

Analysis of Needle Stick Injuries with Implementation of Quality Tools

By

Diksha Sharma

*Dissertation submitted for the partial fulfillment of the
MBA Hospital and Health Management*

Academic year, 2015-2017



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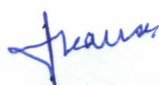
TO WHOMSOEVER MAY CONCERN

This is to certify that Diksha Sharma student of MBA Hospital and Health Management/
Pharmaceutical / Rural Management/ Human Resource Management in Health and
Hospitals from The IIHMR University, Jaipur has undergone internship training at
Columbia Asia Hospital, Palam Vihar, Gurgaon from 13/2/17 to 13/5/17

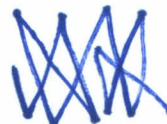
The Candidate has successfully carried out the study designated to him during internship
training and his approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish him all success in all his future endeavors.



Dr. Ashok Kaushik
Dean, Academics and Student Affairs
The IIHMR University, Jaipur



Dr. Alok Mathur
Associate Professor
The IIHMR University, Jaipur

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In recognition of having successfully completed her
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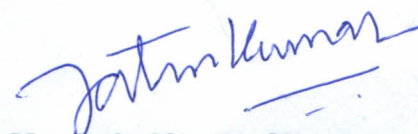
Analysis of Needle Stick Injuries with implementation of quality tools

Date 13/5/2017

Organization COLUMBIA ASIA HOSPITALS,
PALAM VIHAR, GURGAON.

He/ She comes across as a committed, sincere & diligent person who has
a strong drive and zeal for learning

We wish him/her all the best for future endeavors



Mr. Jatin Kumar Sharma
Head of operations
Columbia Asia Palam Vihar

THE IIHMR UNIVERSITY, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled Analysis of Needle Stick Injury with implementation of Quality tools and submitted by Diksha Sharma Enrollment No IIHMR-U/01/2015-17/0272 under the supervision of Dr. Alok Mathur for award of MBA in Hospital and Health/ Pharmaceutical / Rural Management/ Human Resource Management in Health and Hospitals of the University carried out during the period from 13/02/17 to 15/02/17 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Diksha Sharma.
Signature

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CERTIFICATE BY SCHOLAR

This is to certify that all ethical issues have been considered while collecting data for my dissertation titled **"Analysis of Needle Stick Injury with implementation of Quality tools"**

Diksha Sharma

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Abstract

Title: Analysis of needle stick injury with implementation of quality tools

Introduction

Globally three million healthcare workers are exposed to blood-borne pathogens annually and the irony is that up to seventy-five percentages (40-75 %) of needle stick injuries (NSI) are not reported (WHO, 2002) Nurses are the major victims to suffer from needle stick injuries. Injuries with the used sharp or needles are terribly distressing. The effective and evidence based preventive measures of NSIs can assure the occupational safety of nurses as well as other health care workers. Columbia Asia Hospitals invests lot of time and efforts on patient and staff safety. The Mission statement for Columbia Asia Hospitals clearly reflects that “To deliver the best clinical outcomes in the most efficient effective and caring environment”. There has been an increase in the incidence of needle stick injuries. Hence, Columbia Asia hospital at Palam Vihar decided to undertake this quality project in understanding the safety of health care providers in terms of “Needle Stick Injuries”

Objectives of Study: Following were the objectives of the study

- To compile and analyze the data of NSI for 03 years (2014 to 2016)
- To find out the main reasons contributing towards NSI by using quality tool
- To perform cost analysis for needle stick injury

The study was designed as a descriptive study to analyze the incidence of needle stick injuries from the year 2014- 2016.

Methodology:

Study Design: Descriptive study

Setting: Columbia Asia Hospital, Palam Vihar, Gurgaon

Duration of study: 13February – 13 May 2017

Sample:

All the forms filled by staff reporting Needle Stick Injury from 2014-2017 were analysed to study the factors responsible for needle stick injury

Data Collection Procedure: Secondary data was used in the study. The reporting form filled by the affected staff were studied

Findings:

The needle stick injuries show an increase in 2016. The inpatient department was the most affected with more than 30% of the total cases. The staff nurse comprises 77% of the staff affected by needle stick injury. The major reason for needle stick injury was recapping followed by suturing, and then the insulin administration. In 2016, the number of needle stick injury with unknown source has increased reflecting a breach in the sharps disposal management. The Financial loss of approximately RS 100,000 per year incurred due to needle stick injury.

Suggestions:

It would be a long-term benefit if we institutionalize a culture of safety in the work environment. The procedures for reporting and examining sharps injuries and injury hazards should be reinforced. There should be an analysis of sharps injury data for prevention planning and measuring performance improvement. There should be efforts to leverage technology by selecting sharps injury prevention devices (e.g. BD Needle Cutter, Pro safety cannula). We should educate and train healthcare personnel on sharps injury prevention. The posters showing the hazards and prevention of needle stick injury should be displayed at all work stations and the area of biomedical waste management.

Conclusion: There was an increase in incidence of needle stick injury from 2014-2016. The inpatient areas were the most affected with the nursing staff forming the major proportion of those affected by NSI. Recapping being the major cause was focussed on for achieving reduction in the incidence of NSI by reinforcing training in the NSI and leveraging technology for preventing recapping and better sharp waste management. The reduction in incidence of NSI also had financial benefits of approximately RS. 100,000 a year.

Acknowledgement

I, Diksha Sharma , a student of MBA Hospital and health management Batch 20 at IIHMR Jaipur, would like to sincerely express my heartfelt gratitude to:

Dr. Ashish Chandra, General Manager, Columbia Asia Hospital, Palam Vihar for providing me the initiative of conducting a study on needle stick injuries.

Mr. Jatin Kumar sharma, Head of Operations, Columbia Asia Hospital Palam Vihar for being my mentor and project guide for the entire period of my training, providing me vital insights and help me improve my skills to become a better hospital administrator

Dr. Alok Mathur my mentor at IIHMR Jaipur, for his support and guidance, without which this training would not have been possible.

Dr. Ashok Kaushik, Dean, Academic and Student Affairs, for his invaluable inputs and guidance

Lastly, I would like to thank my college, IIHMR Jaipur, for providing me with an opportunity to learn from and work with the best personnel in the Hospital Industry, and for helping me gain an appreciation of where I currently stand as an administrator and how much work I would need in order to meet the quality specifications that the hospital industry seeks

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Introduction

When the first case of HIV Infection from needle stick injury was recognised in 1984, it raised the concern regarding the risk posed to the health care workers from needle stick injury (Rapiti et al. 2005)

The needle stick injury is at high risk of transmitting hepatitis B Virus, hepatitis C virus and HIV virus (Rapiti et al.2005)

Worldwide nearly 3 million health workers get exposed to blood-borne pathogens and nearly 75 % of NSI are not reported (WHO,2002). The WHO report also mentions that the needle stick injuries are seen the highest in the nursing staff. This implies that effective preventive measures need to be taken to ensure occupational safety of nursing staff.

Columbia Asia Hospitals invests lot of time and efforts on patient and staff safety. The Mission statement for Columbia Asia Hospitals clearly reflects that

“To deliver the best clinical outcomes in the most efficient effective and caring environment”

Keeping the above statement in mind the Columbia Asia hospital at Palam Vihar decided to undertake this quality project in understanding the safety of health care providers in terms of “Needle Stick Injury”.

Aim of Study: To study the reasons for increasing incidences of Needle Stick Injuries and providing effective solutions to reduce them.

Objectives of Study:

- To compile and analyze the data of NSI for 03 years (2014 to 2016)
- To find out the main reasons contributing towards NSI by using quality tool
- To perform cost analysis for needle stick injury

The study was designed as a descriptive study to analyze the incidence of needle stick injuries from the year 2014- 2016. The data was analyzed using Microsoft excel in terms of location, staff profile, reasons for needle stick injury and whether the source of NSI was known or not.

The process mapping for source of sharps waste generation, their disposal and waste management was done. The failure modes were identified for different stages in the process of sharps disposal. The causes and severity of the failure were identified. The FMEA was used to as a quality tool in the study.

Review of Literature:

To understand the incidence, hazards and preventive measures for needle stick injury a detailed literature review was done. This provided a better understanding of the work done so far in developing measures to prevent needle stick injuries.

Source	Content	Prevention Strategy
World Health Organization Protection of the Human Environment Geneva 2005 By Elisabetta Rapiti Annette Prüss-Üstün Yvan Hutin	Assessing the burden of disease from sharps injuries to health-care workers at national and local levels 37.6% of Hepatitis B 39% of Hepatitis C 4.4% of HIV/AIDS in Health Care Workers around the world are due to needle stick injuries.	Primary prevention of Needle stick injuries is achieved through elimination of unnecessary injections, and elimination of used needles Implementing education programs, Universal Precautions, eliminating needle recapping, and using containers to safely dispose of sharps, needle stick injuries can be reduced by 80%. (Jagger, 1996; CDC, 1997b)
CDC Work Book (2008) Preventability of Needle sticks in 78 NaSH Hospitals, June 1995--December 2004 (n=11,625)	Data from NaSH show that nurses sustain the highest number of per cutaneous injuries 40% of injuries occur in IPD 41% of injuries occur after use and before disposal of a sharp device 39% during use of a sharp device on a patient 16% during or after disposal Preventable 64% Non -Preventable 18% Unpreventable 18%	Work-practice Controls Hierarchy of controls
U.S.department of health and human services , Centers for Disease Control and Prevention DHHS (NIOSH) Publication No. 2000–108 November 1999 Preventing Needle stick Injuries in Health Care Settings	600,000 to 800,000 needle stick injuries occur annually [Henry and Campbell 1995; EPINet 1999] About half of these injuries go unreported 38% of Per cutaneous injuries occur during use 42% occur after use and before disposal	Selecting and Evaluating needle devices with safety features Ensure that health care workers are properly trained in the safe use and disposal of needles Modify work practices that pose a needle stick

			injury hazard to make them safer Establish procedures for and encourage the reporting and timely follow up of all needle stick and other sharps-related injuries
WHO, ANA Independent Study Module for the Needle stick Safety and Prevention Act of 2000	Over 80% of needle stick injuries can be prevented with the use of safer needle devices (CDC, 1997), which, in conjunction with worker education and work practice controls , can reduce injuries by over 90% (Jagger, 1996).		Hierarchy of Controls Safer devices All health care workers must be vaccinated
FDA, NIOSH and OSHA Joint Safety Communication: Blunt-Tip Surgical Suture Needles Reduce Needle stick Injuries to Surgical Personnel May 30, 2012	Published studies show that using blunt-tip suture needles reduces the risk of needle stick injuries from suture needles by 69 %		The American College of Surgeons (ACS) recommends the universal adoption of blunt tip suture needles as the first choice for the closure of fascia and muscle
CDC Work book 2008			
Occupational Groups of Healthcare Personnel Exposed to Blood/Body Fluids; NaSH, 6/95 to 12/03 (N=23,197)	Nurse 44% Physician 28% Technician 15% Housekeeping 3% Student 4% Clerical/Admin 1% Dental 1% Research 1% Other 4%		Hierarchy of control concept Isolate the hazard (Engineering control) Work practice controls Personal protective equipment Find alternatives to use needles
Work Locations Where Blood/Body Fluid Exposures Occurred; NaSH, 6/95 to 12/03	Inpatient 40% Operating room 25% Procedure room 9%		
Six Devices Account for 78% of All Injuries	Disposable Syringes 30% Suture Needles 20% Winged-Steel Needle 12% Intravenous Catheter Stylets 5% Phlebotomy Needles 3% Scalpels 8%		

Indian Journal of Pathology and Microbiology	105 HCW sustained occupational exposure to blood and body fluids	All health care organizations should train HCWs in infection control procedures and the importance of reporting occupational exposures
An analysis of multi modal occupational exposure leading to blood borne infections among health care workers	Per cutaneous exposure (NSI) 85%	Preventive strategies have to be devised and reporting of NSI need to be made mandatory
(2015)	Mucous membrane splash 13%	
Authors: N Lakshmi Priya, K Usha Krishnan, G Jayalakshmi, S Vasanthi	Exposure on intact skin 2%	
	During blood withdrawal 45.7%	
	During surgical procedures 24.7%	
	Improper disposable of sharps 23%	
	Transferring of needles 3.8%	
	Biopsy procedures 2.8%	
	Source for the NSI was not traceable 29 %	
Study period: January 2010 and December 2013	Known sources for NSI 71%	

Analysis of NSI data for year 2014-2016

Methodology

Study type: Descriptive

Study area: Columbia Asia Hospitals, Palam Vihar, Gurgaon

Data Collection: Data was collected from the incident reporting form filled up by the staff at the time of needle stick injury

Data Analysis: SPSS, Microsoft Excel

The collected data was then analysed in terms of

- Location
- Staff Profile
- Reasons of NSI
- Sources of NSI (whether known or unknown)

Results: NSI (2014-2016)

Location: The most common location was analysed to be the inpatient department. The addition of laundry in the year 2016 indicates a breach in the sharp waste management process.

Figure 1: Graph showing location wise occurrence of NSI

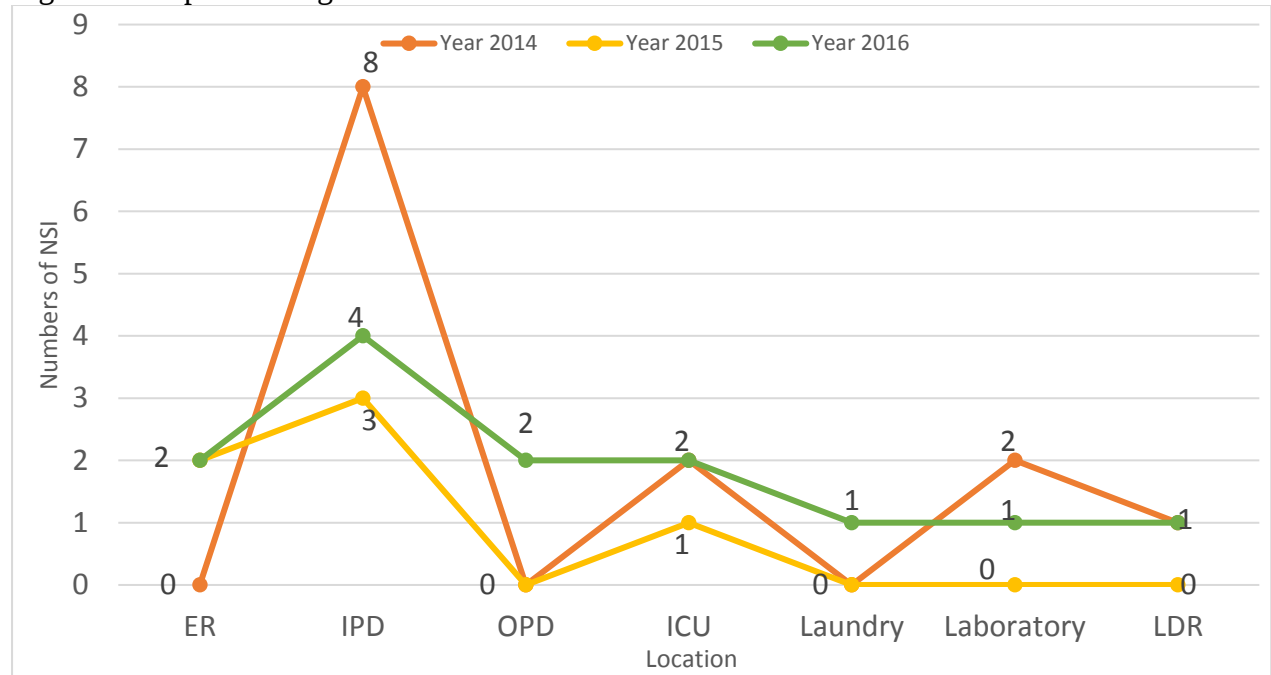


Table 1: Location wise distribution of NSI

Location	Year 2014	Year 2015	Year 2016
ER	0	2	2
IPD	8	3	4
OPD	0	0	2
ICU	2	1	2
Laundry	0	0	1
Laboratory	2	0	1
LDR	1	0	1
Total	13	6	13

Staff Profiling: NSI (2014-2016): The nursing staff is the most common affected by the needle stick injury. We need to focus more on their training and understand the gap in their knowledge and practice

Figure 2: Staff profile affected by NSI

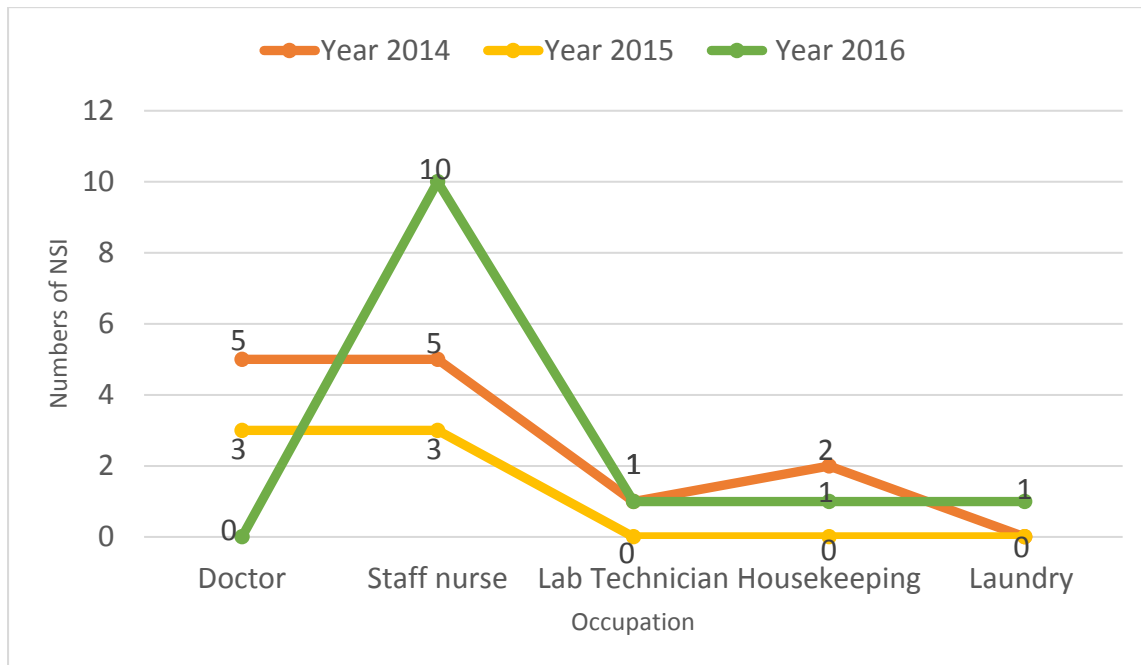


Table 2: Distribution of NSI based on staff profile

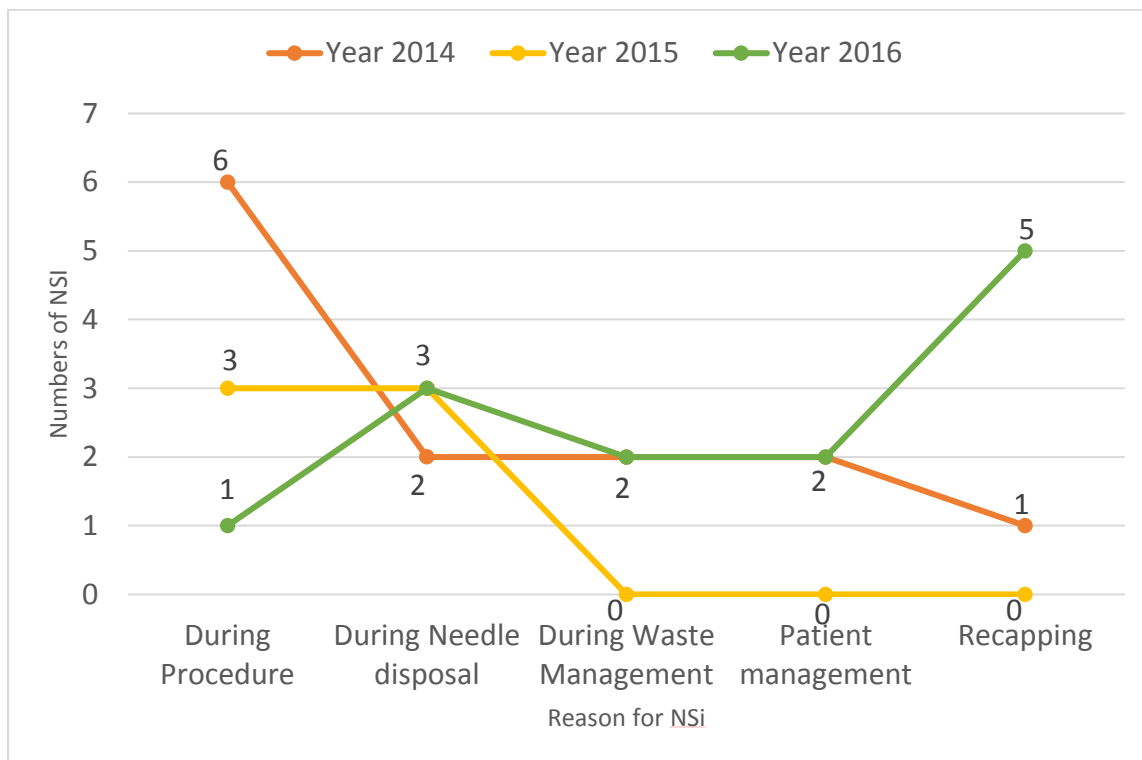
Occupation	Year 2014	Year 2015	Year 2016
Doctor	5	3	0
Staff nurse	5	3	10
Lab Technician	1	0	1
Housekeeping	2	0	1
Laundry	0	0	1
Total	13	6	13

Reason for NSI (2014-2016) : This analysis is important as if the reason for needle stick injury can be identified we can streamline our resources in that particular direction

Table 3: Distribution of NSI based on the stage of sharps use

Reason	Year 2014	Year 2015	Year 2016
During Procedure	6	3	1
During Needle disposal	2	3	3
During Waste Management	2	0	2
Patient management	2	0	2
Recapping	1	0	5
Total	13	6	13

Figure 3: Distribution of NSI based on the stage of sharps use



Source of NSI (2014-2016):

The analysis of whether the source of needle stick injury is known or not helps us identify the need for antiretroviral therapy. Those cases where source of NSI are not known are treated as a probable source of HIV so antiretroviral therapy is mandatory in them. Besides this it also indicates a gap in the sharps waste management process. Hence as our cases of NSI with source not unknown are increasing in 2016 so we need to reinforce the process.

Figure 4: Distribution of NSI based on source

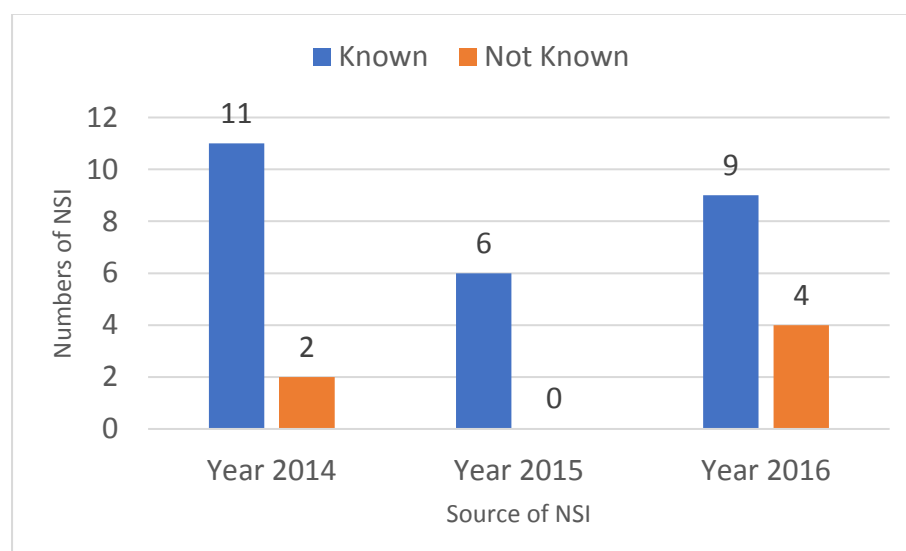


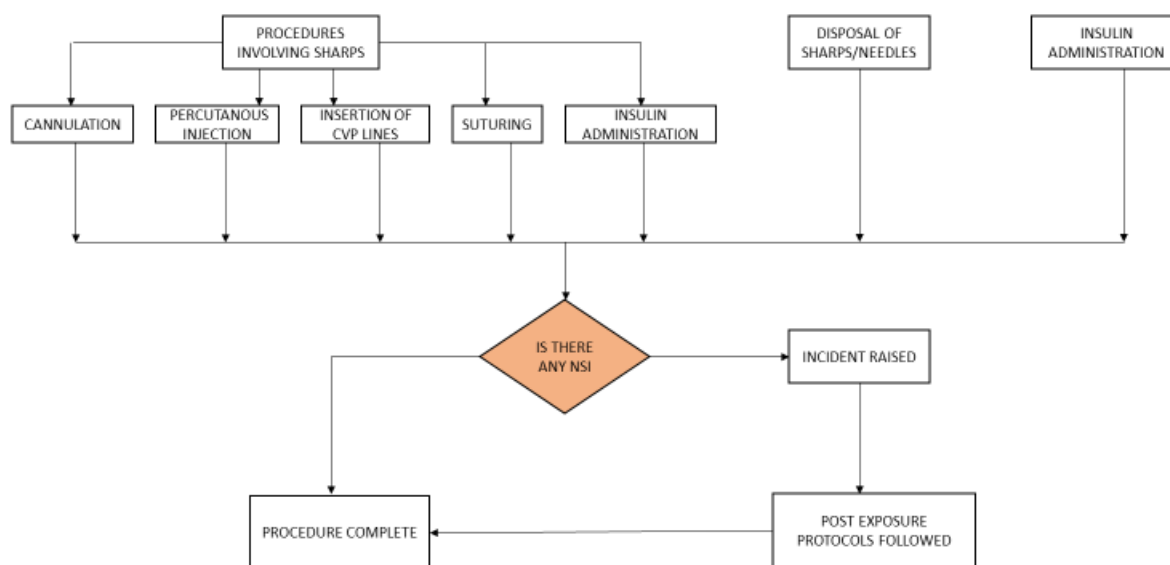
Table 4: Source of NSI

Source	Known	Not Known	Total
Year 2014	11	2	13
Year 2015	6	0	6
Year 2016	9	4	13

The analysis for needle stick injury for the year 2014-2016 identifies an increasing trend of NSI so we need to map the process of sharps waste generation and disposal to identify our corrective actions

Figure 5: Process map of NSI

Process map for the possible incidence of a needle stick injury

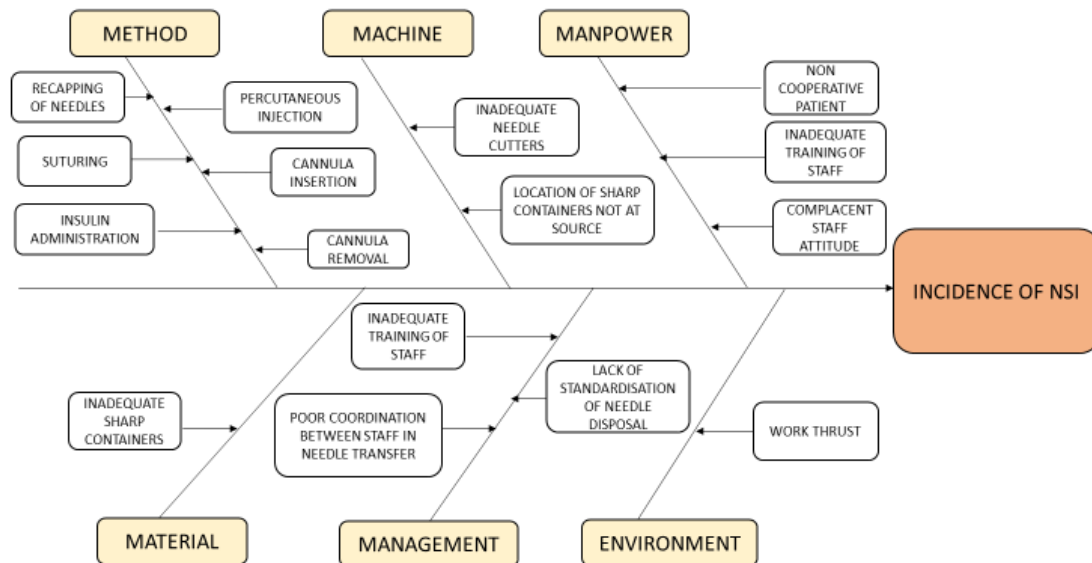


The Fish Bone analysis is then done to identify the causal factors for needle stick injury under following category:

- Man
- Machine
- Material
- Method
- Management
- Environment

Figure 6: Fish bone analysis

Fishbone Analysis For Needle Stick Injury



After understanding the reasons, profiling and the failure modes in the process of needle stick injury we did an FMEA for the same. In this process we measured the severity, detectability and occurrence for each failure mode. The Risk Priority Number (RPN) was then calculated for each failure mode as:

$$\text{RPN} = \text{Severity} * \text{Occurrence} * \text{Detectability}$$

The failure mode with the highest RPN was then identified so we can lower the incidence of needle stick injuries by putting all or resources in it

Steps in the FMEA Process

- 1) Form a FMEA team
- 2) Map the process
- 3) Brainstorming potential failure modes
- 4) What are the consequences of each failure?

The effects are then graded based on the **severity** as under:

Grade	Score
Negligible	0-1
Minor	2-4
Moderate	5-6
Major	7-9
Extreme	10

Occurrence of Needle Stick Injury

Grade	Score
Never happens	0-1
20% occurrence	2-4
50 % occurrence	5-6
70% occurrence	7-9
100% occurrence	10

Detectability of Needle Stick Injury

Grade	Score
100 % detectable	0-1
70 % detectability	2-4
50 % detectability	5-6
70% detectability	7-9
Not detectable at all	10

FMEA Analysis for Needle Stick Injury

Potential Failure Mode	Potential Effects of failure	Severity (S)	Potential Causes of failure	Occurrence (O)	Current process controls	Detectability (D)	RPN (S*O*D)	Criticality (S*O)
PROCESSES								
Percutaneous injection	NSI , Splash, HIV , HCV, Hepatitis B infection	7	Lack of staff experience, Patient movement, wrong Technique	5	Reporting of NSI or Splash, Incident Reporting	7	245	35
Suturing	NSI , Splash, HIV , HCV, Hepatitis B infection	7	Wrong technique, Patient movement	7	Reporting of NSI or Splash, Incident Reporting, reporting by assisting staff	7	343	49

Potential Failure Mode	Potential Effects of failure	Severity (S)	Potential Causes of failure	Occurrence (O)	Current process controls	Detectability (D)	RPN (S*O*D)	Criticality (S*O)
Insulin Administration	NSI , Splash, HIV , HCV, Hepatitis B infection	7	Wrong technique, Patient movement	6	Reporting of NSI or Splash by the IV team	7	294	42
Cannula Insertion	NSI , Splash, HIV , HCV, Hepatitis B infection	7	Wrong technique, Poor coordination, Patient Movement, Staff not trained	3	Reporting of NSI or Splash by the IV team	7	147	21

Potential Failure Mode	Potential Effects of failure	Severity (S)	Potential Causes of failure	Occurrence (O)	Current process controls	Detectability (D)	RPN (S*O*D)	Criticality (S*O)
Cannula removal	NSI , Splash, HIV , HCV, Hepatitis B infection	7	Wrong technique, Patient movement	3	Reporting of NSI or Splash by the IV team	7	147	21
Insertion of CVP lines	NSI , Splash, HIV , HCV, Hepatitis B infection	7	Wrong technique, Poor coordination , Patient Movement, Staff not trained	2	Reporting of NSI or Splash by the IV team	7	98	14

Potential Failure Mode	Potential Effects of failure	Severity (S)	Potential Causes of failure	Occurrence (O)	Current process controls	Detectability (D)	RPN (S*O*D)	Criticality (S*O)
DISPOSAL OF SHARPS AND NEEDLES								
Recapping	NSI , Splash, HIV , HCV, Hepatitis B infection	7	Staff finds it convenient to recap the needle, sharp containers not located at source of sharp waste generation	8	Reporting of NSI or Splash by the IV team	7	392	56
Needle not disposed in sharp containers	NSI , Splash, HIV , HCV, Hepatitis B infection	7	Inadequate number of sharp containers	4	Incident reporting of used needles outside the sharp containers	7	196	24

Potential Failure Mode	Potential Effects of failure	Severity (S)	Potential Causes of failure	Occurrence (O)	Current process controls	Detectability (D)	RPN (S*O*D)	Criticality (S*O)
WASTE MANAGEMENT								
Improper segregation of sharp waste at source	NSI , Splash, HIV , HCV, Hepatitis B infection	7	Lack of awareness of biomedical waste management, housekeeping staff needs training	3	Reporting of NSI or Splash by the IV team, Live audits, assessment of staff knowledge	7	147	21

RPN Scores for each failure mode

Failure Mode	RPN Score
Percutaneous Injection	245
Suturing	343
Insulin Administration	294
Cannula Insertion	147
Cannula Removal	147
Insertion of CVP Lines	98
Recapping	392
Needles not disposed in sharp containers	196
Improper segregation of waste at source	147

 Failure Modes with highest three RPN score

Measuring the cost of sharps injury prevention

Criteria:

- To calculate the cost to the organisation due to the needle stick injuries
- To find the cost saved for the organisation by executing preventive measures for needle stick injury
- To find the cost of leveraging technology in preventing needle stick injuries

The cost to the organisation in post exposure management of needle stick injury can be measured as a **direct** and an **indirect** cost

Direct costs:

This cost can be measured as:

- Cost of laboratory testing of the exposed hospital staff, both for baseline and follow up tests
- Cost of laboratory tests for the known patient source
- Cost of post exposure prophylaxis to the exposed staff

Table 5: Direct Cost of PEP

Direct Cost of Post Exposure Therapy in Needle Stick Injury

Post Exposure Therapy	Cost (Rs)	2014 (n,13)	2015 (n,6)	2016 (n,13)
Staff Blood Tests (done thrice)	2784	36192	16704	36192
Patient Blood Tests	4000	44000	24000	36000
Anti Retroviral Therapy	1080	2160	0	4320
Hepatitis B Immunoglobulin	6950	0	0	0
Total	14814	82352	40704	76512

Indirect costs

These include the cost incurred due to the loss of wages as the affected staff is occupied receiving post exposure care. It also includes cost of the health care provider in providing post exposure care.

Considering the number of injuries to be 13 per year and presuming the source of needle stick injury is known then the total cost of post exposure therapy is $13 \times 7864 = \text{Rs. } 102,232$ per year

Assuming the reduction of Needle stick injuries to reduce by 80%(Ref : WHO, ANA Independent Study Module for the Needle stick Safety and Prevention Act of 2000)

Cost savings with needle safe device and needle safe practices=

(Number of previous injuries) $\times$ (projected percent reduction in injuries with safety feature) $\times$ (the average cost of a needle stick injury to the healthcare facility)= $13 \times .8 \times 7864 = 81,785$

Cost Head	
Cost of proposed needle cutter (B.D) per piece	50
Number of needles destroyed by 1 needle cutter	100
Average consumption of needles in a year	36000
Number of needle cutters required in a year	360
Cost of implementing needle cutter	Rs.18000

Discussion

We at Columbia Asia Hospitals give high priority to the safety of the patients and our staff. In our endeavour to achieve the same this project in needle stick injuries was done.

The key observations were :

The highest number of needle stick injuries were observed in the Inpatient department

The staff nurse comprised 60 % of those sustaining needle stick injuries

In 2016, the needle stick injuries from the unknown source shows an increase of 30% indicating a breach in the process of sharps disposal and waste management

The failure mode with highest RPN is Recapping followed by Suturing and then the Insulin Administration

If we achieve 80% reduction in needle stick injury cases an yearly saving of Rs. 81,785 can be achieved

Recommendations

It would be a long-term benefit if we institutionalize a culture of safety in the work environment

The procedures for reporting and examining sharps injuries and injury hazards should be reinforced

There should be an analysis of sharps injury data for prevention planning and measuring performance improvement

There should be efforts to leverage technology by selecting sharps injury prevention devices (e.g. BD Needle Cutter, Pro safety cannula)

We should educate and train healthcare personnel on sharps injury prevention

The posters showing the hazards and prevention of needle stick injury should be displayed at all work stations and the area of biomedical waste management.

Figure 7: Poster for NSI



Operating (Suturing) controls include:

(Ref : MAJOR PROVISIONS OF THE NEEDLESTICK ACT OF 2000 RIGHTS AND PROTECTIONS: OSHA BLOODBORNE PATHOGENS STANDARD)

To retract tissues and for loading and unloading the needles use instruments instead of fingers

There should be a protocol of doing verbal announcements when passing sharp instruments

To avoid hand to hand transfer of sharps a neutral zone should be used for the same

Where appropriate it is advisable to avoid sharp instruments, and use medicines, electrocautery or laser devices

It is advisable to use round tipped blades instead of sharp tipped blades

Conclusion

This study identified the increasing incidence of needle stick injury from 2014-2016. It states that highest number of needle stick injuries were found in inpatient areas and the nursing staff was the most affected.

Recapping followed by suturing were identified as the major causes of needle stick injury.

Modified training modules reinforcing the safety precautions to prevent needle stick injury, leveraging technology to prevent recapping can reduce incidence of needle stick injuries.

With the benchmark of zero needle stick injuries in a year, we can have a financial gain of approximately Rs. 100,000/- a year. This would also reduce the stress caused to those affected