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Awareness of Biohazard Handling and Grossing Safety Protocol among Pathology Lab Technicians

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Abstract

In a pathology lab, several types of hazardous events occur on a regular basis and therefore, it is important to develop a risk management system so that exposure to hazards in the lab can be controlled or minimised or even eliminated. This study focuses on the awareness of biohazard handling and grossing safety among lab workers. This study aims to evaluate the level of awareness of biohazard handling and grossing safety protocol among pathology lab technicians. An online questionnaire consisting of 25 questions was circulated to participants of the pathology laboratories at various locations in India. The questions were based on the awareness of lab workers dealing with appropriate biohazards. The data was then analysed using bar graphs through SPSS software. The questionnaire based study consisted of 82 lab technicians of both males (50%) and females (50%). A high percent of pathology lab personnels had participated in this study. The results in this study evaluated and included different variables pertaining to biohazards and grossing safety protocol. The safety of employees in the lab depends on the safe operations which helps in preventing risk from biohazards of the working environment in the lab. Therefore, lab safety can be maintained with careful evaluation of all safety incidents and modification of the safety plan.

Introduction

Operating a biological lab safely is difficult. The use of safe operation of the lab requires specific approaches necessary to protect lab workers from lab chemicals and blood-borne pathogens. (Grizzle, Bell and Fredenburgh, 2005) Lab workers must adopt effective safety plans to deal with biohazards in the laboratory. (Tun, 2017) Safety plans need to be specific to the type of operation in the lab for individual lab workers. (Shobowale *et al.*, 2015; Tun, 2017; Alshammari and Irfan, 2018) They should be able to identify potential sources of biohazards in the lab and reduce the likelihood of injury from such sources by adopting Standard Operating Procedures (SOPs) and which will include the use of safety equipment and thus ensure a safe working environment in the laboratory. (Grizzle, Bell and Fredenburgh, 2005; Nasim *et al.*, 2012; Wader, Kumar and Mutalik, 2013; Al-Abhar *et al.*, 2017; Tun, 2017) Oral Pathology lab includes various procedures from, handling the surgical specimen like large excisional specimen as well as small biopsies, hard tissue - teeth specimen, photomicrography of histopathology, routine and special staining along with advanced diagnostic procedures like immunohistochemistry and other molecular diagnostic methods.(Gifrina Jayaraj, Ramani, *et al.*, 2015; Gifrina Jayaraj, Sherlin, *et al.*, 2015; G. Jayaraj *et al.*, 2015; Jangid *et al.*, 2015; Sherlin *et al.*, 2015; Sivaramakrishnan and Ramani, 2015; Swathy, Gheena and Varsha, 2015; Gupta and Ramani, 2016; Thangaraj *et al.*, 2016; Viveka *et al.*, 2016; Sridharan, Ramani and Patankar, 2017; Hannah, Ramani, Sherlin, *et al.*, 2018; Gheena and Ezhilarasan, 2019a; Hema Shree *et al.*, 2019; Sridharan *et al.*, 2019)All these procedures require careful handling of specimen with all the safety protocol followed diligently.Our institution is passionate about high quality evidence

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based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

Lab workers should be given training on safe management of biohazards in the working environment of the lab prior to starting their work in the lab. Training should be updated periodically for all lab workers appropriate to their working environment and background speciality especially pathology lab technicians those dealing with human or animal tissues and also handling chemical and radioactive substances.

Animals and all human tissues are inherently dangerous and must be handled with universal precautions. All pathology lab technicians handling or processing tissues must be educated and trained on the potential dangers of exposure to human and animal tissues including cuts, sticks, splashes, oral or respiratory transmission. All human tissues and to lesser extent animal tissues, whether fixed, paraffin embedded, fresh-frozen or freeze-dried should be considered as biohazardous. As the extent of alteration of tissue increases, the risk from various chemical agents also increases and the tissues may still be infective. Thus, it must be handled with universal precaution. The other sources of biohazard may include systems for transfecting cells with specific genetic products. The safety from such systems should always be considered. (Grizzle, Bell and Fredenburgh, 2005)

Most labs deal with relatively small amounts of most chemicals which may be very dangerous biohazard. Most chemicals are toxic or carcinogenic or teratogens. (Grizzle, Bell and Fredenburgh, 2005; Alshammari and Irfan, 2018) Especially chemicals like ether, when it expires becomes oxidised on opening it, or picric acid that has dried out, may constitute explosive hazards. Combinations of chemicals may also cause spontaneous combustion as well as accelerated heating, which may cause boiling and splashing or even explosion. Lab personnels' should avoid direct contact with even small quantities of carcinogens, teratogens and/or highly toxic agents such as cyanides and other concentrated acids like HCL. When working with such chemicals, the chemical safety plan should ensure potential risks are avoided by proper work procedures and by proper clothing and safety equipment, and by extensive training on biosafety. (Grizzle, Bell and Fredenburgh, 2005)

The other sources of hazardous risks include electrical injuries, fire accidents and radiation hazards. Electrical injuries can be avoided by ensuring that all equipment in the laboratory are grounded and the electrical base plugs are in good condition. Electrical work should be done with great care. This risk to injury can be avoided by ensuring periodical testing and servicing of all purchased equipment in the laboratory. A prime concern is also that great care should be

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taken with electrical appliances/equipment around water sources or wet areas of the laboratory especially in the working environment. (Grizzle, Bell and Fredenburgh, 2005)

Fire safety in the laboratory must be practiced by means of fire drills and emergency exit pathways should be posed at all room exits. Flammable agents should be stored appropriately and located near the exits of the room. (Grizzle, Bell and Fredenburgh, 2005) Lab personnels coming in contact with radioactive materials in the lab should be given extensive training on the radiological safety plan. Lab personnels working with radioactive materials should be shielded from exposure to radiation with use of appropriate lab clothing and safety equipment. (Grizzle, Bell and Fredenburgh, 2005)

The clinical lab is a potentially hazardous place (Shobowale *et al.*, 2015) and hence this study focused on awareness of various biohazards and grossing safety protocol among pathology lab technicians.

Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Ariga *et al.*, 2018; Basha, Ganapathy and Venugopalan, 2018; Hannah, Ramani, Herald. J. Sherlin, *et al.*, 2018; Hussainy *et al.*, 2018; Jeevanandan and Govindaraju, 2018; Kannan and Venugopalan, 2018; Kumar and Antony, 2018; Manohar and Sharma, 2018; Menon *et al.*, 2018; Nandakumar and Nasim, 2018; Nandhini, Babu and Mohanraj, 2018; Ravinthar and Jayalakshmi, 2018; Seppan *et al.*, 2018; Teja, Ramesh and Priya, 2018; Duraisamy *et al.*, 2019; Gheena and Ezhilarasan, 2019b; Hema Shree *et al.*, 2019; Rajakeerthi and Ms, 2019; Rajendran *et al.*, 2019; Sekar *et al.*, 2019; Sharma *et al.*, 2019; Siddique *et al.*, 2019; Janani, Palanivelu and Sandhya, 2020; Johnson *et al.*, 2020; Jose, Ajitha and Subbaiyan, 2020).

Materials and methods

This study was an online survey which consisted of approximately 25 questions relating to awareness of biohazards and grossing safety protocol among lab technicians of the Indian population during the period of April 2020 to May 2020. All willing participants were included in the study. A consent was obtained from the heads of various laboratories prior to online distribution of questionnaires to lab personnels. The questionnaire was developed from existing literature studies composed of questions pertaining to the type of job practice and basic questions relating to workplace and safe work practices, the use of PPEs, disinfection methods, hand hygiene, handling of specimens and lab waste disposals. Other aspects of the study assessed vaccination protocols, use of safety cabinets, fire safety and standard operating procedures.

This prospective cross-sectional study included a sample size of 82 participants of both private and public practice. The data collected was then reviewed and analysed. Incomplete and

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censored data had been excluded from the study. All included data was analysed using the SPSS software. Analysis of percentage and distribution was doen followed by association of various parameters using chi square test.

Results and discussion

In this study, among 82 participants, 50% were males and another 50% were females. (fig.1) and the frequency of each variable measuring the biohazard and grossing safety protocol had been evaluated. Among the study group, the participants' ages ranged between 24 and 41 years. The frequency of the participants of the department of speciality showed 22% biochemistry, 19.5% hematology, 19.5% microbiology, 7.3% molecular genetics, 29.3% pathologist and 2.4% were researchers. (fig.2)

From this study, it is clear that all the participants were aware of the exposure to various biohazards in clinical lab practice. 12.2% participants used lab coats, gloves, masks and 87.8% participants used lab coats, gloves, masks and eyewear as a safety precaution during their work in the laboratory. (fig.3) 36.6% responded that they have the facility to use eye splashes for accidental splash of chemicals. (fig.4) 55% participants practiced post-exposure prophylaxis. 79% participants had been immunised with Hepatitis B vaccine. 72% participants disinfected their work table daily. and 28% disinfected their work table weekly. (fig.5)

With regard to the grossing safety and precautions, 67.1% participants recapped the used syringes; 19% participants recapped the used syringes occasionally and 8% did not recap the used syringes. (fig.6) 89% participants used to discard the used syringes in a needle discarder, 9.8% used to throw needle and syringe separately in a biological discarder and 1.2% used to throw syringes in a biological discard cover. 96.3% used separate discarders for sharps and blades. (fig.7) 35.4% participants used blood samples for mouth pipetting; 12.2% used chemical samples for mouth pipetting; 8.5% used dilution samples for mouth pipetting and 43.9% did not use any sample for mouth pipetting. 32.9% participants experienced serious accidents like chemical spills and splash of HCL. 46.3% have experienced needle-prick injuries in their work practice. (fig.8) 72% of the participants had implemented and abided by the safety policies for managing the chemical accidents. (fig.9)

7.3% called for sweepers if spilling of specimen happened; 20.7% informed infection control committee if spilling of specimen happened; 15.9% used disinfectant and washed with water if spilling of specimen happened; 7.3% used disinfectant and informed infection control committee and also called for sweepers if spilling of specimen happened; 11% used disinfectant, wiped with tissue and informed infection control committee if spilling of specimen happened; 13.4% used disinfectant, wiped with tissue and informed infection control committee and also washed with water if spilling of specimen happened; 9.8% used disinfectant, wiped with tissue, informed

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infection control committee, washed with water and also called for sweepers if spilling of specimen happened; 6.1% wiped with tissue, informed infection control committee and also washed with water if spilling of specimen happened. (fig.10)

From this study, it is evident that all participants had fire extinguisher, fire blankets in their laboratory. 96.3% had used Standard and Basic Operating Procedures (SOPs/BOPs) in their labs. 89% participants responded that there is maintenance of accident records in their labs. (fig.11)

Association of the gender and the various parameters discussed to assess the awareness about the precautionary measures followed by the lab workers was analysed using chi-square test and depicted in the graphs (Figure 12 -15). (P value <0.05 was considered to be statistically significant.) Majority of males exhibited better awareness and knowledge regarding various safety protocols and precautionary measures in the lab.

A limited number studies had investigated the knowledge and compliance on the biosafety of laboratory staff to standard precautionary measures. The study revealed both males and females equally had a required level of awareness of biohazard handling and grossing safety of pathology lab. In this study, it is evident that several types of hazardous events occur within the labs on a regular basis and it is therefore important to assess the safety practices of lab personnels with respect to their work practice in the lab.

It is also evident that, most of the participants in this study had used all sorts of PPEs during their safety practices in the lab which indicates good working practices of lab personnels in the clinical lab. The findings in the study represents only a small percent of participants which have facility of using eye splashes in their labs during accidental splash of chemicals, which implies there is a need for implementation of more awareness in the use of eye splashes in most labs.

Another finding in the study showed poor practice of post-exposure prophylaxis of the participants suggesting that there must be more regular implementation of post-exposure prophylaxis during work practices. This study revealed that only 79% participants had been immunised with Hepatitis B vaccine which seems to be more than in previous studies. (Shobowale *et al.*, 2015)

The findings in this study also suggests that a small percentage of participants experienced hazardous accidents like chemical spills and needle-prick injuries during their work practice which implies the need to learn and be trained with improved biosafety practices. Nearly more than half percent of the participants used a safety cabinet in their laboratories.

The study also revealed more than 60% of pathology lab staff had been undergoing training on the biosafety of pathology labs. Whereas, a few studies showed there is a general lack of

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biosafety training among the pathology lab staff. (Shobowale *et al.*, 2015) and in another study (Grizzle, Bell and Fredenburgh, 2005; Nasim *et al.*, 2012; Wader, Kumar and Mutalik, 2013; Al-Abhar *et al.*, 2017; Tun, 2017) it was shown that only 39% of laboratory staff had received laboratory biosafety training. This practice still needs to be looked at and an improvement policy must be implemented to such practices.

Conclusion

Within the limits of this study, there is an increasing need for biosafety to be placed in the forefront of issues in lab practices in over respective facilities.

The safety of lab personnels depends on safe operations, thereby preventing risks from biohazards in the working environment of the lab. Monitoring safety incidents in the lab can bring about modification of the safety plan.

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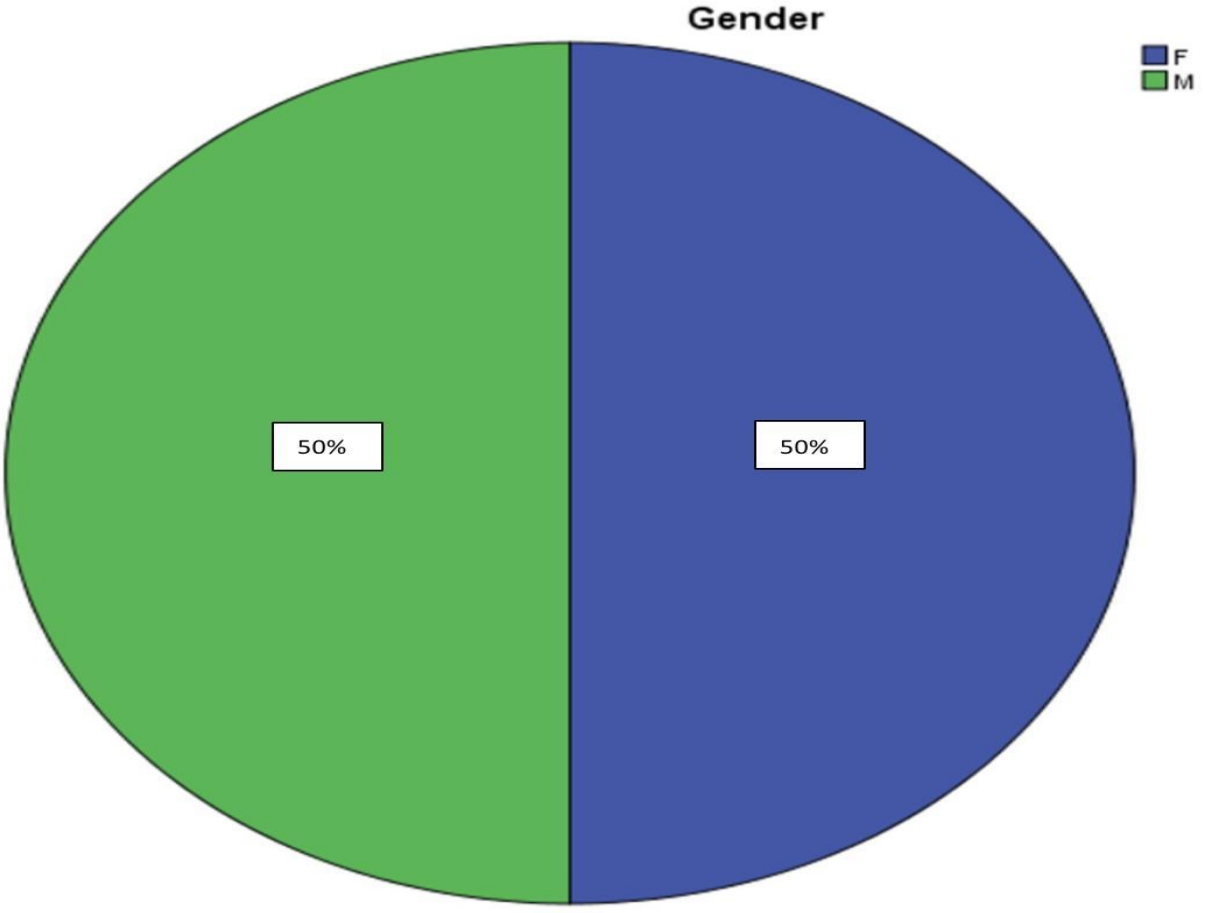

Figure- 1 Pie chart depicting the association of responses based on gender distribution of participants with the percentage of males being 50% and females being 50%

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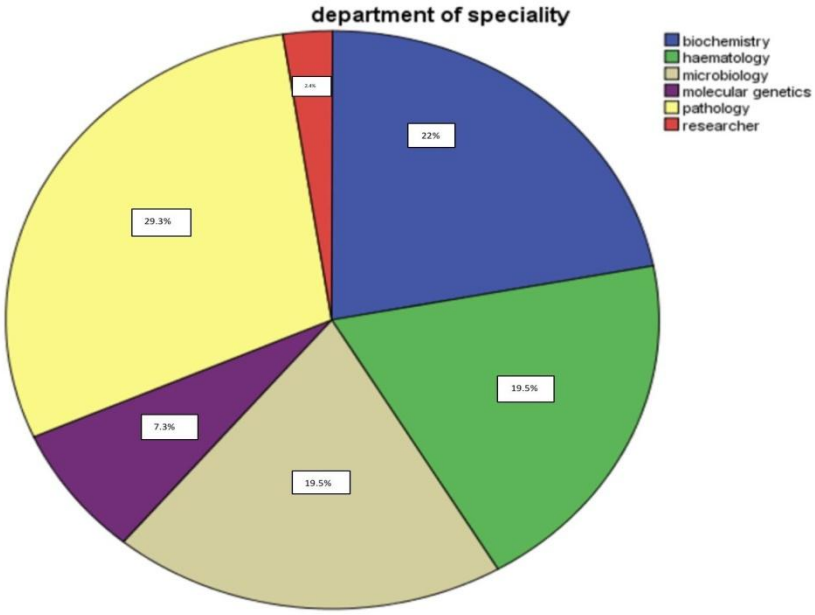

Figure- 2 Pie chart depicting the association of responses based on distribution of speciality department of participants showing biochemistry (22%), haematology (19.5%), microbiology (19.5%), molecular genetics (7.3%), pathology (29.3%) and researchers (2.4%)

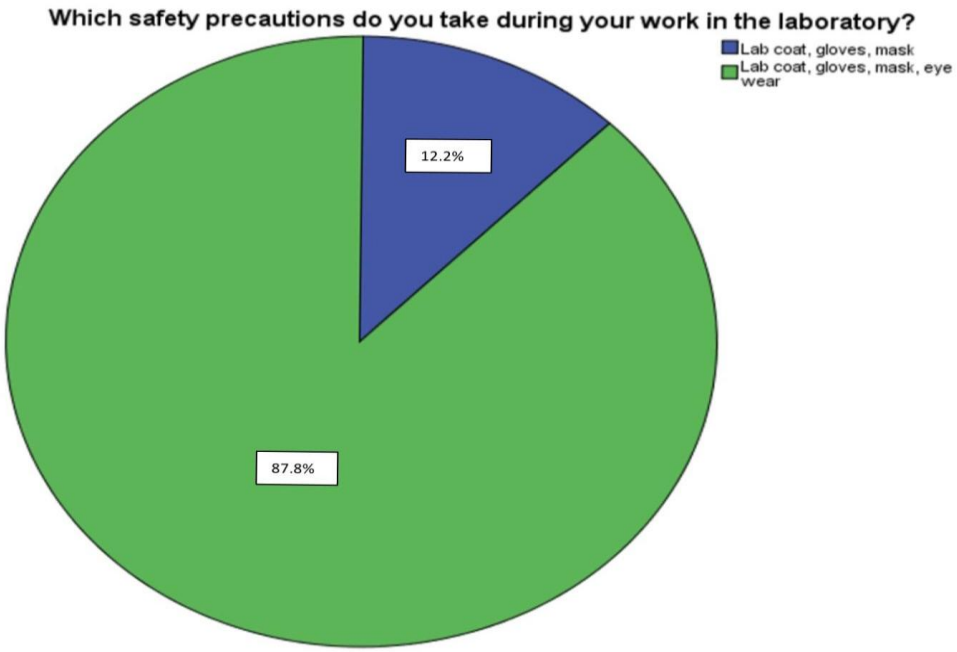

Figure- 3 Pie chart depicting the association of responses based on the awareness of safety precautions taken by participants during lab work. 12.2% used lab coat, gloves and mask and 87.8% used lab coat, gloves, mask and eye wears.

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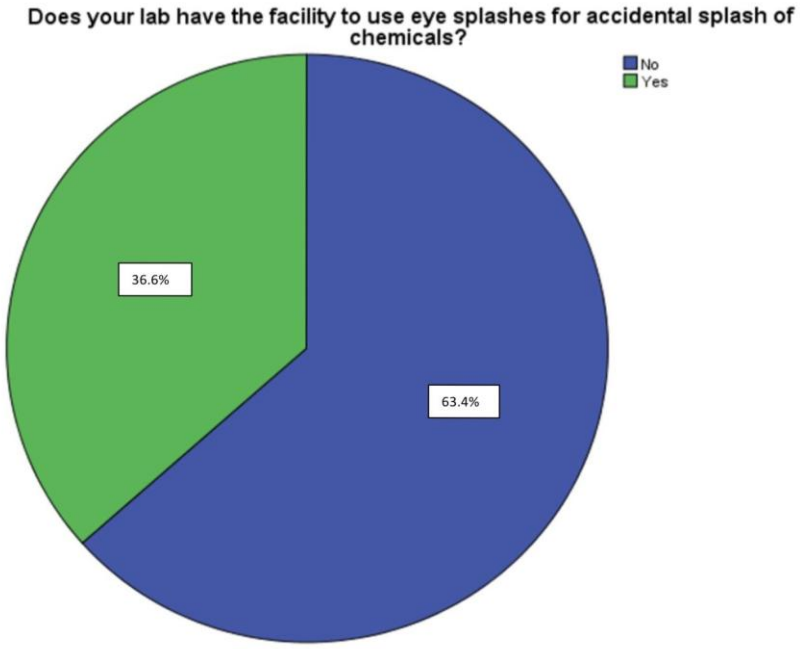

Figure- 4 Pie chart depicting the association of responses based on the awareness regarding the facility to use eye splashes for accidental splash of chemicals at lab work. Those who agreed - 36.6%, disagreed - 63.4%

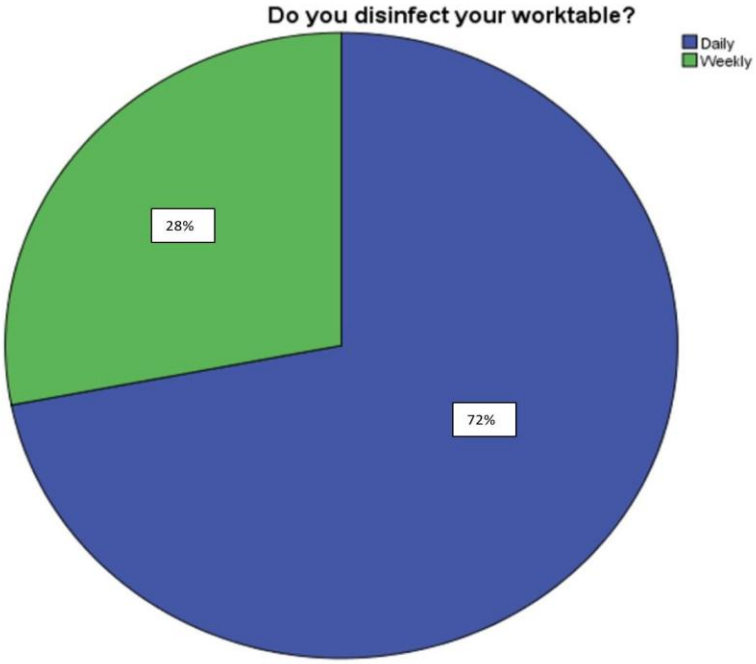

Figure- 5 Pie chart showing the frequency of responses of the participants who disinfect their worktable. Participants who disinfect their work tables daily - 72% , weekly - 28%

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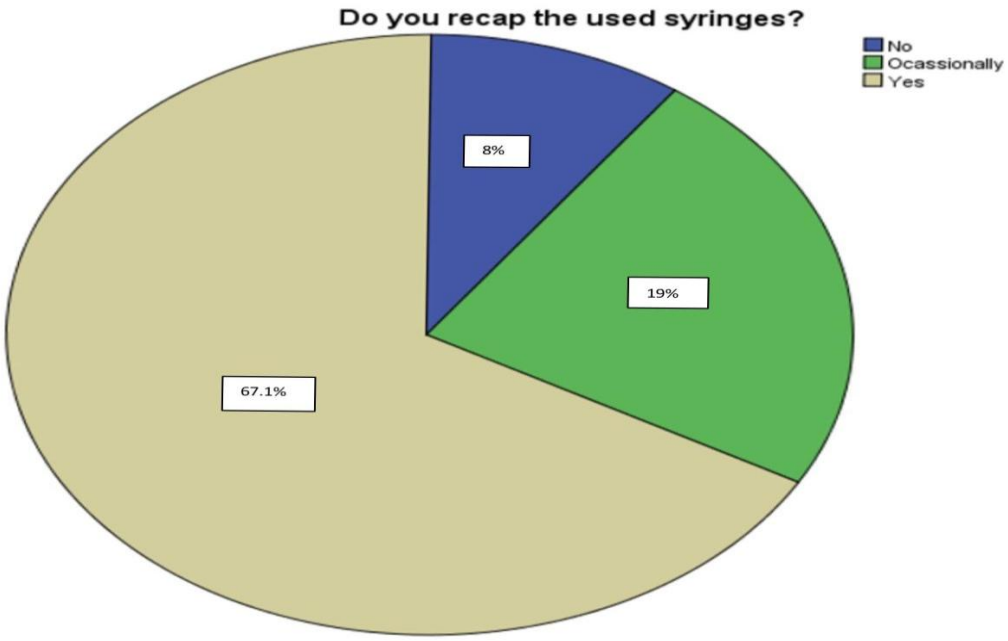

Figure- 6 Pie chart showing frequency of the participants who recap the used syringes. Those who agreed - 67.1%, disagreed - 8%, occasionally - 19%

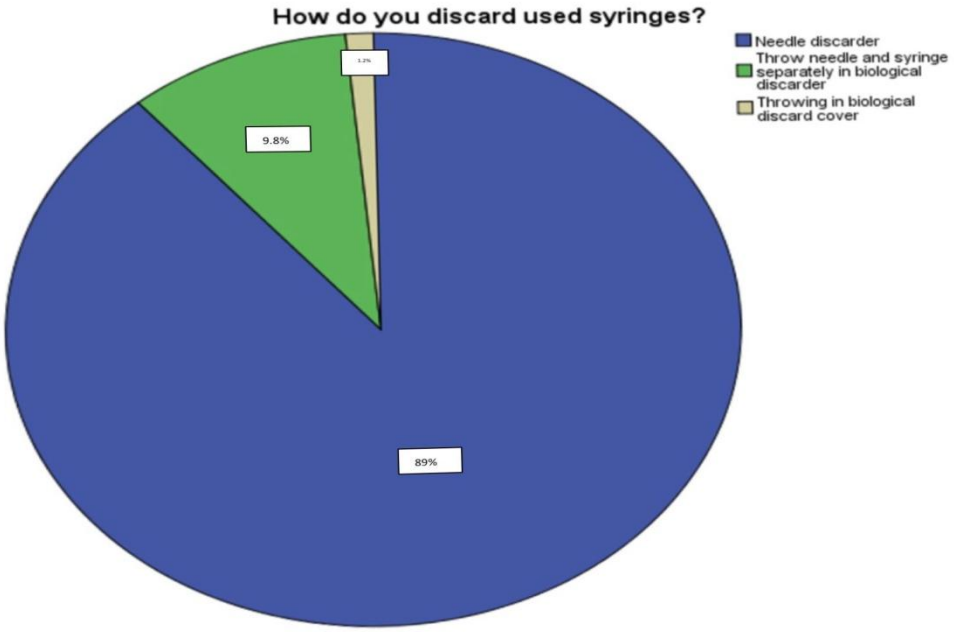

Figure- 7 Pie chart showing frequency of response of participants who responded to how they discard the used syringes. Those who used needle discarder - 89% , throw away needle and syringe separately in biological discarded - 11%

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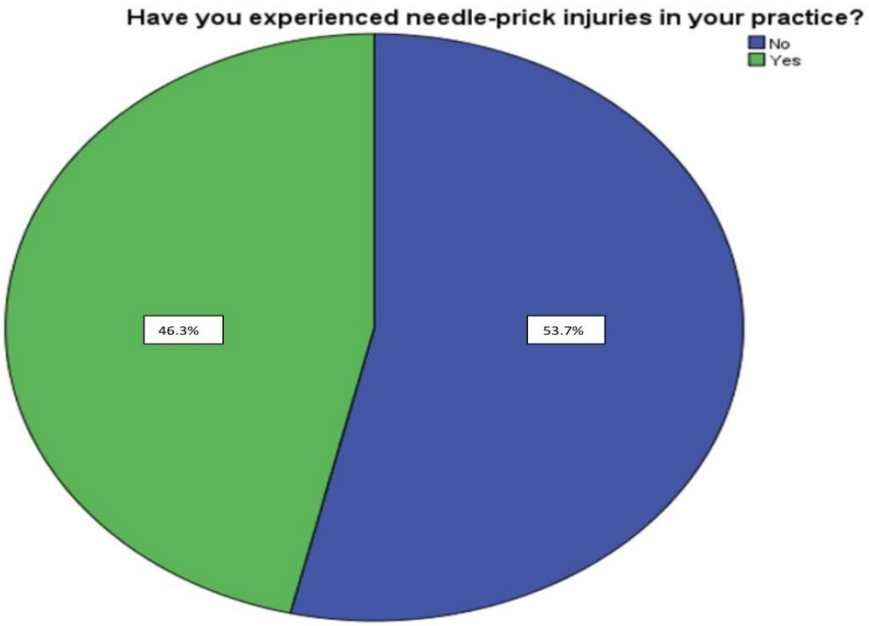

Figure- 8 Pie chart showing frequency of response of participants who experienced needle-prick injuries in their practice. Those who agreed - 46.3%, disagreed - 53.7%

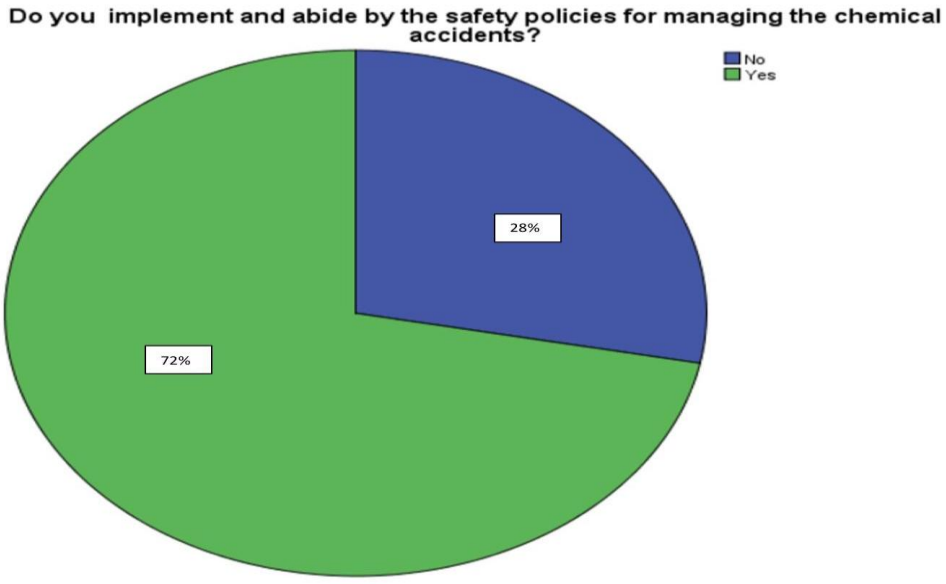

Figure- 9 Pie chart showing frequency of responses of participants who implement the safety policies for managing the chemical accidents. Those who agreed - 72%, disagreed - 28%

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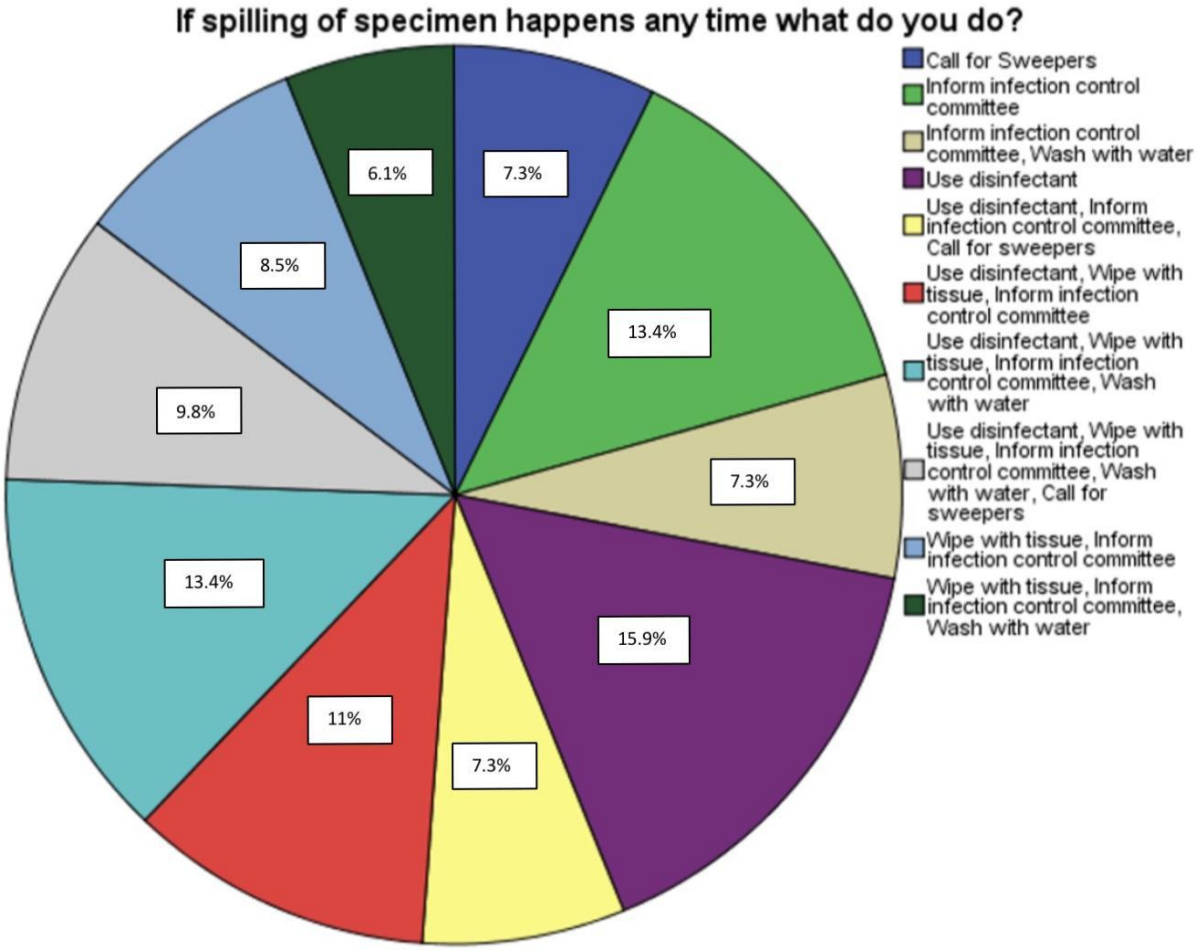

Figure- 10 Pie chart showing frequency of participants who responded what they do if spilling of specimens happens. Those who called for sweepers - 7.3% ; informed infection control committee - 13.4% ; informed infection control committee , washed with water - 7.3% ; used disinfectant - 15.9% ; used disinfectant, informed infection control committee, called for sweepers - 7.3% ; used disinfectant, wiped with tissue, informed infection control committee - 11% ; used disinfectant, wiped with tissue, informed infection control committee, washed with water - 13.4% ; used disinfectant, wiped with tissue, informed infection control committee, washed with water, called for sweepers - 9.8% ; wiped with tissue , informed infection control committee - 8.5% ; wiped with tissue, informed infection control committee, washed with water - 6.1%

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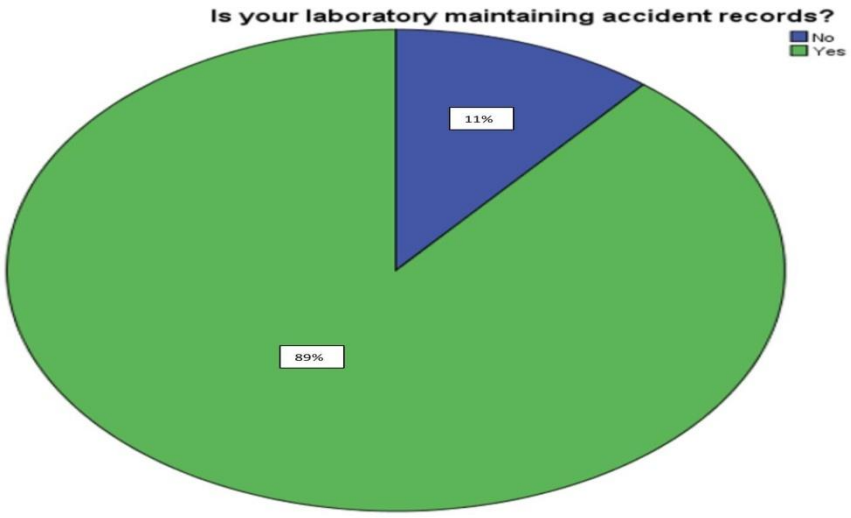

Figure- 11 Pie chart showing frequency of responses of participants' regarding facility of maintaining accident records in their laboratory. Those who agreed - 89% , disagreed - 11%

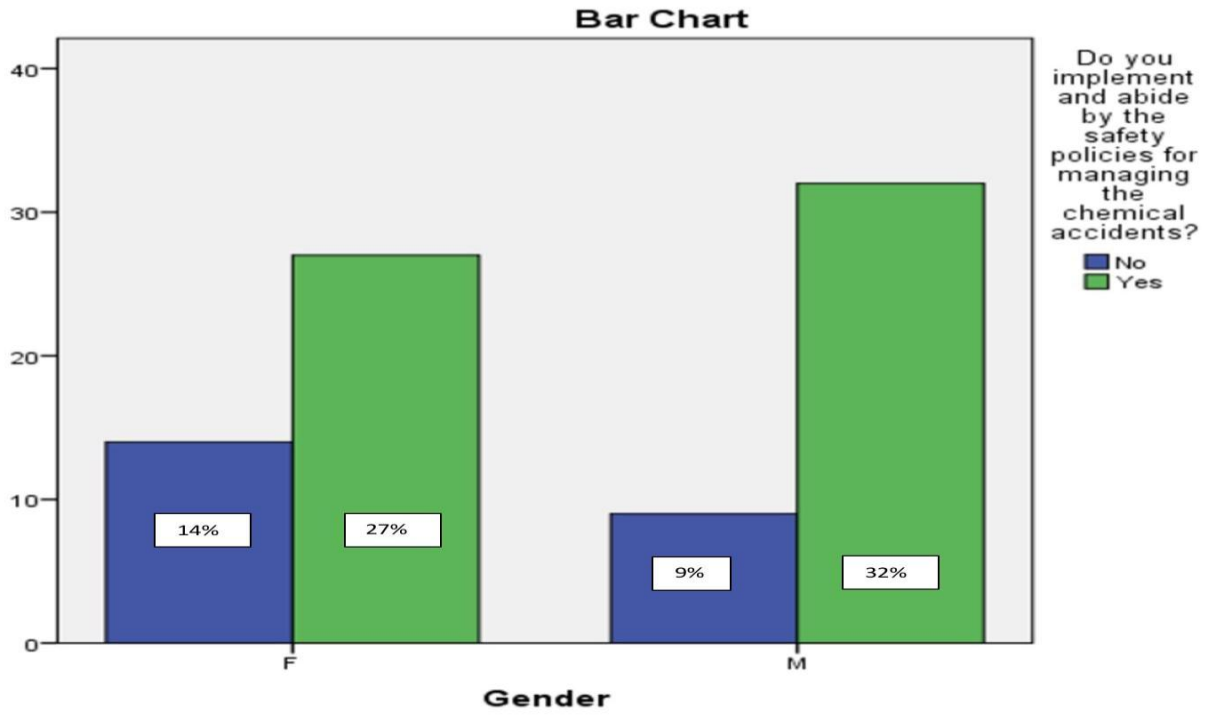

Figure- 12 Bar chart showing association between gender and awareness of participants who implement and abide by the safety policies for managing the chemical accidents. X-axis represents the gender , Y-axis represents the number of responses. Males were found to be more aware and practice implementation and abide by the safety policies for managing the chemical accidents than females. Pearson's chi-square test shows p-value is 0.219 (>0.05). Hence it is not statistically significant.

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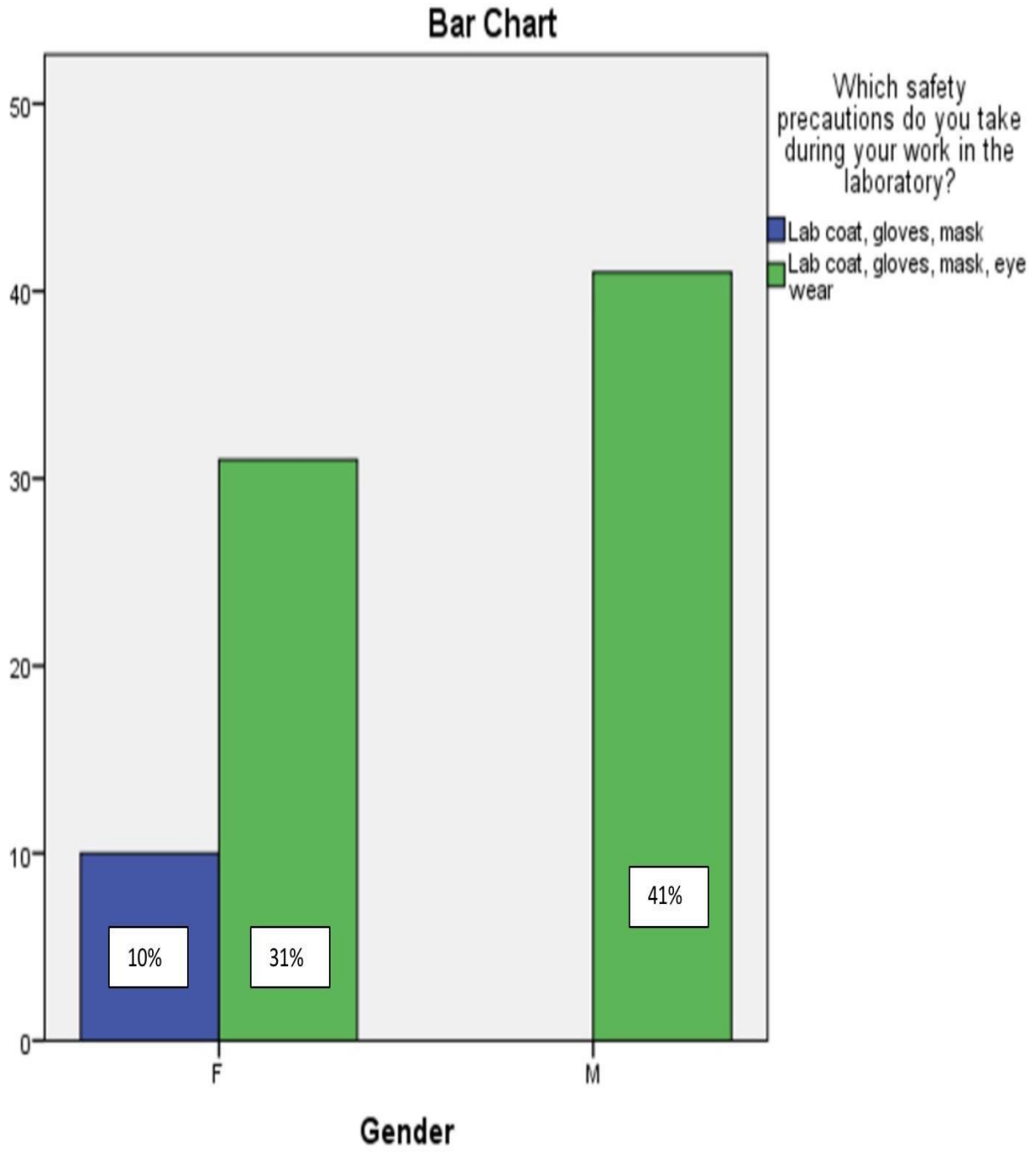

Figure- 13 Bar chart showing association between gender and awareness of safety precautions taken by participants during their work in the laboratory. X-axis represents gender , Y-axis represents number of responses. Males are found to be more aware of the safety precautions taken during their work in the laboratory rather than females. Pearson's chi-square test shows p-value is 0.001 (<0.05). Hence it is statistically significant.

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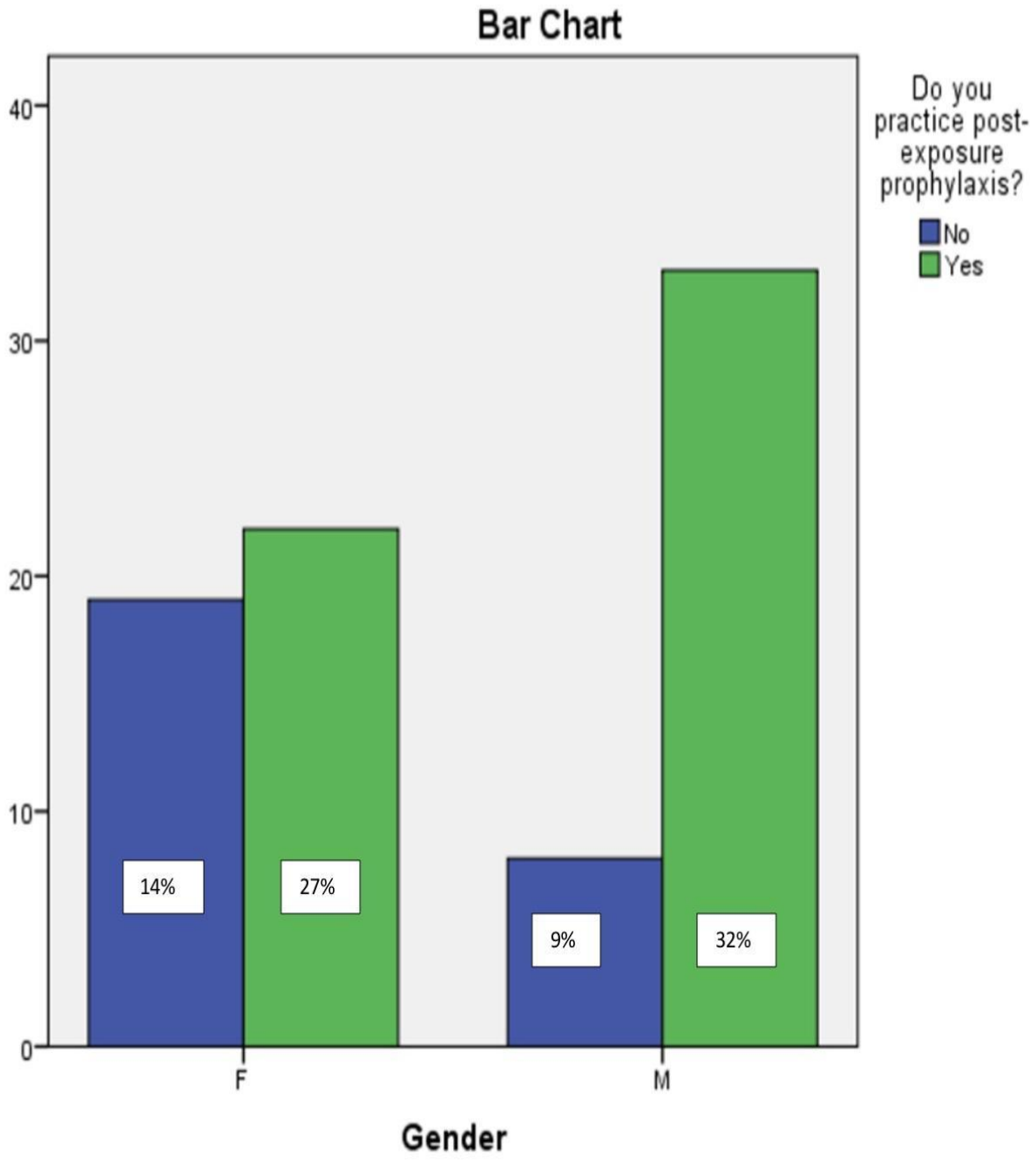

Figure- 14 Bar chart showing association between gender and awareness of practice of post-exposure prophylaxis. X-axis represents gender, Y-axis represents number of responses. Males are found to be more aware than females regarding the practice of post-exposure prophylaxis. Pearson's chi-square test shows p-value is 0.010 (<0.05). Hence it is statistically significant.

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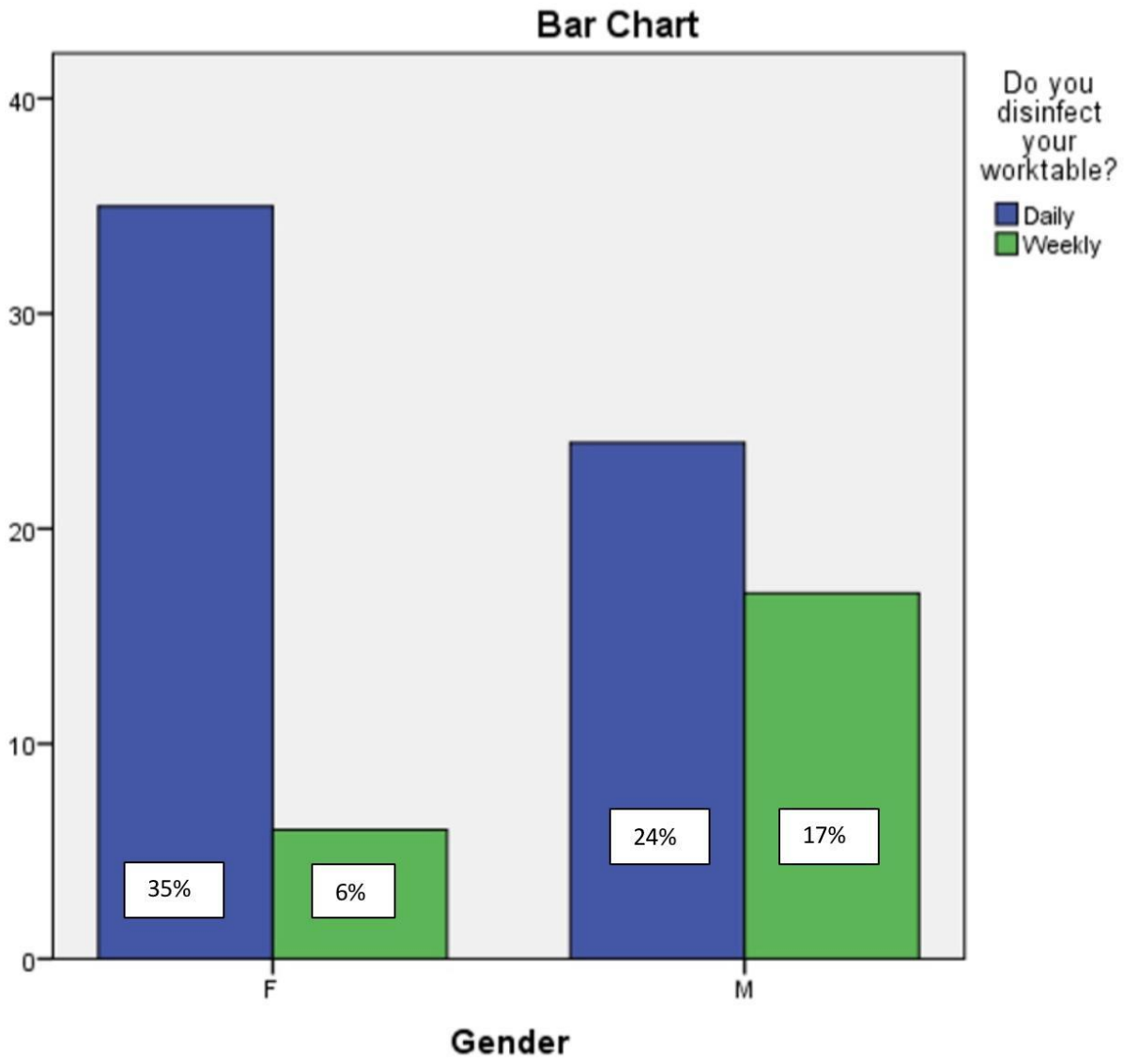

Figure- 15 Bar chart showing association between gender and awareness of participants disinfecting their work tables at work. X-axis represents gender, Y-axis represents number of responses. Majority of males were found to disinfect their work tables at work rather than females. Pearson's chi-square test shows p-value is 0.007 (<0.05). Hence it is statistically significant.