 (88)	5 (63)
Cleaning services	7	2 (29)	5 (71)	0 (0)	2 (29)	7 (100)
Laboratories	4	1 (25)	1 (25)	2 (50)	4 (100)	4 (100)
Total	2,927	343 (12)	2,420 (83)	164 (6)	2,282 (78)	2,348 (80)

NOTE. HBV, hepatitis B virus.

[a] Security services, beauty salons, and civilians.

54.5 accidents expected per 1,000 person years, respectively. Of the 2,927 registered cases analyzed in our study, 243 involved employees with an employer who did not have a contract with the call center. In the 3-year study period, 183 employers with more than 145,000 employees at risk were affiliated with the call center.

In Table 5, the figures for the risk assessment and interventions undertaken for the reported blood exposure accidents are summarized. A total of 2,446 (83.5%) of the sources was known and willing to cooperate to fulfill the requirements of the protocol. Of the 164 source patients who were tested for HBV, 11 had positive results (0.4%). Of the 286 source patients tested for HIV and HCV antibodies, 7 (0.2%) had results that were positive for HIV, and 7 (0.2%) had results that were positive for HCV. Hepatitis B vaccination was advised on a total of 188 occasions, and HBIg administration was advised 41 times. Seventy HBV vaccinations and 28 HBIg administrations were arranged directly by the call center; in the other cases, the injured individual chose to make their own arrangements (eg, arrangements were made by the employer or general practitioner). Hepatitis B vaccination was advised for protection in cases in which there was an unknown source 69 times.

A total of 291 healthcare workers indicated at the first contact that they did not know their anti-hepatitis B surface antigen (anti-HBs) titer. Depending on the risk, testing was performed for anti-Hbs (51 cases), a booster with or without HBIg (3 and 61 cases, respectively) was given and subsequent titer measurement was performed, or the source was tested (28 cases). Many injured individuals ($n = 148$) who reported at first contact that they did not know their anti-HBs titer were eventually able to provide their titer results.

HIV PEP was administered 3 times. A total of 20 cases were enrolled for serologic follow-up to exclude seroconversion of HIV and HCV because the initial preventive measures were judged to be inadequate. However, during the follow-up, none of these individuals experienced seroconversion. The overall annual costs of the call center amounted to an estimated €250,000, €500,000, and €520,000 per year and €461, €449, and €415 per accident in 2007, 2008, and 2009, respectively.

DISCUSSION

Over a period of 3 years, the national call center recorded an increasing number of blood exposure incidents, which reached a total of 1,255 accidents in 2009 and an average of 976 accidents per year. The data presented here underscore the need for 24-hours-per-day, 7-days-per-week emergency consultation after work-related accidents that involve a risk of transfer of blood-transmittable disorders.

Employees at convalescent and nursing home branches, who represent the largest job group, reported the most accidents in absolute numbers, followed by employees in the

TABLE 4. Estimated Incidence of Blood Exposure Accidents for Those at Risk, by Occupational Branch (n = 2,598)

Occupational branch	Person years[a]	No. of accidents	Estimated incidence[b]	95% CI
Private clinics	277	19	68.6	44.3–104.6
Hospitals	1,400	76	54.3	43.6–67.4
Municipal health services	496	26	52.4	36.0–75.7
General practitioners	267	13	48.7	28.7–81.5
Laboratories	145	6	41.4	19.1–87.3
Funeral care	684	23	33.6	22.5–50.0
Midwifes (KNOV)	139	4	28.8	11.2–71.7
Other[c]	1,481	31	20.9	14.8–29.6
Dental offices (NMT)	48,322	775	16.0	15.0–17.2
Correctional institutions	1,869	23	12.3	8.2–18.4
Occupational healthcare	950	11	11.6	6.5–20.6
Nursing homes and home healthcare (ActiZ)	108,600	1,147	10.6	10.0–11.2
Mental institutions	37,217	232	6.2	5.5–7.1
Pharmacies (SBA)	15,801	59	3.7	2.9–4.8
Care for disabled (VGN)	68,890	214	3.1	2.7–3.6
Ambulance services (paramedics)	11,836	20	1.7	1.1–2.6
Cleaning services (OSB)	3,461	5	1.4	0.6–3.4
Total	301,834	2,684	8.9	8.3–8.9

NOTE. ActiZ, Organisatie van Zorgondernemers; CI, confidence interval; KNOV, Koninklijke Nederlandse Organisatie van Verloskundigen; NMT, Nederlandse Maatschappij tot Bevordering der Tandheelkunde; OSB, Ondernemersorganisatie Schoonmaak–en Bedrijfsdiensten; SBA, Stichting Bedrijfsfonds Apotheken; VGN, Vereniging Gehandicaptenzorg Nederland.

[a] Employees at risk.

[b] Per 1,000 person years.

[c] Civil services, refugee centers, and industrial companies.

dental branch. In dental practices, a tenfold increase in the number of accidents reported was observed after the establishment of a collective agreement. The observed increase in incident reporting after this agreement underscores the potential underreporting and neglect of care when the necessary facilities for reporting and consultation are either lacking or entail a cost for those involved. Figures regarding the frequencies of blood exposure accidents for specific occupational groups are scarce and strongly influenced by the availability of facilities for reporting such accidents.[6,10,11] The estimated incidence figures reported in this study were calculated on the basis of the number of employees reported to be at risk by employers in the various occupational branches. We found relatively frequent reports from public health branches.

In the Dutch national guidelines for the handling of blood exposure accidents, a distinction is made between low- and high-risk accidents.[6] In the case of high-risk accidents, possible transmission of HIV and HCV must be kept in mind and PEP prescription considered. These accidents require major care and proper treatment under considerable time pressure. A total of 11.7% of the reported accidents analyzed in our study were estimated to be high risk. Those who reported high-risk accidents included the employees of ambulance services, private clinics, midwife practices, occupational health services, hospitals, and general practices. One might therefore consider improving prevention policy aimed at specific high-risk actions per branch. Personnel from correctional institutions, where blood exposure incidents are frequently associated with violent situations, often unnecessarily report accidents that are without risk of blood-transmissible disease. This suggests that professional education to improve knowledge of actual risks may be of use.[12,13]

The registration of reported accidents by the call center and the feedback provided to employers after evaluation of all reported accidents can help to improve the quality of accident handling.[14] In an earlier study, we have also shown that, through improvements in logistics by the coordinating center, a considerable reduction in turnaround time for the management of an incident can be achieved.[8]

At the same time, the figures from the call center can be used to improve the national guidelines and tailor them to specific risks within specific branches, such as dental practices and penitentiaries.[15] There were also considerable differences between the occupational groups with regard to reporting speed. This finding also thus offers a point for improvement of the education within the relevant branches.

The extent of hepatitis B vaccination among the occupational groups with frequent exposure varied greatly. In the dental branch, the extent of vaccination was less than 90%; in the professional home care branch, it was less than 80%; and in the hospitals, it was 95%.

One of the starting points for the national guidelines was the push to reduce the use of HBIg in favor of hepatitis B vaccination.[6,16,17] HBV vaccination was advised a total of 188 times, and administration of HBIg was advised only 41 times. This is in accordance with our other studies, in which a

TABLE 5. Summary of Risk Assessment and Actions Taken, 2007–2009 (n = 2,927)

Variable	No. (%) of accidents
Risk estimation	
High-risk accidents	343 (11.7)
Low-risk accidents	2,420 (82.6)
No-risk accidents	164 (5.6)
Source patient	
Willing to cooperate	2,446 (83.5)
Tested for HBV	
Overall	164 (5.6)
Positive results	11 (0.4)
Tested for HCV	
Overall	286 (9.8)
Positive results	7 (0.2)
Tested for HIV	
Overall	288 (9.8)
Positive results	7 (0.2)
Injured individuals	
Vaccinated for HBV	2,282 (77.9)
Anti-Hbs titer	
<10	43 (1.5)
Unknown	291 (9.9)
Hepatitis B vaccination	
Advised	188 (6.4)
Executed	70 (2.4)
HBIg administration	
Advised	41 (1.4)
Executed	28 (1.0)
Reference serum	
Advised	22 (0.8)
Executed	15 (0.5)
Test anti-Hbs titer	
Advised	51 (1.8)
Executed	46 (1.6)
Appointment made for HBV vaccination	119 (4.1)
PEP protocol initiated	3 (0.1)

NOTE. anti-Hbs, anti–hepatitis B surface antigen; HBIg, hepatitis B immunoglobulin; HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus; PEP, postexposure prophylaxis.

reduction in HBIg administration was calculated after the introduction of the new Dutch national guidelines.[15]

Because the employers are responsible for the costs involved, the reporting of an accident may constitute an obstacle to the implementation of suitable and safe policy for the prevention of blood transmissible infections. The collective arrangement of a contract or, as in the case of dentists, insurance may offer a way out. The costs associated with handling accidents by a call center may initially seem high, but it should be considered that this is a 24-hours-per-day, 7 days-per-week service and that a call center reduces additional costs associated with sick leave and consultations with occupational practitioners. In the future, a thorough cost-benefit analysis could explain this further. A future cost effectiveness analysis might also help to convince employers that 24-hours-per-day, 7-days-per-week emergency consultation is effective. Employees should have no restrictions on reporting blood exposure accidents.

In conclusion, there is room for improvement with regard to the prevention of accidents, handling of accidents, and care after accidents in occupational groups in which employees are exposed to blood-transmittable disorders. The figures reported here can help to guide these improvements.

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