Insulin Syringe Use and Risk to Patients or Healthcare Workers

a report by

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There are 18.2 million people in the US (6.3% of the population) who have diabetes.[1] While an estimated 13 million have been diagnosed, unfortunately 5.2 million people (nearly one-third) are unaware that they have the disease.[1] Of those individuals who have been diagnosed with diabetes, 30% of them use insulin injections at least once a day. Individuals who have to inject themselves need to use proper techniques in the delivery of the insulin injection, disposal of the syringe and use prevention strategies to protect themselves from needlestick injury.

Currently, the American Diabetic Association (ADA)[2] recommends diabetic patients who self-administer insulin to inject the insulin with a needle and syringe, which delivers insulin just under the skin. Most insulin syringes are small with very sharp points and have a special coating to help the needles enter the skin as painlessly as possible. Insulin syringes come in several different sizes to match insulin strength and dosage. To date, there are a variety of insulin syringes available on the market; however, there are no insulin syringes that have been developed specifically for 'patient safety'. Insulin syringes that are available for safe use include a safety mechanism that prevents re-capping of the syringe; however, the cylinder that is used inhibits clear vision of the insulin dose, which may cause inaccurate insulin doses for patients (see *Table 1*).

Healthcare workers (HCW) provide care to insulin dependent diabetics who are hospitalized and are unable to give their own injections. In spite of new safety devices for needlestick protection with insulin syringes HCW may still obtain a needlestick injury because the protective sleeve may slip when disposing of the syringe. Although the insulin syringes have small bore needles, the rate of small bore needlestick injury continues to be under-reported by HCW because perception exists that needlestick injuries are an inherent occupational risk.[3]

Needlestick Injury in HCWs

There are more than 10 million HCWs in the US and according to the National Institute of Occupational Safety and Health (NIOSH) approximately 384,325 percutaneous needlestick injuries occur per year[4] resulting in 1,000 new cases of HCW who contract HIV, Hepatitis B virus (HBV) or Hepatitis C (HCV) annually.[3] Needlestick/sharp injuries account for over 75% of the traumatic injuries among HCWs in hospital settings.[3]

Most HCWs are reluctant to report a needlestick/sharp injury fearing restriction in their practice[5] and/or loss of employment. Surgeons may be reluctant to report a needlestick injury due to concerns of reprisal[6] and continue to be the least likely of all HCW to report an injury (OSHA, 2001a).[3] The under-reporting of needestick/sharp injury among HCWs continues to be of concern despite the growing number of needle-less products on the market and mandatory training required by OSHA.[3]

Bloodborne Pathogens and HCW Safety

Infections with bloodborne pathogens resulting from exposure to blood through percutaneous injuries are an occupational hazard for HCW. The consequence of needlestick/sharp injury is the risk and dangers associated with exposure to bloodborne pathogens (HBV, HCV and HIV). Needlestick/sharp injuries have been associated with bloodborne transmission to HCW by three main factors – the nature and frequency of exposure, the risk of transmission of infection after a single exposure to the pathogen and the prevalence of infected susceptible patients and HCW. Current transmission rates among HCW are HBV 2% to 40%, HCV 2.7% to 10% and HIV 2% to 4%.[1] Given the serious and even fatal consequences of needlestick/sharp injuries and the limited effectiveness of post-exposure therapies, it is crucial to prevent needlestick/sharp injuries from occurring.

McCormick & Maki[7] outlined factors related to HCW behavior, incidence of injuries and factors associated with the environment; however, more recent investigations have centered around efforts associated with engineering controls, medical devices and understanding the events associated with an injury. Jagger and associates[8] characterized sharps-related

Table 1: Types of insulin Syringes – Pros and Cons

Type of Insulin Syringes	*Pros*	*Cons*
Regular syringe without safety features	*Ease of use* *Commonly used by patients in home setting* *Patients are familiar with its use*	*No safety device* *No retractable sleeve to prevent needle sticks* *Needle can be reused by patient*
Syringe with retractable sleeve	*An approved method for patient and healthcare worker (HCW) safety* *Re-engineered safety mechanism that provides some safety features to protect from needlestick injury*	*Sleeve obstructs the view of number of units if dosing is below 40 units* *May not be able to pull sleeve and put in place properly* *Sleeve can be easily pulled off and not used by HCW or patient* *Sleeve can be pulled back and the needle reused*
Snap-safety (Inviro) syringe	*No obstruction to see numbers for proper dosing* *Disposal is easy* *Cannot be reused*	*New to market place, just introduced* *Input about device from patients and HCW not yet available*
Insulin pens	*Easy to use once trained* *Excellent for children* *Dose is easy to calculate* *Easy to transport*	*May have needlestick injury when changing small needles* *Cost is higher than syringes* *Disposable expensive, reusable – some only allow one type of supply compared with inter-changeable cartridges*
Needleless injectors	*No needle for an injury to occur*	*Patient compliance difficult*

injuries in the operating room (OR) through a systematic collection of data specifically related to the type of surgical device used, function, and use of blunt needles or retractable scalpels to decrease the rate of injury among surgical personnel. Jagger[8] noted that use of safer devices in the OR could reduce injuries by 30%. The literature demonstrates that OR personnel could have decreased incidence of needlestick/sharp injury if they use surgical devices that can prevent the number of injuries occurring per procedure.

Despite universal precautions and work practice controls HCWs continue to not wear protective devices, dispose of needles properly or comply with the Bloodborne Pathogen Standard.[9] Aiken et al.[10] reported that in 1,000 general staff nurses 61% obtained a needlestick injury in medication administration and did not report it to employee health services. Other HCWs such as anesthesiologist have reported a rate of 56% per 1,000 of needlestick injuries while caring for patients pre- or post-operatively.[11] Moreover, physicians who work in non-surgical hospital settings have reported a rate of 63% per 1,000 needlestick injuries while providing patient care.[12] Despite the revised OSHA[3] standard that redefined engineering controls to include sharp injury protective devices and requirement of needleless systems the incidence and rate of needlestick injuries among HCW remains significant.

Syringes and Safety

Needlestick injuries continue to occur because HCW do not have access to safer devices such as syringes that have shields, recessed or retractable needles. Although hospital administrators provide safety syringes, needlestick injuries occur because of the lack of compliance by HCW to adhere to the Bloodborne Pathogen Standard of care.[13] Since 2001, syringes have been re-engineered to provide added safety to HCW; however, some syringe devices that were readily marketed may not have been adequately designed. For example, the design and re-engineering of some syringes may not provide adequate safety since the retractable needle devices and shields often fail after use by 'slipping' and leaving the needle exposed, which can be a potential cause for needlestick injury. The engineering mechanisms may not have been conceptualized from a safety or user perspective, but rather they were developed quickly to meet market needs. Regardless of how efficient or inefficient the retractable syringes perform, some employers have not adopted their use due to cost and may increase the risk of needlestick injury to HCW. Nelson[14] reported that despite the cost and the implications of not adopting available retractable syringes, HCWs were more at risk of injury from contaminated needles and the cost of injury outweighed the cost of providing a retractable syringe. Appropriately designed and engineered needle safety devices for patient care may eliminate needlestick injury among healthcare providers.

In light of the need to improve HCW safety in healthcare settings, awareness about the prevention of needlestick injury continues to be a safety factor for both HCW and patients. For example, for HCWs who use insulin syringes and obtain a needlestick injury a systematic approach to the risk involved and human

factors associated with injury from the syringe and the appropriate training to correct the incident and risk must be considered to decrease the rate of needlestick injuries. The engineering of a syringe for diabetics and/or other patient populations must also be developed based on the principle of 'safety first'. Utilization of the principle of 'safety first' would assure human factors engineering (HFE) techniques that address ease of use, comfort, and needlestick fail-safety features that may reduce needlestick injury to both patients and HCWs.

One new innovative approach to patient safety for insulin dependent diabetic patients has been the development of the Inviro Snap Safety Syringe.[15] This new safety syringe was developed with the concept of 'safety first' and is one example of an insulin syringe that is easy to use, has a retractable needle that does not slip during use and reduces the volume of waste when disposed. A unique feature about this syringe is the way the needle is disposed, which can decrease the overall cost of disposable waste. Once the insulin is injected into the patient, the plunger is turned, pulled back and the used needle becomes trapped into the syringe barrel. This HFE feature prevents the user from becoming injured because there is no sleeve or other retractable device to manipulate. The final step is to snap off the plunger and discard the syringe. By using this patient safety syringe the HCW or patient is prevented from any type of needlestick injury or the ability to re-use the needle because the needle is retracted into the syringe barrel. The design of this syringe as a safety syringe compared with re-engineering syringes already available is what makes the syringe different and possibly safer for use.

Prevention Strategies

Prevention continues to be the best method to decrease needlestick injuries among HCW and patients. The Centers for Disease Control and Prevention (CDC) estimates that 62% to 88% of needlestick injuries can be prevented by the use of safer medical devices.[1] Development of safer technologies that decrease HCW or patient risk of needlestick injury continues to be valuable since the long-term effects of injury may potentially decrease the cost of healthcare and save lives. The widespread use of safety devices may therefore need to be adapted both in hospital and home settings since the benefits of these new technologies may provide safer environments and decrease injury.

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