

Needle Stick Injury Among Healthcare Workers In a Tertiary Care Setting of Uttarakhand

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Abstract

A needle stick injury (NSI) is a serious occupational health hazard in health care settings. Any break in the continuity of skin caused by contaminated needle stick or any infected sharps like vials, scalpel blade, etc can be a source of percutaneous exposure for the health care worker.

Aims:The purpose of conducting this study was to observe the occurrence of NSI depending on the sex, profession and working areas of the health care workers, reasons leading to these injuries and why do they go unreported in most cases.

Methodology:The present study was a record-based study in accordance with RECORD guidelines comprising of the retrospective analysis of reported incidences of NSI. Analysis of data of all the health care workers who voluntarily reported NSI, injuries by sharps such as cannulas, broken vials and splashes on cuts and mucous membrane by potentially infectious materials like blood and other body fluids were conducted. Statistical Package for the Social Science software (SPSS version 16.0) and Microsoft Excel 2010 were used for the statistical analysis of the data.

Results:The study consisted of a total of 142 HCWs who got exposed to the NSIs and reported the event to the HICC. This study revealed an ample of aspects related to the NSIs occurring in the hospital and provided us with comparison between the number of NSIs in the pre-Covid and during Covid period.

Conclusions: It can be concluded that the occurrence of NSI doesn't depend entirely on any one of the factors rather many different reasons.

Keywords: Occupational health, RECORD guidelines, Seroconversion

Abbreviations:

1. NSI – Needle Stick Injury
2. HCW – Healthcare Workers
3. RECORD – REporting of studies Conducted using Observational Routinely-collected Data
4. HICC - Hospital Infection Control Committee
5. PPE – Personal Protective Equipment
6. NACO - National AIDS Control Organisation
7. OT – Operation Theatre
8. NIOSH - Occupational Safety and Health
9. OSHA - Occupational Safety and Health Administration

Introduction

A needle stick injury (NSI) is a serious occupational health hazard in health care settings. NSIs are described as injuries caused by needles or sharps such as hypodermic needles, blood collection needles, intravenous stylets and needles used to connect parts of intravenous delivery system. Any break in the continuity of skin caused by contaminated needle stick or any infected sharps like vials, scalpel blade, etc can be a source of percutaneous exposure for the Health Care Worker (HCW).

The HCWs are at an increased risk of NSI due to the environment in which they work. NSI poses an increased risk of blood borne pathogenic infections like hepatitis B, hepatitis C, HIV in the HCWs who regularly deal with patients' blood, urine and saliva (1). The United States Centre for Disease Control and Prevention estimates that about 600,000-1,000,000 NSIs occur annually (2). The risk of infection due to NSI accounts for 0.2-0.5% for HIV, 3-10% for HCV and 40% for HBV (3).

It has been observed that the major cases of NSIs occur due to failed or improper use of personal protective equipment like gloves, trying to recap the needle, improper disposal of needles and sharps, setting of IV cannula and drips. Inadequate work experience and low knowledge about blood borne infections have also been found to be responsible for occurrence of NSI among HCWs.

NSIs in different HCWs occur according to their work place and the environment in which they work. It has been observed in various studies that about 40% of the NSIs in the past 3 months and 75% in the past one year (4) went unreported which is prevalent among the HCWs (21, 22). This is a major problem that hinders the exposed HCWs from receiving the post exposure prophylaxis and often leads to serious consequences.

1. Literature Review

Many studies have been done to find out the reason for why the NSIs go unreported and no specific reason could be agreed upon but according to these studies the reasons seem to include unawareness of the reporting system, heavy work load, fear of being blamed and losing the job, lack of knowledge of importance of NSI and the level of hazards it can cause (5-7). This clearly shows that further studies are required to assess this behavior of HCWs for not reporting the NSIs.

The recent Covid-19 pandemic has not only affected the lifestyle of the people around the world but has also brought in a lot of changes to the healthcare system on a global basis. The emergency revealed the level of vulnerability of healthcare workers towards the occupational exposure to various hazards and has given a demonstration on how to ensure their safety (8).

It is observed that use of Personal Protective Equipments (PPE) by the HCWs during the pandemic not only provided a shield from the infectious virus but also a reduction in number of NSIs as well (9). The pandemic not only awakened the consciousness of people towards their health, hygiene and preventive measures but also made them realise how important it is to take precautions against the occupational risks so that they could render their duties well.

The present study serves the dual purpose of not only reporting the incidence of NSIs in our hospital for the past four years (2018-2021), but, also at the same time comparing the results between the two eras of pre-pandemic and during pandemic times. The study also incorporates the details of circumstances, place, body site of injury in its final analysis. Anti-HBsAg titre is routinely done in our hospital for the NSI individuals, which has also been reported in the study. The study uniquely amalgamates the occurrence of NSI and its consequences distributed distinctly over the two time-frames.

2. Methodology

This article discusses some of the unique results which were observed and presents its results on the basis of the REporting of studies Conducted using Observational Routinely-

collected Data (RECORD) guidelines which were developed to help researchers and journals to maintain a high level of quality in reporting of healthcare studies using routinely-collected data (10).

3.1 Study design

The present study is a record-based study in accordance with RECORD guidelines of reported incidences of NSIs in a tertiary care hospital in Dehradun. Since the advent of Covid-19 pandemic in last few days of year 2019, the reported NSIs on or before 31st December 2019 were taken as pre-Covid and NSIs on or after 1st January 2020 were considered as during Covid-19 times.

This study takes into account the analysis of the data of all the HCWs who voluntarily reported NSIs, injuries by sharps such as cannulas, broken vials and splashes on cuts and mucous membrane by potentially infectious materials like blood and other body fluids. The self-reporting HCWs who were exposed to the injuries were offered a standard questionnaire to fill which included their demographic details, information regarding the type of injury, site of injury, the source of injury whether known or unknown, the use of personal protective equipment at the time of injury or splash, the type of work done by the HCWs, severity of the injury, circumstance of the reported injury, what emergency health care measures were taken, hepatitis B vaccine status, what immediate post exposure measures were taken, status of the source of exposure if known, and also if the HCW knew about their HIV,HBV,HCV positivity status. Blood sample was taken according to the hospital's standard protocol from each of the exposed HCW along with that of the patient from whom needle was infected (if the source was known) and the collected sample was tested for various blood borne infections that have the probability of being transferred via NSI.

3.1.1 Participants

The participants included in this study are the HCWs of the tertiary care hospital comprising the doctors, nurses, lab technicians, ward attendants, and house-keeping staff. All the HCWs who self-reported the exposure to the Hospital Infection Control Committee (HICC) were asked to fill up an informed consent form stating their approval to be included in the study and their data to be used.

3.1.2 Variables

The collected blood samples were screened for HIV1 and HIV2. They were tested for Hepatitis B surface antigen and antibodies against Hepatitis C virus. The health-care workers were also tested for hepatitis B surface antibodies titre (anti HBs titre).

3.1.3 Study size

The study size was directly dependent on the number of NSIs that were self-reported in the hospital between the above-mentioned period of 4 years that makes up the sample size to be 142.

3.2 Data Sources and Analysis

The data for analysis was extracted from the past HICC-NSI record during the 2018-2021 period. An informed consent was taken from each of the reporting HCW at the time of their voluntary reporting to HICC and an ethical clearance certificate was obtained from the ethics committee of the attached institute before the commencement of study.

Screening for HIV1 and HIV2 was done using the rapid test kit as per the NACO (National AIDS Control Organisation) guidelines. Hepatitis B surface antigen (HBsAg) and antibodies against HCV were tested immediately by rapid test kit followed by electrochemiluminescence immunoassay kits. HCWs were also tested for hepatitis B surface antibodies titre (anti HBs titre). Subjects with AntiHBs titre of 10 IU/L were considered as responders to vaccination and those with less than 10 IU/L were considered as non-responders. The HCWs who got exposed to HIV seropositive patients were immediately referred for anti-retroviral therapy. All the HCWs were counselled and advised to get tested again; first after 3 weeks, then after 3 months and then finally after 6 months to check for any seroconversion. Blood samples from the patients from whom the HCW got infected was also collected and tested (if the source was known) for HIV, HCV, HBV viral loads if the screening tests came out to be positive. Counselling session and post-exposure prophylaxis (if required) were arranged for the exposed HCWs.

Bias-Since it was a record-based study, chances of bias at any level are less but might occur at the level of questionnaire filling by the HCWs due to the fear of consequences that he or she thinks might face if he tells the truth how the event took place. The fear of losing job may prevent the healthcare worker from presenting the exact event. Also, not reporting the event can be included in this as well.

3.3 Quantitative variables

The obtained data from two different phases of the study was arranged in different groups based on the sex, profession, working area, circumstances of injury and body site of injury of the healthcare worker. Variables were also segregated on the basis of the status (known/unknown) of the patient and on the anti-HBs titre of the healthcare worker.

Statistical methods- Statistical Package for the Social Science software (SPSS version 16.0, IBM Corporation US) and Microsoft Excel 2010 were used for the statistical analysis of the data in the study. A $P < 0.05$ was considered statistically significant.

3. Results

The demographic characteristics of 142 study participants is presented in Table 1 who got exposed to NSI and reported the event to HICC. It was observed that a greater proportion of females (57.7% in pre-Covid and 60.6% during Covid period) were exposed to NSI than that of males (42.3% in pre-Covid and 39.4% during during Covid period).

4.1 Descriptive data

This study revealed an ample of aspects related to the NSIs occurring in the hospital and provided us with comparison between the number of NSIs in the pre-Covid and during Covid period. It showed how the profession of the healthcare worker is related to their chances of occurrence of NSI. It brought into account the numbers depicting the most frequently injured areas and sites of the body.

The study also makes a comparison in rates of occurrence of NSI in the various departments of the hospital. Comparison has also been made in the circumstances involved in occurrence of NSIs.

Profession-wise distribution reveals that the number of exposed (self-reporting) doctors decreased from 15 (21.1%) to 8 (11.3%). The affected number of staff nurses increased from 18 (25.4%) to 22 (31%). A total of 16 nursing students got exposed to NSI, 10 (14.1%) during pre-Covid and 6 (8.5%) during Covid times. No difference in exposed numbers observed among lab/OT technicians. Twelve (16.9%) resident doctors were found to come in contact with NSI pre-Covid which went up to 15 (21.1%) during the Covid phase. The number of affected ward attendants/helpers was found to be raised from 4 (5.6%) to 11 (15.5%) [Table 1].

When taken in account the place of occurrence of injury, it was observed that the numbers were same in emergency department during both the phases. Number of these injuries in OT dropped from 17 (23.9%) to 9 (12.7%) and that in the ICU raised from 5 (7%) to 11 (15.5%). Labs and blood bank experienced a drop in the occurrence of injuries from 7 (9.9%) to 6 (8.5%) and same was the number seen for the surgical department. Medicine department showed a rise in the pre-Covid and during Covid injuries from 23 (32.4%) to 29 (40.8%). NSIs in other places in the hospital also decreased from 8 (11.3%) to 6 (8.5%) [Table 1].

While analysing the data according to the circumstances in which the injury occurred showed that the injuries to the healthcare worker during sampling procedure reduced from 18 (25.4%) in pre-Covid to 6 (8.5%) during Covid times. During intravenous procedures

(recapping) the events of injuries were raised from **16 (22.5%) to 25 (35.2%)** whereas during surgical procedures a drastic fall from 31 (43.7%) in pre-Covid to only 2 (2.8%) in the Covid phase was seen. NSIs during biomedical waste segregation was found to be raised from 6 (8.5%) to 14 (19.7%). Various other circumstances of occurrence of injuries were seen to cause 24 events in the Covid phase which caused no injury in the pre-Covid times. [Table 1]

The collected data when studied in accordance with the site at which the injuries were reported, it was seen that the injuries in the right hand index finger reduced from 37 (52.1%) to 22 (31%). Injuries on the left hand index finger raised from 14 (19.7%) to 28 (39.4%). The number of injuries occurring on the right thumb raised from 4 (5.6%) to 7 (9.9%) and that on the left thumb raised from 5 (7%) to 9 (12.7%). Injuries occurring in other parts of the body saw a decrease from 11 (15.5%) to 5 (7%) in the pre-Covid and during Covid times respectively.

4.2 Statistical Significance

A statistically significant association was found between site of injury and place where injury occurred ($p=0.021$) [Table 2].

Table 3 illustrates the data of NSI according to the site of injury compared across both Covid phases. In majority of cases it was seen that the index finger of right hand was injured 37 (62.7%) in pre-Covid times which dropped to 22 (37.3%) during both the phases. NSI in both hand index fingers was associated with statistically significant difference.

Table 4 represent the data on the basis of Hepatitis B vaccination status and Anti-HBs titre of the exposed HCW. It was observed that the number of completely vaccinated HCWs was 20 in 2018 and 46 in 2019, which went down to 28 and 21 during the Covid in the year 2020 and 2021 respectively. The values of Anti-HBs titre showed quite variations in the pre-Covid and during Covid times.

It was also studied if the source status of the injury to the exposed worker was known or not. We found out that the cases with unknown source status dropped during the Covid times from 6 to 3. The number of known and reactive cases also showed a descend between pre Covid and during the Covid times. However the number of known and non-reactive cases rose during the Covid times. The data is well organized in Table 5.

Health care professional's behavior after the exposure was also noted which showed that most of the healthcare workers cleansed the site with disinfectant or soap and water whether pre-Covid or during the Covid times. Majority of them were using PPE kit during the exposure. Although, this number rose during the Covid times. The comparison is illustrated

properly in Figure 1. Figure 2 pictorially presents the reactive and non-reactive status of source patient.

4. Discussion

Occupational hazards have always played a major role in all fields. Various preventive measures and laws are designed to prevent the accidents occurring at the occupational sites. Same goes with the NSIs that occupy a bulk of occupational accidents or health hazard faced by the HCWs at work. Many guidelines have been laid down by different bodies like WHO, National Institute for Occupational Safety and Health (NIOSH) and Occupational Safety and Health Administration (OSHA) . NSIs are the route for transmission of serious blood borne infections like HIV, Hepatitis B and C and it is very important to prevent these injuries to lower the transmission of blood borne infections among HCWs.

The above study presents a comparative analysis of exposure to NSIs in a tertiary care hospital in pre and during Covid era. It was seen that there weren't any striking differences in the number of exposures between two time spans. However, a slight decrease in number of NSIs among doctors was observed. This change can be attributed to the proper use of PPEs that was distinctly followed during the Covid period. It not only helped to prevent the transmission of Covid but also helped to reduce occupational accidents. During Covid times the entire healthcare staff of the hospital was provided with PPE kits and other required protective measures to help them provide best services to the patients. The decrease in number of elective surgical interventions has also been a reason for decreased number of exposure among doctors (11).

It was observed that the percentage of NSIs was more among nurses when compared to doctors. This could be because of the reason that nurses are more involved in frequent close contact with the patients. They perform most of the procedures with the sharp items including phlebotomy, intravenous needles insertion and putting injections (12). The exposure to sharps decreased in doctors whereas it increased amongst the nurses, helpers and ward attendants. The increased number of injuries in these groups can be an indication that PPEs were not properly used and at the same time minor surgical procedures were not performed carefully (13). An increased patient load is also a reason for increased incidences of exposure among nurses. The hospital had an immense patient load during the Covid time and the healthcare staff had to over-work as many of the staff members were also infected. Increased workload and decreased efficiency due to increased work hours was also a reason

for increased incidences of NSIs. Same can be attributed for increase in incidences of exposure among resident doctors.

Instances of injuries during recapping and biomedical waste segregation showed a marked increase during the Covid times which goes in correlation with the increased number of injuries reported by the nurses and helpers and ward attendants. Many other NSIs were reported that had no specific scenario of occurrence. These types of exposure can be put into the category of injuries that might have occurred due to the increased layering. The increased covering of the PPE no doubt provides protection but at the same time decreases the efficiency of the healthcare workers causing a hindrance in their work leading to mishandling and injuries (14). A decrease in the exposure incidences from the OT was observed during the Covid phase which was due to decreased number of elective surgical interventions.

Our study also points in the direction that the incidences of occupation hazards are more in a developing country than a developed one due to insufficient staff, long working hours, lack of experience and educational programs and lack of training (15-18). Here also, nurses were the occupational group with highest number of incidences reported both in the pre Covid and during Covid period which was similarly reported in other studies (19). Therefore, it is very necessary to run training programs for prevention of NSIs among nurses (20).

Obtaining increased number of incidences among nurses can also be due to more reporting by this group and less reporting of incidences from other occupational groups as documented in certain studies (21).

It has been observed in a study that the aggressive vaccination has contributed in the decline of risk of HBV infection after the exposure (22, 23). Out of HIV, HBV and HCV, only HBV vaccination is available. The status of the vaccination can be checked by Anti-HBs titre. A level of more than 10mIU/ml indicates proper immune response after vaccination. The healthcare workers should get this titre checked from time to time. Hepatitis B vaccine provides protection for atleast 10 years and may last longer (24). Most of the exposed workers were found to be vaccinated completely with all three doses. It should be made compulsory for the healthcare workers to get vaccinated against hepatitis B virus as it will reduce the risk of infection among them (25). The health care centers should try to persuade the staff to get vaccinated by making them aware about its benefits and about the consequences of not getting vaccinated.

This study has its own limitations. The study only takes into account the incidences that were reported but many of the incidences go unreported due to negligence hence there

should be organization of workshops and different programs increasing the awareness about the importance of reporting a NSI and the consequences a non-reported hazard might lead to.

5. Conclusion

It can be concluded that the occurrence of NSI doesn't depend entirely on any one of the factors rather many different reasons. Proper usage of PPE during Covid times decreased the rate of exposure at some sites but the work load at the same time increased the rate in certain scenarios. Also, the healthcare workers should be made aware about all the consequences that can take place due to NSI. Workshops should be held regularly to make them aware about the related risks, to train them to avoid the NSI and to follow proper guidelines and report the same. The HCWs should also be made to understand the importance of proper usage of PPEs.

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Table 1: Baseline characteristics of Study participants

Variables	Categories	Pre Covid		During Covid		Chi- Square/ P-value
		N	%	N	%	
Gender wise distribution	Male	30	42.3	28	39.4	0.0291/ 0.86
	Female	41	57.7	43	60.6	
Profession wise distribution	Doctors	15	21.1	8	11.3	8.416/0.209
	Staff nurse	18	25.4	22	31	
	Nursing Students	10	14.1	6	8.5	
	Lab/OT Technicians	7	9.9	7	9.9	
	Residents (SR/JR)	12	16.9	15	21.1	
	WardAttendants/Helpers	4	5.6	11	15.5	
Place of occurrence	Housekeeping Staff	5	7	2	2.8	5.843/0.441
	Emergency	4	5.6	4	5.6	
	OT	17	23.9	9	12.7	
	ICU	5	7	11	15.5	
	Lab & Blood Bank	7	9.9	6	8.5	
	Surgical department	7	9.9	6	8.5	
Circumstances of Injury	Medicine department	23	32.4	29	40.8	10.43/0.03
	Others	8	11.3	6	8.5	
	During sampling procedure	18	25.4	6	8.5	
	During intravenous administration (recapping)	16	22.5	25	35.2	
	During surgical procedure	31	43.7	2	2.8	
	Biomedical waste segregation	6	8.5	14	19.7	
Site of Injury reported	Others	0	0	24	33.8	12.69/0.013
	Rt. Hand index finger	37	52.1	22	31	
	Rt. Thumb	4	5.6	7	9.9	
	Lt. Hand index finger	14	19.7	28	39.4	
	Lt. Thumb	5	7	9	12.7	
Others	11	15.5	5	7		

Table: 2 Association between Site of Injury and Place							
		Site of Injury					Chi square/ p- value
		Rt. Hand index finger	Rt. Thumb	Lt. Hand index finger	Lt. Thumb	Other s	
Ward	Emergency	3(5.1%)	0(0%)	1(2.4%)	4(28.6%)	0(0%)	40.073/0 .021
	OT	17(28.8%)	1(9.1%)	2(4.8%)	4(14.3%)	4(25%)	
	ICU	5(8.5%)	1(9.1%)	8(19%)	1(7.1%)	1(6.3%)	
	Lab & Blood Bank	3(5.1%)	1(9.1%)	7(16.7%)	1(7.1%)	1(6.3%)	
	Surgical department	8(13.6%)	0(0%)	3(7.1%)	0(0%)	2(12.5%)	
	Medicine department	19(32.2%)	7(63.6%)	16(38.1%)	5(35.7%)	5(31.3%)	
	Others	4(6.8%)	1(9.1%)	5(11.9%)	1(7.1%)	3(18.8%)	

Table 3: Association between Site of Injury and time-period of Covid

Site of Injury	Year		Chi Square/ P value
	Pre Covid	During Covid	
Rt. Hand index finger	37(62.7%)	22(37.3%)	6.524/0.011
Rt. Thumb	4(36.4%)	7(63.6%)	0.887/0.532
Lt. Hand index finger	14(33.3%)	28(66.7%)	6.627/0.010
Lt. Thumb	5(35.7%)	9(64.3%)	1.268/0.399
Others	11(68.8%)	5(31.2%)	2.536/0.183

Table 4: Hepatitis B vaccination status and Anti-HBs titre of NSI exposed HCWs

Year	Era	Unvaccinated/Incomplete vaccination	Completely vaccinated (All 3 doses)	Anti-HBs titre		
				>10mIU/ml	<10mIU/ml	ND (not done)
2018	Pre-	6	20	10	2	8
2019	Covid	10	46	21	3	22
2020	During	12	28	14	3	11
2021	Covid	10	21	12	4	5
Total		38	104	56	12	46

Table 5: Source status (known/unknown) among NSI exposed HCWs, Source status (known/Unknown)

Year	Era	Unknown	Known & Reactive			Known & Non-Reactive
			HIV	HBV	HCV	
2018	Pre-Covid	1	1	3	0	21
2019		5	3	3	7	27
2020	During Covid	0	1	2	2	35
2021		3	0	2	5	21
Total		9	5	10	14	104

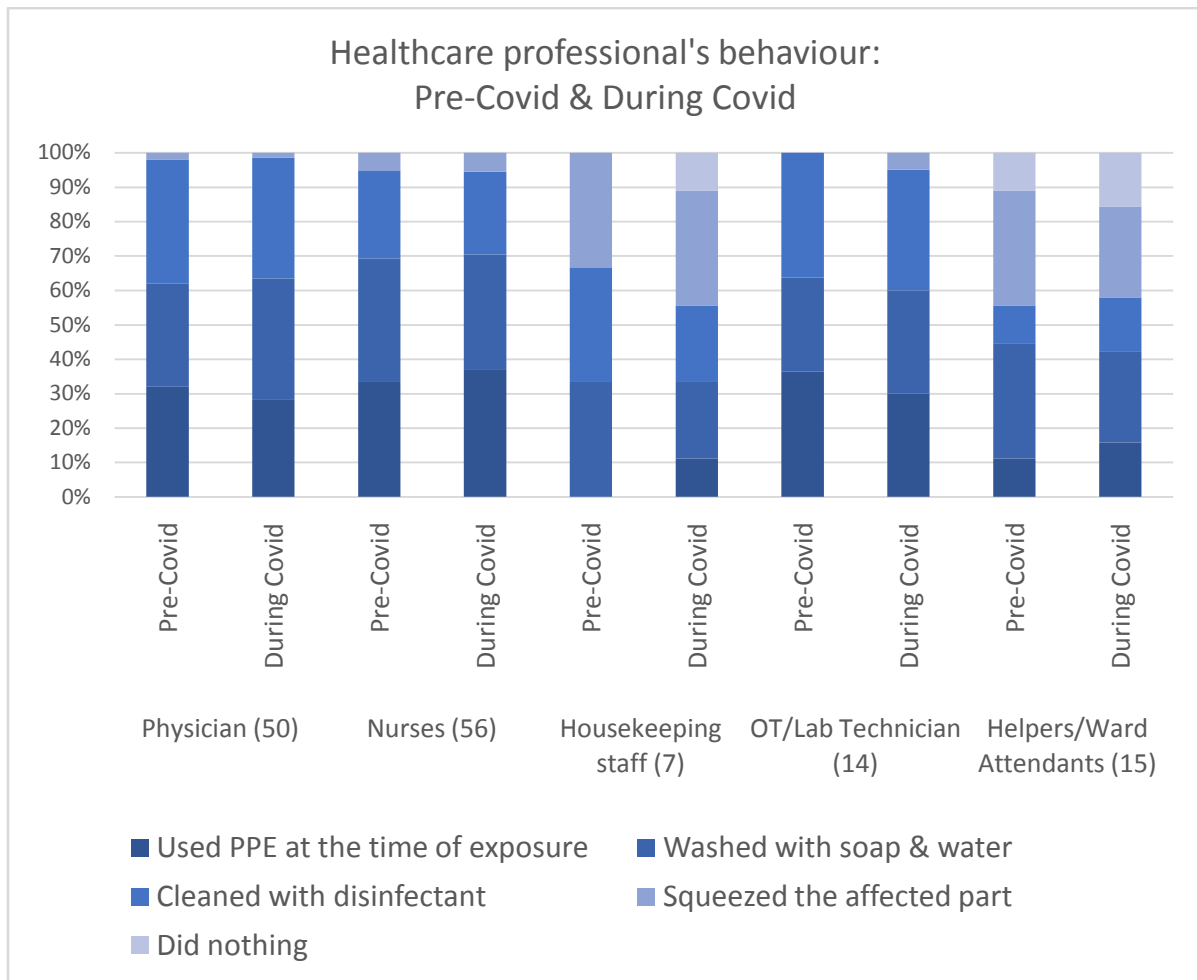


Figure 1: Healthcare professional's behaviour: Pre-Covid& During Covid

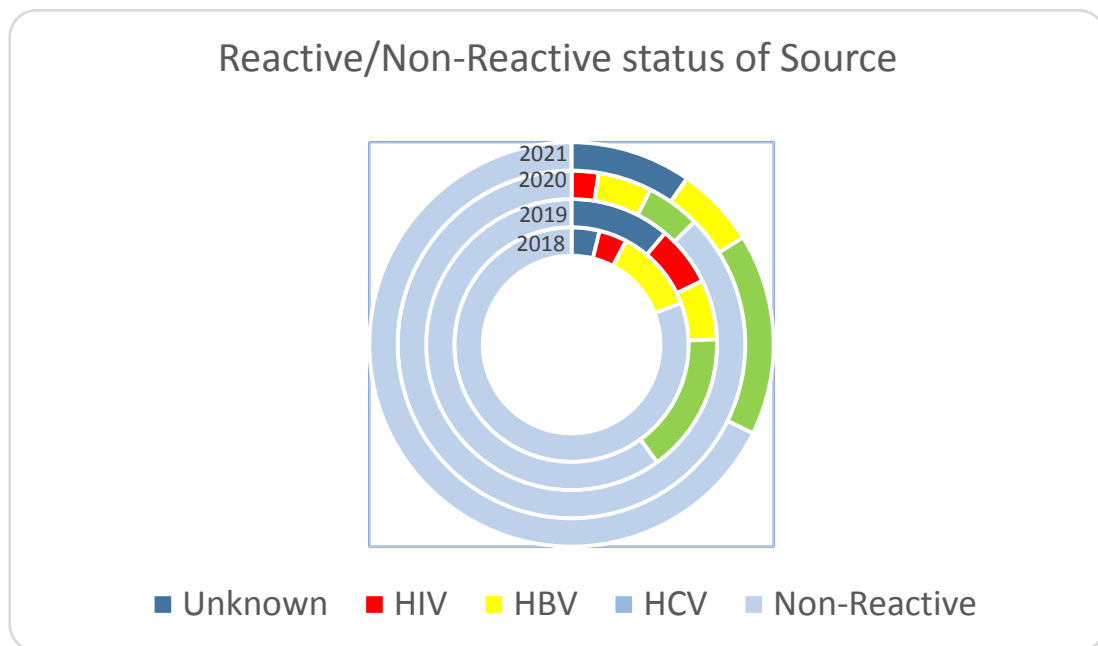


Figure 2: Reactive/Non-Reactive status of Source