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Reducing needlestick injuries through safety-engineered devices: results of a Japanese multi-centre study

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SUMMARY

Background: Quantitative information on the effectiveness of safety-engineered devices (SEDs) is needed to support decisions regarding their implementation.

Aim: To elucidate the effects of SED use in winged steel needles, intravenous (IV) catheter stylets and suture needles on needlestick injury (NSI) incidence rates in Japan.

Methods: Japan EPINet survey data and device utilization data for conventional devices and SEDs were collected from 26 participating hospitals between 1 April 2009 and 31 March 2014. The NSI incidence rate for every 100,000 devices was calculated according to hospital, year and SED use for winged steel needles, IV catheter stylets and suture needles. Weighted means and 95% confidence intervals (CI) were used to calculate overall NSI incidence rates.

Findings: In total, there were 236 NSIs for winged steel needles, 152 NSIs for IV catheter stylets and 180 NSIs for suture needles. The weighted NSI incidence rates per 100,000 devices for SEDs and non-SEDs were as follows: winged steel needles, 2.10 (95% CI 1.66–2.54) and 14.95 (95% CI 2.46–27.43), respectively; IV catheter stylets, 0.95 (95% CI 0.60–1.29) and 6.39 (95% CI 3.56–9.23), respectively; and suture needles, 1.47 (95% CI −1.14–4.09) and 16.50 (95% CI 4.15–28.86), respectively. All devices showed a significant reduction in the NSI incidence rate with SED use ($P < 0.001$ for winged steel needles, $P = 0.035$ for IV catheter stylets and $P = 0.044$ for suture needles).

Conclusion: SED use substantially reduces the incidence of NSIs, and is therefore recommended as a means to prevent occupational infections in healthcare workers and improve healthcare safety.

Introduction

Healthcare workers are at high risk of bloodborne pathogen (BBP) infections as an occupational hazard.[1–3] While the pathogens of primary concern for BBP infections are hepatitis B virus, hepatitis C virus and human immunodeficiency virus (HIV), other pathogens such as dengue virus and malaria

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parasites also present the risk of infection through needlestick injuries (NSIs). Even when infections do not occur, NSIs can have severe and long-lasting psychological effects on healthcare workers.[4,5]

As a countermeasure to these threats, the US Occupational Safety and Health Administration issued the Bloodborne Pathogens Standard in 1991,[6] which provided guidelines to minimize or eliminate the risks of occupational exposure and BBP infection. In 2000, the specifications of this standard were adopted into legislation in the Federal Needlestick Safety and Prevention Act.[7] This legislation required the monitoring of NSI prevention efforts, and also mandated the implementation of safety-engineered devices (SEDs). In Europe, the European Parliament officially issued Directive 2010/32/EU on the prevention of sharps injuries in the hospital and healthcare sector in 2010.[8] The countries of the European Union were required to incorporate this directive into municipal law, and adopt preventive measures against NSIs for healthcare workers.

In contrast, Japan is lagging behind in legislating the prevention of occupational infections. In 2011, the Japanese Ministry of Health, Labour and Welfare encouraged the adoption of appropriate infection control measures targeting healthcare workers, including investigations into the implementation of safety equipment designed to prevent NSIs.[9] However, this announcement did not include any government directives, and therefore amounted to little more than a notification to healthcare institutions regarding the major points of consideration in infection control measures. In contrast to healthcare institutions in the USA and Europe, those in Japan are afforded full autonomy with regard to the implementation of SEDs. However, the healthcare working environment in Japan is by no means completely safe, with as many as 16.9% of nurses experiencing one or more NSIs from contaminated devices per year.[10]

Quantitative information on the effectiveness of SEDs is needed to support the decision-making process for Japanese authorities to legislate on device implementation. The lack of such information renders it difficult to justify the implementation of a compulsory SED promotion system, which would invariably generate additional costs for healthcare providers. However, only a few single-institution investigations on the effectiveness of SEDs have been conducted in Japan,[11,12] and there are no multi-centre studies with generalizable results. Therefore, the aim of this study was to elucidate the effects of SED use on the incidence of NSIs in Japan through a multicentre analysis.

Methods

Study design and participants

A multi-centre retrospective case–control study was conducted to examine the effects of SED use on the incidence of NSIs for every 100,000 devices. The target devices in this study were winged steel needles, intravenous (IV) catheter stylets and suture needles. All 1369 hospitals in Japan that employed at least one certified infection control nurse were asked to participate in this study. Participating hospitals were asked to submit NSI surveillance data voluntarily from the Japanese version of the Exposure Prevention Information Network (Japan EPINet), as well as device utilization data for both conventional (non-SED) devices and SEDs. The final analysis was conducted on 26 hospitals that had agreed to participate in the study and had provided both types of data.

Data collection and analysis

Japan EPINet survey data and device utilization data for conventional devices and SEDs were collected from the participating hospitals, and the data were merged according to hospital, year and SED use before analysis.

EPINet was originally developed in 1992 at the University of Virginia's International Healthcare Worker Safety Center.[13] The Japan EPINet surveillance system was introduced in 1996, and targets healthcare institutions throughout Japan.[14] At present, the Japan-EPINet Survey Working Group collects data continuously from approximately 100 HIV/acquired immunodeficiency syndrome (AIDS) referral hospitals. The group has also publicly released the Japan EPINet survey and data registration system to enable non-target hospitals to conduct their own independent surveillance. As a result, hospitals are able to conduct and manage NSI surveillance independently using the Japan EPINet survey. In this study, participating hospitals were asked to submit Japan EPINet-compliant data from 1 April 2009 to 31 March 2014 (FY2009 to FY2013). Details of the Japan EPINet surveillance system have been reported previously,[14–16] and are therefore only described briefly here. Japan EPINet data include anonymized information provided by the injured personnel themselves, such as their occupation, nature of the incident, injured site, device used, and use or non-use of SEDs. The number of NSIs reported for winged steel needles, IV catheter stylets and suture needles was calculated according to hospital, year and SED use. Years with reports of NSIs from other devices but none from the target devices were treated as having no cases, while years without reports of NSIs from any device (target or otherwise) were excluded from the analysis.

Annual device utilization data for the target conventional devices (winged steel needles, IV catheter stylets and suture needles) and their corresponding SEDs were collected from FY2009 to FY2013. Each hospital provided SED utilization data according to the major brands of devices available in the market during the study period. The list of brands of target SEDs was prepared based on the Safety Devices Catalog (5th edition) published by the Research Group of Occupational Infection Control and Prevention in Japan.[17] In addition, the survey forms provided to participating hospitals also included a section to report brand names and utilization of SEDs that were not included in the device list. Participating hospitals also provided brand names and utilization data for conventional devices. The quantitative use of the three target devices was calculated according to hospital, year and SED use. Years without any responses regarding target device utilization or years without target device utilization data were excluded from the analysis.

With the number of devices used as the denominator and the number of NSIs as the numerator, the NSI incidence rate for every 100,000 devices was calculated according to hospital, year and SED use for winged steel needles, IV catheter stylets and suture needles. The analysis was therefore limited to years in which both the number of NSIs and target device utilization data were available. However, as the device utilization data differed between the hospitals and years, weighted means and 95% confidence intervals (95% CI) were used to calculate overall