

Needlestick Injuries in European Hospital Nurses giving Injections to Patients with Diabetes

Costigliola V, Letondeur C, Frid A, Strauss K

Abstract

Introduction: With the June 2010 publication of EU Council Directive 2010/32 /EU scrutiny is now being focused on the safety and protection of diabetes nurses.

Methods: We used a questionnaire to study the frequency and risks of Needlestick Injuries (NSI) associated with diabetic injections in European hospitals. 634 nurses participated from 13 western European countries and Russia.

Results: When patients with diabetes who self-inject at home are hospitalized injections are given always by the staff in 31% of cases, by the patients themselves where possible in 33%, initially by staff, then the patient takes over in 12% and both staff and patient throughout the stay in 21%. 86% of nurses said their hospitals had a written policy on the prevention of NSI but, where it was available, only 56% were familiar with it. 67% of the nurses had not attended any training on the prevention of NSI and only 13% had attended one in the last year. 7.1% of nurses report recapping needles and 5.9% report storing unprotected needles temporarily on a tray, trolley or cart. 32% of nurses report suffering a NSI while giving a diabetic injection at some point in the past. 29.5% of NSI occurred while recapping a used needle. 57% of nurses unscrew pen needles using their own fingers. In 80% cases the source patient's identity was known and the sharp item was 'contaminated' (known previous percutaneous exposure to patient) in almost half the cases (43%). NSIs were reported to the proper authorities in only 2/3 of cases.

Conclusion: Our study shows that frequent NSI occur in European nurses treating people with diabetes in hospital settings. These injuries are a source of possible infection despite the small size of diabetes needles. The introduction of safety-engineered medical devices has been shown to reduce the risk of injury. A new European Directive that has now come into force specifically stipulates that wherever there is risk of sharps injury, the user and all healthcare workers must be protected by adequate safety precautions, including the use of 'medical devices incorporating safety-engineered protection mechanisms'.

Introduction

Needlestick injuries (NSI) are one of the most frequent occupational hazards faced by nurses, phlebotomists, doctors and other healthcare workers, as well as those working in downstream functions such as cleaning and waste disposal. Such injuries have the potential for transmitting at least 30 life-threatening blood-borne pathogens, including Hepatitis B (HBV), Hepatitis C (HCV) and HIV¹. Only 1/10,000 ml of infected plasma is required for HBV transmission², and many times this volume is present within the barrel or on the sides of medical sharps, including insulin needles.

A surprising number of NSIs occur after use, during the disposal process. HBV is stable in dried blood for at least seven days and HCV for at least 16 hours³, thus NSI with devices used previously can still be infectious. Not all healthcare workers (HCW) are covered by HBV vaccination; in fact the European range is from 30-90% depending on the country and branch of medicine⁴.

The June 2010 publication of EU Council Directive 2010/32 /EU, on the prevention of sharps injuries in the hospital and healthcare sector, highlighted the importance of consistently implementing mandatory measures to prevent these potentially fatal injuries. The directive must be implemented in all member states by 11 May 2013 at the latest. In accordance with a new EU Directive⁵ ⁶ and its transpositions into member state legislation, at-risk injections must be given with a safety-engineered device.⁷ This obligation covers all procedures in the hospital as well as those performed in distributed institutional settings (e.g. nursing homes, home health settings, ambulatory clinics).⁸

In the past some authorities have established a risk hierarchy where certain applications of medical needles have been considered to pose less threat than others⁹. This approach usually assumes that one class of devices (e.g. insulin syringes) represent a low risk compared to devices intended for vascular access or blood sampling. However, the most common devices involved in NSI are the syringe and needle.¹⁰ ¹¹ Scrutiny has now been

¹ European Parliament, Preventing needle-stick injuries in the health sector, 11th February 2010
<http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+IM-PRESS+20100210IPR68824+0+DOC+XML+V0//EN>

² Wittmann A, Köver J, Hofmann F, Kralj N. Übertragene Blutvolumina nach Nadelstichverletzungen an s.c. Kanülen, Dokumentations-CD-ROM über 49. Jahrestagung der DGAUM 2009: 382-384.

³ Risks of Dried Blood, Center for Disease Control, Atlanta, USA, 1995.

⁴ Prüss-Üstün A, Rapiti E, Hutin Y. Global burden of disease from sharps injuries to health-care workers; Environmental Burden of Disease Series, No. 3; World Health Organization Protection of the Human Environment Geneva 2003. Table 9, Hepatitis B vaccine coverage among health-care workers

⁵ Council Directive 2010/32/EU, Official Journal of the European Union, L134/71

<http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:134:0066:0072:EN:PDF>

⁶ EU Commission for Employment, Social Affairs and Inclusion, New legislation to reduce injuries for 3.5 million healthcare workers in Europe, 8th March 2010.

⁷ Article 3.2 says that where risk cannot be eliminated the employer shall take appropriate measures to minimise the risks.

Appropriate measures to minimise the risks would include the provision by employers of safer needle devices. (Cf. NHS Employers, Implementation advice on sharps agreement, 12th October 2010)

⁸ The Directive specifically requires: 'eliminating the unnecessary use of sharps by implementing changes in practice and *on the basis of the results of the risk assessment*, providing medical devices incorporating safety-engineered protection mechanisms.' Council Directive 2010/32/EU, Official Journal of the European Union, L134/71 and Council Directive 2010/32/EU, Official Journal of the European Union, L134/69.

⁹ Het verminderen van prikaccidenten door inzet van veiligheidssystemen, Dutch Nationaal Hepatitis Centrum, March 2009.

¹⁰ Perry J, Parker G, Jagger J. EPINet Report 2004. Percutaneous Injury Rate. International Healthcare Worker Safety Center. August 2007.

focused on the safety and protection of diabetes nurses and other professionals when they are administering treatment to their patients.

Is the diabetes specialist at risk? And is the risk they face more or less equivalent to that of their colleagues in other healthcare functions? Lee¹², in a survey of acute care nurses in the US, showed that NSI were very frequent amongst nurses working with diabetic patients. Kiss¹³ has shown that over 40% of NSI in nursing homes come from insulin pens.

The European Medical Association (EMA), in cooperation with BD, sponsored a questionnaire survey for European nurses who give injections to patients with diabetes in the hospital setting. The purpose of the survey was to assess the frequency and risks NSI associated with diabetic injections in Europe. The questionnaire was voluntary and completely anonymous and surveyed practice in 14 European countries. Here we report on the findings.

Methods

The English version of the questionnaire was validated initially by a group of UK diabetes nurse educators and was then translated into the languages of the other European countries. All versions of the questionnaire are available for review at www.wise-workshop.org. A full set of study results and by-country results are also available on this site.

Nurses who injected insulin and/or GLP-1 agents such as exenatide (Byetta™) or liraglutide (Victoza™) at least twice a week for more than 6 months in a hospital setting were invited to participate. Nurses consented to answer all the questions anonymously and were not remunerated for their participation. The study was performed from March to July 2011. Preliminary study findings were presented at the WISE (Workshop on Injection Safety in Endocrinology) meeting in Brussels, 13-16 October 2011.

SPSS software was used to perform the data analysis. Two-tailed tests were used in all analyses. Initially results from each of the 14 countries were analyzed independently and only when the distributions of key demographic parameters were shown to be comparable were all the data pooled into an overall database.

Results

Table 1 shows the countries and number of nurses who participated per country in the survey. 634 nurses participated from 13 western European countries and Russia. Most

¹¹ Watterson L. Sharp Thinking. *Nursing Standard*. October 2005; 20 (5): 20-22.

¹² Lee JM, Botteman MF, Nicklasson L, Cobden D, Pashos CL. Needlestick injury in acute care nurses caring for patients with diabetes mellitus: a retrospective study. *Curr Med Res Opin*. 2005 May;21(5):741-7.

¹³ Kiss P, De Meester M, Braeckman L. Needle stick injuries in nursing homes: The prominent role of insulin pens. *Infect Control Hosp Epidemiol* 2008; 29:1192-1194.

replies (69%) came from nurses on Endocrine/diabetes wards or Internal Medicine wards and most participants were currently injecting patients with diabetes at least twice a day. 623 nurse out of 634 (98%) had experience treating patients who used insulin pens at home and 541 nurses out of 634 (78%) had patients who used syringes at home, hence the majority of nurses were familiar with both devices.

Since most patients in Europe inject at home with an insulin pen while most hospital injections are given with a syringe, we asked, *How do patients who use a pen device at home receive injections when in hospital?* Table 2 shows the answers. Table 3 gives the results of the same question asked of patients who use a syringe at home.

When asked who gives the injections when a patient with diabetes is hospitalized the overall answers were: Always the staff (31%), the patient where possible (33%), initially staff, then the patient takes over (12%) and both staff and patient throughout the stay (21%). However, there were considerable differences by country (Table 4) with several southern European countries mainly entrusting staff to give the injections while northern European countries allowed the patients to give their own injections.

Overall 86% of nurses said their hospitals had a written policy on the prevention of NSI but, where it was available, only 56% were familiar with it. 67% of the nurses had not attended any training on the prevention of NSI and only 13% had attended one in the last year. Regarding sharps disposal, Table 5 shows the answers to the question, *What do you do with used needles or syringes immediately after use?* 7.1% of nurses report recapping needles and 5.9% report storing unprotected needles temporarily on a tray, trolley or cart.

Almost a third of nurses surveyed (32%) report suffering a NSI sometime in the past while giving a diabetic injection. The percentages by country are given in Table 6. Of those who received a NSI, 49% occurred with a conventional (non-safety) syringe, 44% with a conventional pen needle, 1.2% with a safety syringe and 0.4 with a safety pen needle. Nurses who had suffered a NSI with pen needles were asked which end of the needle caused the injury. Most of them were injured by the patient end of the needle but nearly 1 out of 10 reported being injured by the cartridge end. Table 7 lists the timing and circumstances for the NSIs. 29.5% of NSI occurred while recapping a used needle.

Removing pen needle is a critical and dangerous step because the user's fingers must come very close to the exposed tip. Nurses were asked how they performed this step and Table 8 shows the answers. 57% unscrew pen needles using their own fingers.

Nurses who had had NSIs rated them as 'superficial to moderate' (based on amount of resultant blood flow) in almost all cases (96%). In 80% cases the source patient's identity was known and the sharp item was 'contaminated' (known previous percutaneous exposure to patient) in almost half the cases (43%).

NSIs were reported to the proper authorities in 2/3 of cases. Table 9 shows the reasons given for not reporting a NSI. Nurses who had suffered a NSI were asked about the

actions taken immediately thereafter (Table 10). They were also queried about emotional consequences (Table 11).

Discussion

Our survey shows that nearly a third of European nurses have suffered a NSI in the past in the context of giving injections to patients with diabetes in the hospital setting. USA data from Lee¹⁴ showed that 78% of nurses had 'ever experienced a NSI' (all devices included) and that 30% of these came from insulin needles. Hence approximately 24% of USA nurses have suffered a NSI from giving diabetic injections, a figure similar to our own. These injuries put nurses at risk of blood-borne pathogens such as HBV, HCV and HIV.

Policies on safer practices are not in themselves effective in preventing NSI.¹⁵ When they are available nurses are often unfamiliar with them (29%) or untrained in NSI prevention (67%). Unsafe practices such as unscrewing pen needles with the hands and recapping continue to be practiced at high rates. Safety devices have been shown to significantly reduce the incidence of NSI.^{16 17 18 19}

Patients with diabetes may be a source for HCW of pathogenic viruses. According to one study²⁰, HBV DNA was discovered in 11% of type 2 patients with diabetes, compared to 3% of the control sample. Studies have shown very high effectiveness of HBV vaccination to prevent the development of hepatitis²¹. However a worrying proportion of European nurses (from 30-90% depending on the country)²² have not had HBV vaccination²³.

¹⁴ Lee JM, Botteman MF, Nicklasson L, Cobden D, Pashos CL. Needlestick injury in acute care nurses caring for patients with diabetes mellitus: a retrospective study. *Curr Med Res Opin.* 2005 May;21(5):741-7.

¹⁵ Adams D, Elliott T.S.J., Impact of safety needle devices on occupationally acquired needle stick injuries: a four-year prospective study. *J Hosp Infect* 2006;64:50-55.

¹⁶ Tarantola A, Golliot F, Astagneau P, Fleury L, Brucker G, Bouvet E; CCLIN Paris-Nord Blood and Body Fluids (BBF) Exposure Surveillance Taskforce. Four-year surveillance from the Northern France network, *Am J Infect Control.* 2003;31:357-63.

¹⁷ Cullen BL, Genasi F, Symington I, Bagg J, McCreddie M, Taylor A, Henry M, Hutchinson SJ, Goldberg D. Potential for reported needle stick injury prevention among healthcare workers in NHS Scotland through safety device usage and improvement of guideline adherence: an expert panel assessment. *J Hosp Infect* 2006;63: 445-451.

¹⁸ Meryl H. Mendelson, Bao Ying Lin-Chen, Lori Finkelstein-Blond, Eileen Bailey, Gene Kogan. Evaluation of a Safety IV Catheter (IVC) (Becton Dickinson, INSYTE™ AUTOGUARD™) : Final Report Eleventh Annual Scientific Meeting Society for Healthcare Epidemiology of America, 2001 SHEA, Toronto, Canada.

¹⁹ Louis N, Vela G, Groupe Projet. Évaluation de l'efficacité d'une mesure de prévention des accidents d'exposition au sang au cours du prélèvement de sang veineux. *Bulletin Épidémiologique Hebdomadaire* 2002;51:260-261.

²⁰ Demir M, Serin E, Göktürk S, Ozturk NA, Kulaksizoglu S, Ylmaz U. The prevalence of occult hepatitis B virus infection in type 2 diabetes mellitus patients. *Eur J Gastroenterol Hepatol.* 2008 Jul;20(7):668-73.

²¹ Michel ML, Tiollais P. Hepatitis B vaccines: protective efficacy and therapeutic potential. *Pathol Biol (Paris).* 2010 Aug;58(4):288-95.

²² Prüss-Ustün A, Rapiti E, Hutin Y. Global burden of disease from sharps injuries to health-care workers; Environmental Burden of Disease Series, No. 3; World Health Organization Protection of the Human Environment Geneva 2003. Table 9, Hepatitis B vaccine coverage among health-care workers

²³ De Schryver A, Claesen B, Meheus A, van Sprundel M, François G., Department of Epidemiology and Social Medicine, University of Antwerp, Antwerp, Belgium. European survey of hepatitis B vaccination policies for healthcare workers., *Eur J Public Health.* 2010 Sep, published at

<http://www.ncbi.nlm.nih.gov/pubmed?term=European%20survey%20of%20hepatitis%20B%20vaccination%20policies%20for%20healthcare%20workers>

The CDC has recently recommended mandatory HBV vaccination for patients with diabetes and has warned that many of them may have been infected in places where they undergo assisted blood glucose monitoring, with more than one person using the monitor.²⁴ The prevalence of HCV²⁵ among people with diabetes is also higher than the general population and that of HIV²⁶ is approximately equal. For the latter viruses no vaccination currently exists.

NSI with diabetes needles or lancing devices are one of the highest frequency sharps injury in the healthcare setting.²⁷ Some health care workers believe that because people with diabetes inject with short thin needles they represent little risk of injury. However, pen injection devices aspirate human cells back into the cartridge²⁸. These potentially infectious cells can then be deposited back into the needle and then transmitted accidentally through both ends should a NSI occur.

The results of Tables 7 and 8 indicate a high frequency of improper disposal of just-used sharps by nurses in hospitals and similar facilities, in the EU. Education on the seemingly innocuous practices of recapping needles, storing unprotected needles temporarily on a tray, trolley or cart and unscrewing used pen needles with one's hands would go a long way to reducing NSI risk. Nurses who experience a NSI may have to change their work routines and duties for varying periods following injury, often involving a prolonged and stressful period of not knowing whether they have contracted a life-threatening infection²⁹.

Currently a number of safety-engineered medical devices exist, including active devices (where the user manually activates a needle shield) or passive devices (which shield or retract the needle automatically after it has been deployed). Many diabetes nurses are unaware that these devices are available. A number of studies³⁰⁻³¹ have shown that NSI rates fall dramatically after safety devices are adopted. Acquisition costs may initially seem off-putting to healthcare organizations, yet a number of studies³²⁻³⁴ reveal that the prevention of injury usually leads to a positive return on investment.

²⁴ <http://www.internalmedicineneeds.com/single-view/poll-hepatitis-b-vaccine-recommended-for-adults-with-diabetes/7eff3bd28f.html> and <http://www.cdc.gov/vaccines/>

²⁵ Simó R, Hernández C, Genescà J, Jardí R, Mesa J. High prevalence of hepatitis C virus infection in diabetic patients. *Diabetes Care*. 1996 Sep;19(9):998-1000.

²⁶ Mondy K, Overton ET, Grubb J, Tong S, Seyfried W, Powderly W, Yarasheski K. Metabolic syndrome in HIV-infected patients from an urban, midwestern US outpatient population. *Clin Infect Dis*. 2007 Mar 1;44(5):726-34. Epub 2007 Jan 22.

²⁷ Kiss P, De Meester M, Braeckman L. Needle stick injuries in nursing homes: The prominent role of insulin pens. *Infect Control Hosp Epidemiol* 2008; 29:1192-1194.

²⁸ Le Floch JP, Herbreteau C, Lange F, Perlemuter L. Biologic material in needles and cartridges after insulin injection with a pen in diabetic patients. *Diabetes Care* 1998;21:1502-1504.

²⁹ See, for instance, *Nursing Times*, Why we must stop needlesick injuries, 3 October 2006

³⁰ Adams D, Elliott TS. Impact of safety needle devices on occupationally acquired needlestick injuries: a four-year prospective study. *J Hosp Infect* 2006;64:50-5.

³¹ Jagger J et al. The impact of U.S. policies to protect healthcare workers from bloodborne pathogens: The critical role of safety-engineered devices. *Journal of Infection and Public Health* (2008) 1, 62—71.

³² Armadans Gil L, Fernandez Cano MI, Albero Andres I, Angles Mellado ML, Sanchez Garcia JM, Campins Marti M, Vaque Rafart J. [Safety-engineered devices to prevent percutaneous injuries: cost-effectiveness analysis on prevention of high-risk exposure] *Gac Sanit* 2006 Sep-Oct;20(5):374-81.

<http://www.ncbi.nlm.nih.gov/pubmed/17040646>

³³ Anna H. Glennard ;Ulf Persson, Costs associated with sharps injuries in the Swedish health care setting and potential cost savings from needle-stick prevention devices with needle and syringe *Scandinavian Journal of Infectious Diseases*, Volume 41, Issue 4 2009 , pages 296 – 302.

<http://informahealthcare.com/doi/abs/10.1080/00365540902780232>

A new European Directive that has now come into force specifically stipulates that wherever there is risk of sharps injury, the user and all healthcare workers must be protected by adequate safety precautions, including the use of 'medical devices incorporating safety-engineered protection mechanisms'³⁵.

In conclusion our study shows that frequent NSI occur in European nurse treating people with diabetes in hospital settings. These injuries are a source of possible infection despite the small size of needles used in the management of diabetes. The introduction of safety-engineered medical devices has been shown to reduce the risk of injury. By May 2013, the EU Directive will make it compulsory to use such safety devices in all situations where there is significant risk of sharps injury and infection. In the meantime, many healthcare organizations across the EU are introducing safety devices for use by their staff in advance of that deadline in order to avoid financial, regulatory, reputational and human risk.

³⁴ NHS Scotland, Needlestick Injuries; Sharpen your Awareness, Annex 3, Safer Devices Cost Benefit Assessment.
<http://www.sehd.scot.nhs.uk/publications/nisa/nisa-13.htm>

³⁵ Council Directive 2010/32/EU, Official Journal of the European Union, L134/71
<http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:134:0066:0072:EN:PDF>

Duality of interest

KS and CL are employees of BD.

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Table 1: Countries and Nurses participating in survey

	Number	Percent	Cumulative Percent
Russia	68	10.7	10.7
Greece	20	3.2	13.9
NL	62	9.8	23.7
Belgium	41	6.5	30.1
France	37	5.8	36.0
Spain	113	17.8	53.8
Italy	59	9.3	63.1
Switzerland	12	1.9	65.0
UK	65	10.3	75.2
Denmark	17	2.7	77.9
Sweden	17	2.7	80.6
Germany	90	14.2	94.8
Ireland	12	1.9	96.7
Finland	21	3.3	100.0
Total	634	100.0	

Table 2: Device used and Primary Injector for Patients using Pens at home

<i>How do patients <u>who use a pen device at home</u> receive injections when in hospital?</i>	%
They continue on the pen and give their own injections	58.7
They continue on the pen but nurses give their injections	26.0
They are switched to syringes but they give their own injections	0.6
They are switched to syringes and nurses give their injections	10.8
Other	3.9

Table 3: Device used and Primary Injector for Patients using Syringes at home

<i>How do patients <u>who use a syringe device at home</u> receive injections when in hospital?</i>	%
They continue on the syringe and give their own injections	22,6
They continue on the syringe but nurses give their injections	34,6
They are switched to pens but they give their own injections	15,7
They are switched to pens and nurses give their injections	14,8
Other	12,4

Table 4: Percentage of diabetic injections given in hospital by the staff vs by patients themselves*

	Always the staff	Patient where possible
Russia	31.3	9.0
Greece	80.0	5.0
NL	3.2	59.7
Belgium	19.5	29.3
France	8.1	54.1
Spain	66.4	8.0
Italy	71.9	10.5
Switzerland	25.0	41.7
UK	4.7	65.6
Denmark	11.8	58.8
Sweden	5.9	47.1
Germany	19.1	40.4
Ireland	8.3	66.7
Finland	14.3	23.8

*percentages for each row do not add to 100 because other answer options were available; for all results see www.wise-workshop.org

Table 5: Disposition of used sharp immediately after use

<i>What do you do with used needles or syringes immediately after use?</i>	%
Put immediately into a sharps container	83.0
Store temporarily on a cart, trolley or tray, then dispose in sharps container	5.9
Recap needle and dispose of in sharps container	7.1
Clip the needle off and store in the clipping device	0.3
Throw needle in the rubbish	1.0

Table 6: Percentage of Nurses by Country who acknowledge suffering a NSI while giving injections to persons with diabetes

Russia	25.0%
Greece	55.0%
NL	23.0%
Belgium	19.5%
France	43.2%
Spain	39.8%
Italy	30.5%
Switzerland	33.3%
UK	15.4%
Denmark	29.4%
Sweden	50.0%
Germany	42.2%
Ireland	16.7%
Finland	40.0%
TOTAL	32.3%

Table 7: Timing and Circumstances of reported NSIs

<i>Did the injury occur?</i>	%
Before use of item	19.9
During use of item	13.0
Passing instruments	2.4
While recapping a used needle	29.5
While putting item into sharps container	16.1
After disposal (e.g. item protruding from opening of sharps container or piercing side of replaced cap)	3.1
Injured by patient holding the contaminated needle	2.1
Other	14.0

Table 8: Method for Removing Pen Needles after Use

<i>When changing pen needles how is the needle removed?</i>	%
I unscrew it with my fingers	57.3
The patient unscrews it	8.9
I unscrew it with an instrument such as clamps or tweezers	6.0
I use a specifically designed needle remover	7.3
I twist it off using the top of the sharps container	13.5
I do not remove it	1.0
Other	6.1

Table 9: Reasons given for not reporting NSIs

<i>If you didn't report the NSI, what was the reason?</i>	%
I didn't think the incident presented a health risk	67.3
I was too busy at the time	8.8
I was too embarrassed	2.7
I thought reporting might have negative repercussions for my job/career	0.9
I did not want to know the answer	0.0
Other	20.4

Table 10: Steps taken immediately after a reported NSI

<i>If you reported it, were you required to take any of the following steps?*</i>	%
Take prophylactic medication(s)	8.3
Have my blood taken for tests	79.5
Blood taken from the source patient to determine their sero-status	53.6
Change my working habits/department	12.3
Stop working for a time	2.4

***percentages add to more than 100 because several answers were possible**

Table 11: Emotional Consequences of NSIs

<i>Did any of the following occur after your accident?</i>	%
Depression, crying spells, sleep or eating abnormalities	3.1
Tension in family or marriage/partner relationships	0.8
Panic attacks, excessive worry, inability to work	2.7
Other emotional disturbances	6.6
No emotional disturbances	86.0