

Awareness About Ppe Disinfection Methods Among Dental Students - The Need Of The Hour

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Abstract

Introduction: Protective apparel, helmets, goggles, or other garments or equipment intended to shield the wearer's body from injury or infection is known as personal protective equipment (PPE). Physical, electrical, heat, chemicals, biohazards, and airborne particulate matter are all threats covered by protective equipment.

Aim: To assess the awareness of PPE disinfection methods among dental students.

Materials and methods: A questionnaire was prepared using Google forms based by on the awareness about the PPE disinfection methods among dental students in Chennai. It was then circulated among a certain set of participants using applications such as WhatsApp and Gmail.

Results and discussion: The results were obtained from SPSS in the form of graphs which were later added to pages. 30% of the males and 35% of the females are shown to be aware of the disinfection methods of the PPE kit. 27,50% of males and 45% of females prefer using proper disinfectants.

Conclusion: Knowledge and awareness of the various methods is not just enough since everyone need not be well versed about the leading technology of disinfection especially with the onset of the pandemic. Thus more awareness must be created.

Keywords: PPE, Sterilization, disinfectant.

INTRODUCTION:

Protective apparel, helmets, goggles, or other garments or equipment intended to shield the wearer's body from injury or infection is known as personal protective equipment (PPE)[1]. Physical, electrical, heat, chemicals, biohazards, and airborne particulate matter are all threats covered by protective equipment. Disinfectants are chemical agents that are used to kill or inactivate bacteria on inert surfaces. Disinfection is less efficient than sterilisation, which is an intense physical or chemical procedure that destroys all forms of life. Disinfectants are distinct from other antimicrobial agents such as antibiotics, which kill bacteria within the body, and antiseptics, which kill bacteria on living tissue[1,2]. Disinfectants vary from biocides in that biocides are designed to destroy all types of life, not just microorganisms. Microbes' cell walls are destroyed or their metabolism is disrupted by disinfectants. It's also a form of decontamination, and it's the process of reducing the number of pathogenic microorganisms on a surface using physical or chemical

methods. Disinfectants may also be used to kill microorganisms on the skin and mucous membranes, as the term "disinfectant" originally meant "to kill bacteria" in the medical dictionary[3].

Sanitizers are agents that disinfect and treat at the same time. Sanitizers kill less germs than disinfectants[4]. Disinfectants are often used to destroy infectious species in hospitals, dental surgeries, kitchens, and toilets. Sanitizers are milder than disinfectants and are mostly used to clean items that come into contact with humans, while disinfectants are concentrated and are used to clean surfaces such as floors and building structures.

Sodium hypochlorite (bleach / chlorine) at a recommended concentration of 0.1 percent or 1,000ppm can be used in non-healthcare environments (1 part of 5 percent strength household bleach to 49 parts of water). Surface disinfection can also be done with 70-90 percent alcohol. To remove dirt, clean the surfaces with water and soap or a detergent first, then disinfect. Cleanliness must always begin with the least smeared (cleanest) area and work its way up to the most soiled (dirtiest) area to avoid spreading dirt to less soiled areas.

Disinfection can be done either by physical or chemical methods[5]. Glutaraldehyde-based formulations (2%), stabilised hydrogen peroxide (6%), peracetic acid (variable amounts, but 1% is sporicidal), and sodium hypochlorite (5.25 percent, diluted to 1000 ppm available chlorine – 1:50 dilution) are some of the chemical germicides used for high-level disinfection. The best chemical germicide for a given situation should be chosen based on the item to be disinfected, its structure, and intended use; the degree of disinfection required; and the scope of services, physical facilities, equipment, and personnel available[6]. Hot-water disinfection (pasteurisation) and steam disinfection are two physical methods for high-level disinfection (e.g. autoclaving at lower temperature). Pasteurization seems to be a non-toxic and outlay alternative to chemical germicides for high-level disinfection. Apparatus must be immersed in water at a temperature of about 70 °C for at least 30 minutes (less than the temperature that typically damages plastic). A commercial washer or pasteurizer may be used for pasteurisation. Microwave irradiation is a low-cost, high-efficiency method of sterilisation and disinfection. Steam sterilisation, on the other hand, is not ideal for treating low melting point plastics, powders, or anhydrous oils. Bacterial spores can survive disinfection at high levels. Microbial screening may confirm that high-level disinfection has destroyed vegetative bacteria, but such sampling is not regularly recommended. When cleaning or processing equipment and instruments, personal protective equipment (PPE) is needed to avoid splashing, spraying, or aerosols.

Soap (e.g. liquid dish soap) and clean water should be used to clean the appliances. Fully rinse the equipment with clean water. Disinfect the equipment to destroy any pathogens that might still be present[7]. Equipment can be disinfected in a variety of ways, and the materials available at the health-care facility should be used. Heat may be used to disinfect heat-resistant equipment that can handle high temperatures (e.g. 80°C); such equipment can be disinfected with a washer–disinfector[8]. Use chemical disinfection (e.g. soak in 1:100 sodium hypochlorite solution for 30 minutes) for plastic equipment that may not withstand 80 °C and for equipment that may be damaged by boiling, or in the absence of the equipment mentioned above. Rinse with sterile or safe water if using chemical disinfection (i.e. water boiled for 5 minutes and cooled)[9]. Since tap or distilled water can harbour microorganisms that can trigger pneumonia, sterile water is preferred for rinsing off residual liquid chemical disinfectant from a respiratory system that has been chemically disinfected for reuse. If sterile water is not available, rinse with tap water or filtered water (water that has been passed through a 0.2 filter), then proceed with an alcohol rinse and forced-air drying[10]. Among the dry items are: A drying function is also included in physical equipment (such as a washer, pasteurizer, or autoclave). Allow equipment parts to air dry on a clean towel or cloth for chemical methods. Dry appliances should be stored in sealed packages[11,12].

Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade[13–28]. Our institution is passionate about high quality evidence based research and has excelled in various fields [8,29–42]

This study was designed to assess the awareness among dental students regarding the various PPE disinfection methods and to provide the students with enough information on other techniques that are not very popular but effective, which is very much the need of the hour during this pandemic.

MATERIALS AND METHODS:

A questionnaire was prepared using Google forms based on the awareness about the PPE disinfection methods among dental students in Chennai. It was then circulated among a certain set of participants. The results were then calculated and presented with accurate statistics using the statistics software IBM SPSS statistics (Version 23). The results were obtained from SPSS depicted in the form of graphs.

RESULTS:

In fig. 1, 30% of the males and 35% of the females are shown to be aware of the disinfection methods of the PPE kit. 27,50% of males and 45% of females prefer using proper disinfectants (fig.2). 30% of males and 35% of females are aware about PPE disinfection methods(fig:3). 22.50% of males and 42.50% of females are aware that all equipment comes under the term PPE (fig:4). In (fig.5,) both the males (10%) and the females (20%) agree that UV and hydrogen peroxide sterilization and disinfection is the preferred type. The association between gender and various responses was analysed using chi square test (p value < 0.05 was considered statistically significant) depicted in Fig 6-17

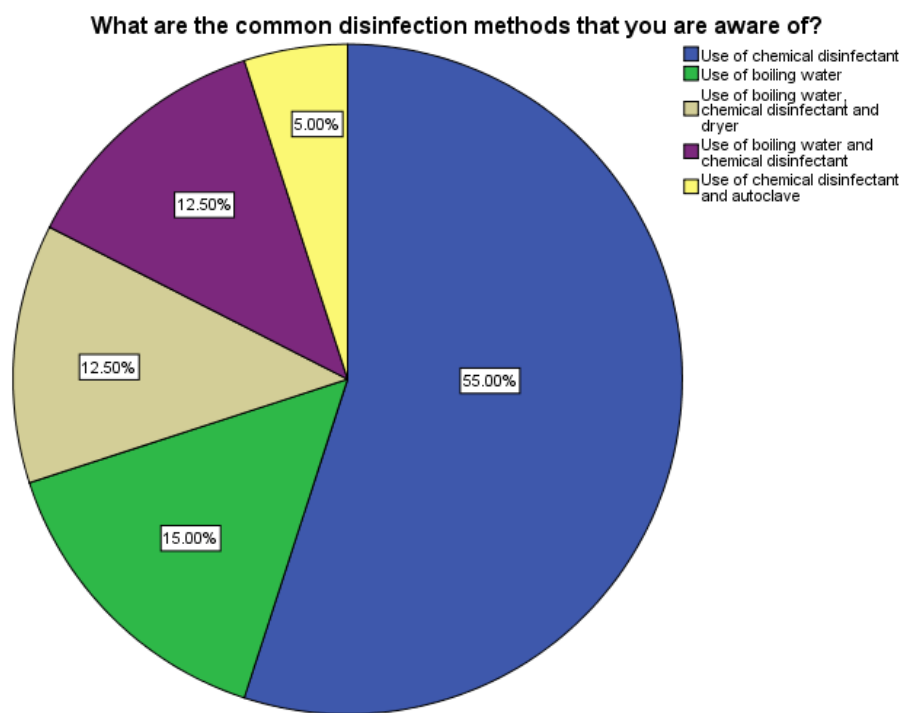


Fig. 1: The above pie chart shows the common disinfection methods that the participants are aware of. The blue portion denotes use of chemical disinfectant, the green portion denotes use of boiling water, the khaki portion denotes use of chemical disinfectant in the dryer, the purple portion denotes use of boiling water and disinfectant and the yellow portion denotes use of chemical disinfectant and autoclave. Majority of the participants (55%) were aware of the use of chemical disinfectants.

What is the most commonly used disinfection method during the pandemic?

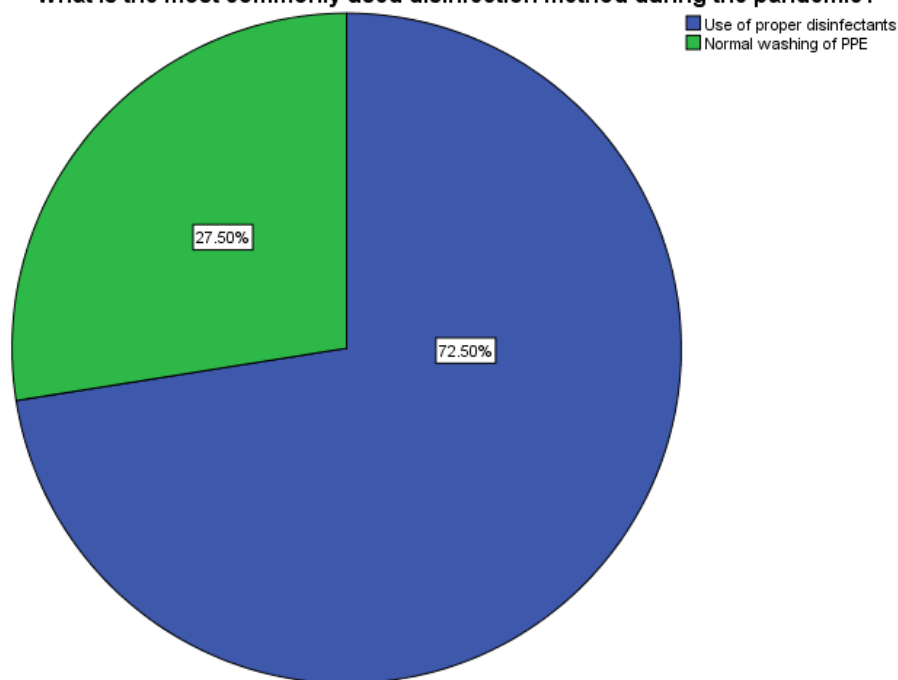


Fig.2: The above pie chart shows the most commonly used disinfection method during the pandemic. The blue portion denotes use of proper disinfectants and the green portion denotes normal washing of PPE. Majority of the population (72.5%) chose to use proper disinfectants alone.

Are you aware of the disinfection methods for the PPE (Personal Protective Equipment)?

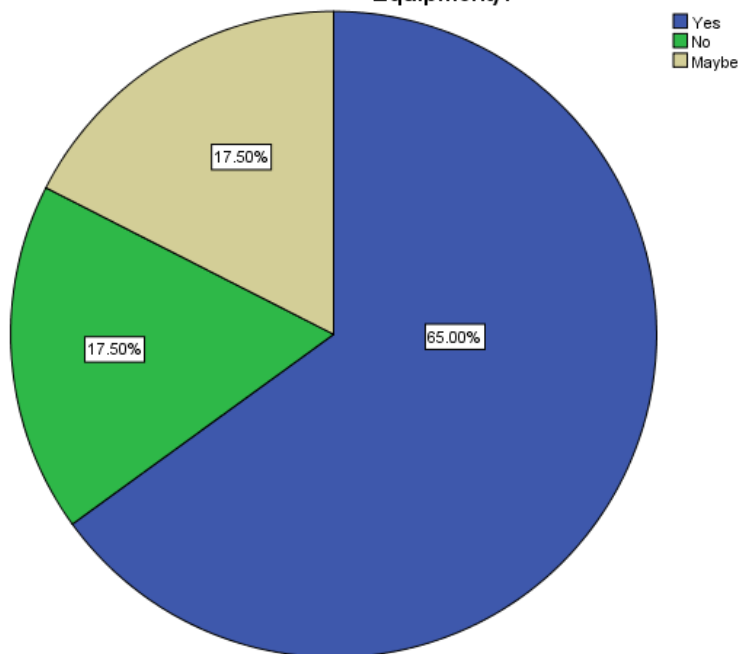


Fig. 3: The above pie chart shows how aware the participants were regarding the disinfection methods for the PPE. The blue portion denotes that they are aware, the green portion denotes that they are not aware and the khaki portion denotes they may be aware. Majority of the population (65%) were aware of the disinfection methods for the PPE.

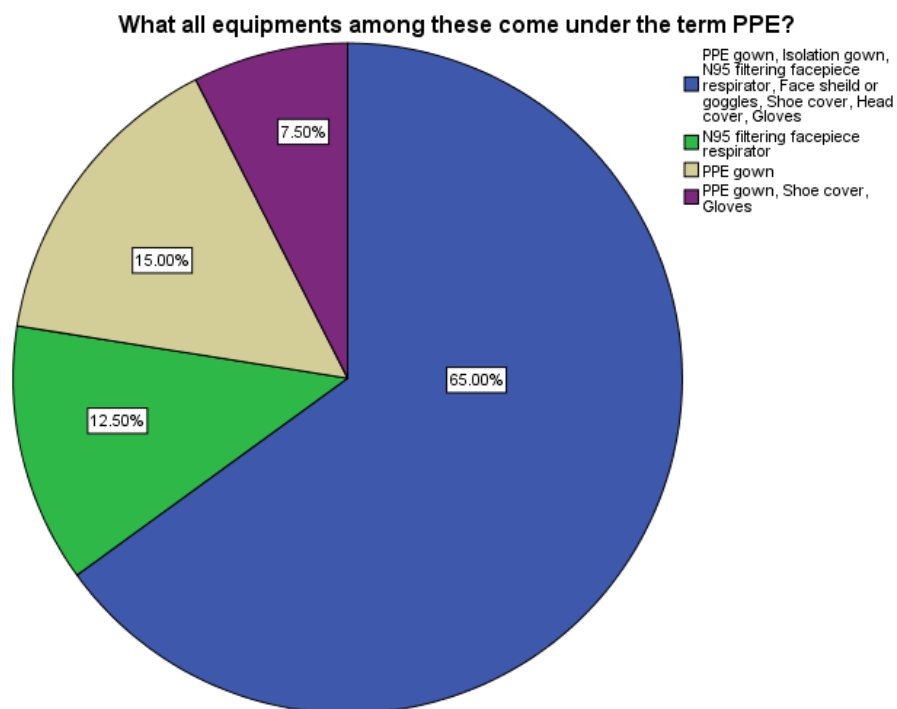


Fig. 4: The above pie chart shows what all equipment comes under the term PPE. The blue portion denotes PPE gown, isolation gown, N95 filtering facepiece, face shield or goggles, shoe covers, head cover and gloves come under the term PPE; green portion denotes N95 filtering respiratory come under the term PPE; khaki portion denotes PPE gown alone and the purple portion denotes the PPE gown, shoe cover and gloves. Majority of the participants responded with PPE gown, isolation gown, N95 filtering facepiece, face shield or goggles, shoe covers, head cover and gloves as what comes under the term PPE.

Which of these are the various kinds of sterilization and disinfection methods that you are aware of?

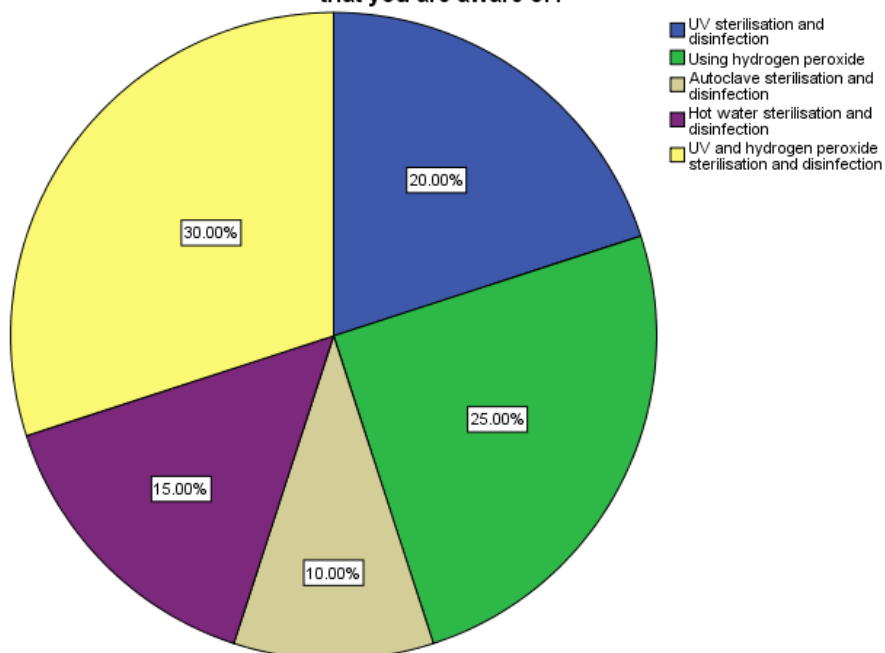


Fig. 5: In the above pie chart it is shown what the various sterilisation and disinfection methods the participants are aware of. The blue portion denotes UV sterilisation and disinfection, the green portion denotes using hydrogen peroxide, the khaki portion denotes autoclave sterilisation and disinfection, the purple portion denotes hot water sterilisation and disinfection; and the yellow portion denotes UV and hydrogen peroxide sterilisation and disinfection. Majority of the participants were aware of UV and hydrogen peroxide sterilisation and disinfection.

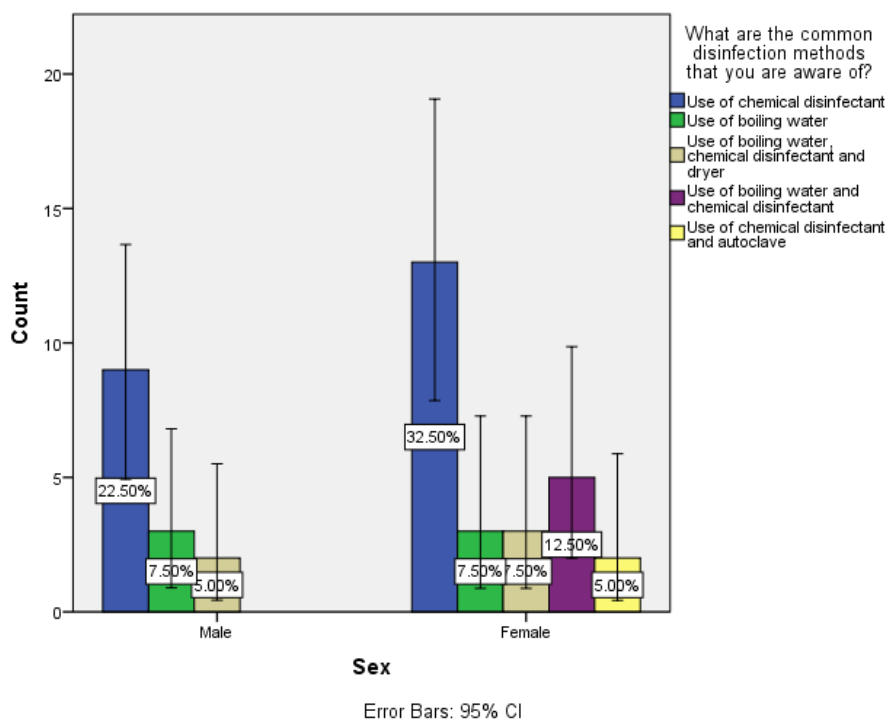


Figure. 6: The above bar graph represents association between the awareness of common disinfection methods and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue represents use of chemical disinfectant, green is use of boiling water, brown is chemical disinfectant and dryer, purple is use of boiling water and chemical disinfectant and yellow represents use of chemical disinfectant and autoclave. 22.50% of males and 32.50% of females preferred chemical disinfectant method, 7.50% of males and females preferred use of boiling water, 5% of males and 7.50% of females preferred chemical disinfectant and dryer, 12.50% of females preferred boiling water and chemical disinfectant method, and 5% of the females preferred use of chemical disinfectant and autoclave. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 4.755 (>0.05) hence statistically not significant hence proving that there was no significant association between the awareness of common disinfection methods and gender.

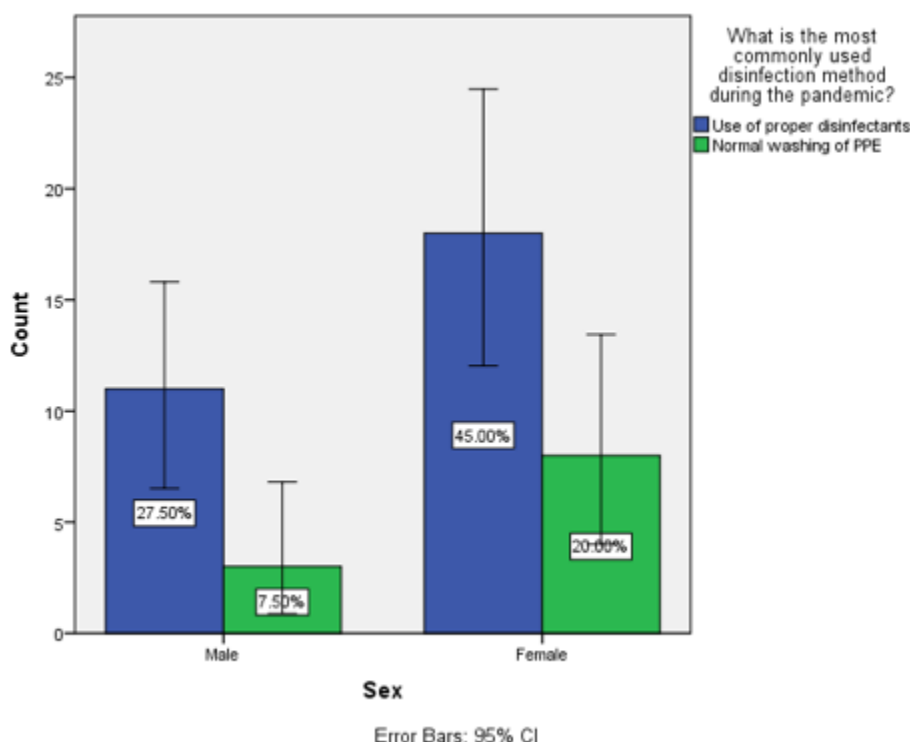


Figure. 7: The above bar graph represents the association between the most commonly used disinfectant method during the pandemic and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue represents use of proper disinfectants and green is normal washing of PPE. 27.50% of males and 45% of females preferred usage of proper disinfectants and 7.50% of males and 20% of females prefer normal washing of PPE. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 0.398 (>0.05) hence statistically not significant hence proving that there was no significant association between the most commonly used disinfectant method during the pandemic and gender.

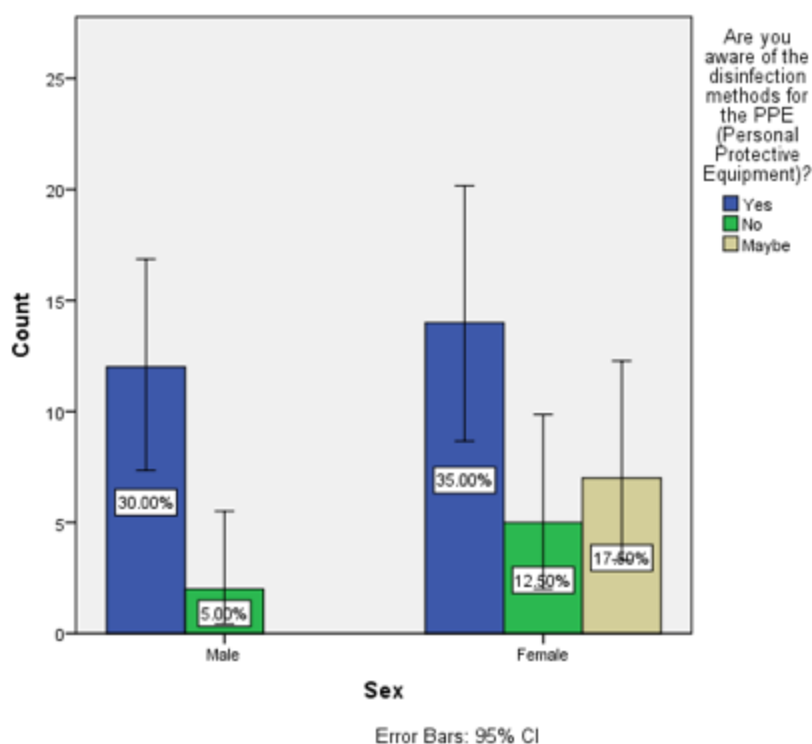


Figure. 8: The above bar graph represents the association between awareness of disinfection methods for PPE and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue represents yes, green is no and brown is maybe. 30% of males and 35% of females say it as yes. 5% of males and 12.50% of females say no and 17.50% of females replied as maybe. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 5.318 (>0.05) hence statistically not significant hence proving that there was no significant association between awareness of disinfection methods for PPE and gender.

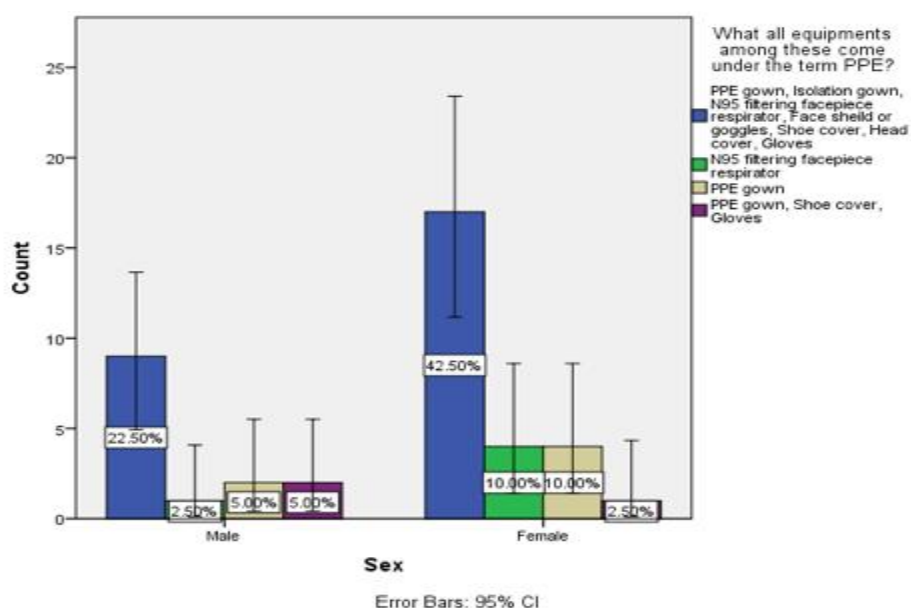


Figure. 9: The above bar graph represents the association between the equipment coming under the term PPE and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue represents PPE gown, isolation gown,

N95 filtering facepiece respirator, face shield, shoe cover, head cover and gloves. Green is N95 filtering facepiece respirator. Brown is PPE gown and purple Indicates PPE gown, shoe cover, head cover and gloves. 22.50% of males and 42.50% of females say it as PPE gown, isolation gown, N95 filtering facepiece respirator, face shield, shoe cover, head cover and gloves. 2.50% of males and 10% of females say it as N95 filtering facepiece respirator. 5% of males and 10% of females say it as PPE gown and 5% of males and 2.5% of females say it as PPE gown, shoe cover, head cover and gloves. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 1.826 (>0.05) hence statistically not significant hence proving that there was no significant association between the equipment coming under the term PPE and gender.

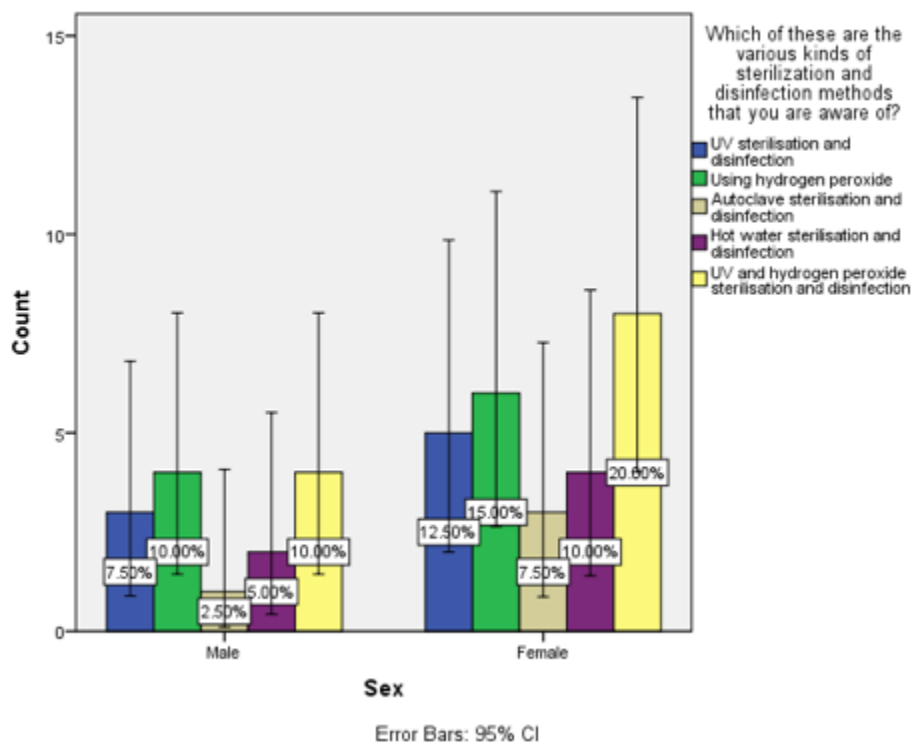


Figure. 10: The above bar graph represents association between awareness of various kinds of sterilisation and disinfection methods and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue represents UV sterilisation and disinfection methods. Green is using H₂O₂. Brown is autoclave sterilisation and disinfection methods. Purple is hot water sterilisation and disinfection methods and yellow represents UV and H₂O₂ sterilisation and disinfection methods. 7.5% of males and 12.5% of females are aware about UV sterilisation and disinfection methods. 10% of males and 15% of females were aware about H₂O₂. 2.50% of males and 7.5% of females are aware about autoclave sterilisation and disinfection methods. 5% of males and 10% of females know about hot water sterilisation and disinfection methods and 10% of males and 20% of females are aware about UV and H₂O₂ sterilisation and disinfection methods. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 0.330 (>0.05) hence statistically not significant hence proving that there was no significant association between awareness of various kinds of sterilisation and disinfection methods and gender.

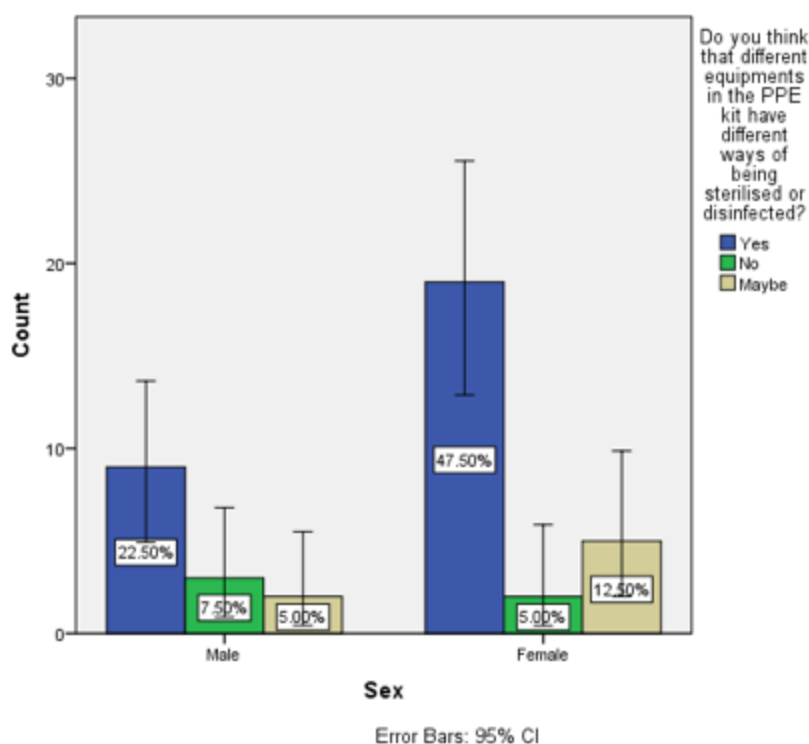


Figure. 11: The above bar graph represents an association between the awareness that different equipment in the PPE kit have different ways of being sterilised or disinfected and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue represents yes, green is no and brown is maybe. 22.50% of males and 47.50% of females say it as yes. 7.50% of males and 5% of females responded as no and 5% of males and 12.50% of females say maybe. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 1.601 (>0.05) hence statistically not significant hence proving that there was no significant association between the awareness that different equipment in the PPE kit have different ways of being sterilised or disinfected and gender.

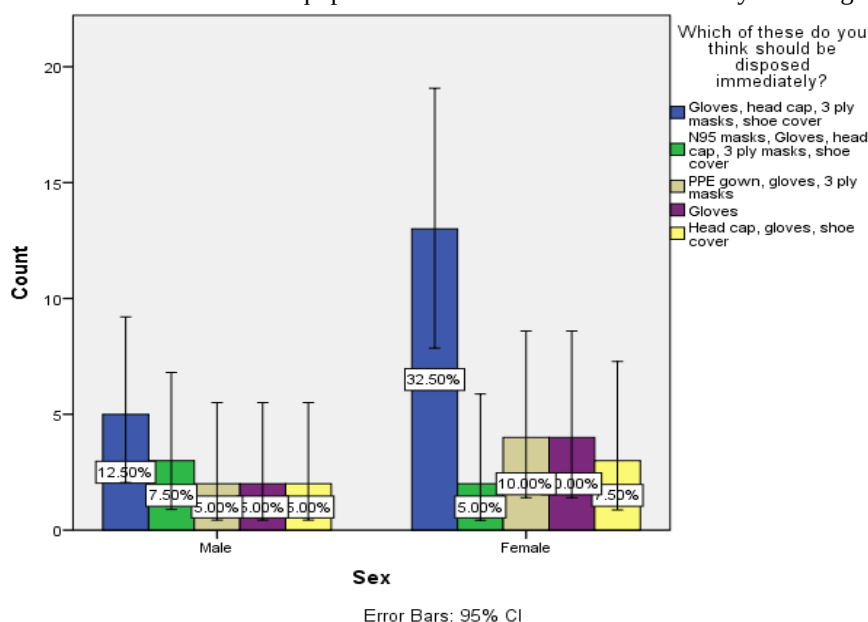


Figure. 12: The above bar graph represents association between the materials that have to be disposed immediately after use and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue indicates Gloves, head cap,

3 ply masks, shoe cover. Green indicates N95 masks, gloves, head cap, 3 ply mask, shoe cover. Brown is PPE gown, gloves, 3 ply masks and yellow is head cap, gloves and shoe cover. 12.50% of males and 32.50% of females say it as Gloves, head cap, 3 ply masks, shoe cover. 7.50% of males and 5% of females say it as N95 masks, gloves, head cap, 3 ply mask, shoe cover. 5% of males and 10% of females say it as PPE gown, gloves, 3 ply masks and 5% of males and 7.50% of females replied as head cap, gloves and shoe cover. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 1.856 (>0.05) hence statistically not significant hence proving that there was no significant association between the materials that have to be disposed immediately after use and gender.

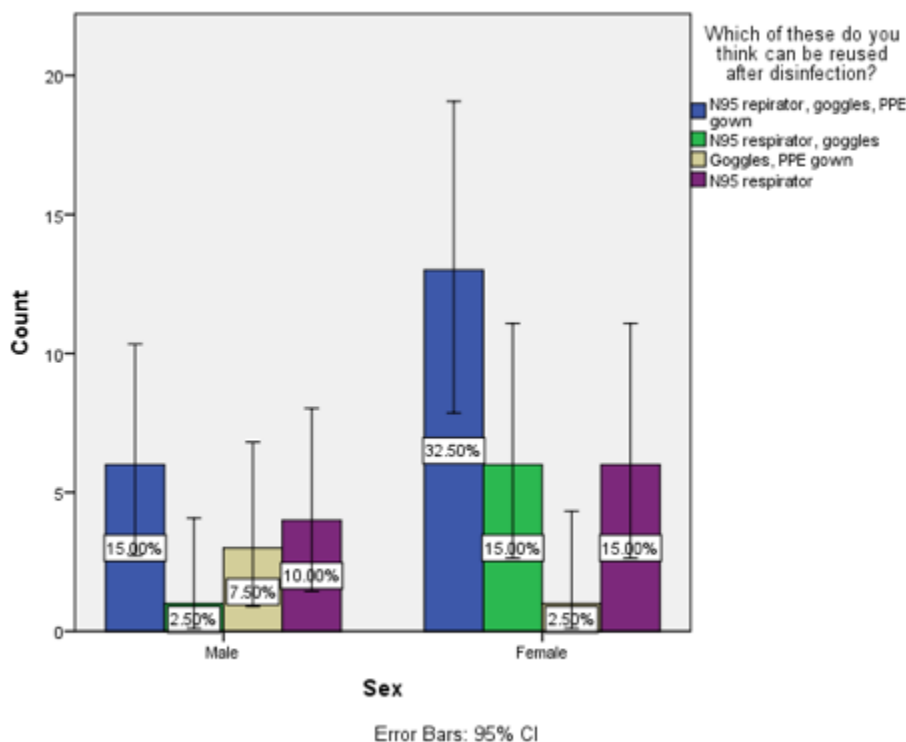


Figure. 13: The above bar graph represents association between the materials that can be reused after disinfection and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue indicates N95 respirator, goggles, PPE gown. Green is N95 respirator, goggles. Brown is goggles, and PPE gown and purple is N95 respirator. 15% of males and 32.5% of females say that N95 respirator, goggles, PPE gown can be reused. 2.50% of males and 15% of females say it as N95 respirator, goggles. 7.50% of males and 2.50% of females say it as goggles and PPE gown can be reused and 10% of males and 15% of females say that only N95 respirator can be reused. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 4.341 (>0.05) hence statistically not significant hence proving that there was no significant association between the materials that can be reused after disinfection and gender.

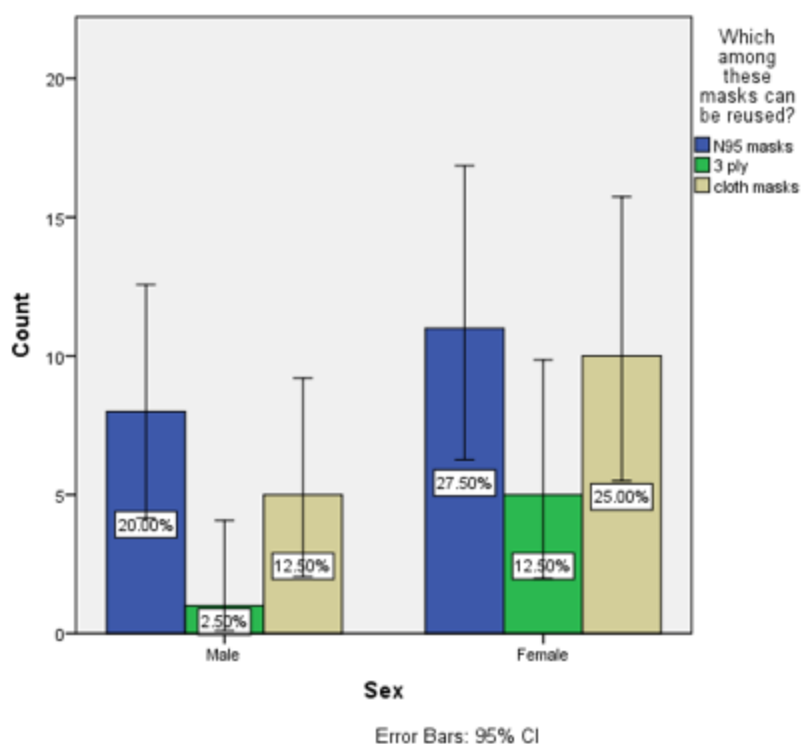


Figure. 14: The above bar graph represents association between the type of masks which can be reused and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue is N95 mask, green is 3 ply and brown represents cloth masks. 20% of males and 27,50% of females suggest N95 mask. 2.50% of males and 12.50% of females prefer 3 ply masks and 12.50% of males and 25% of females suggest cloth masks. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 1.326 (>0.05) hence statistically not significant hence proving that there was no significant association between the type of masks which can be reused and gender.

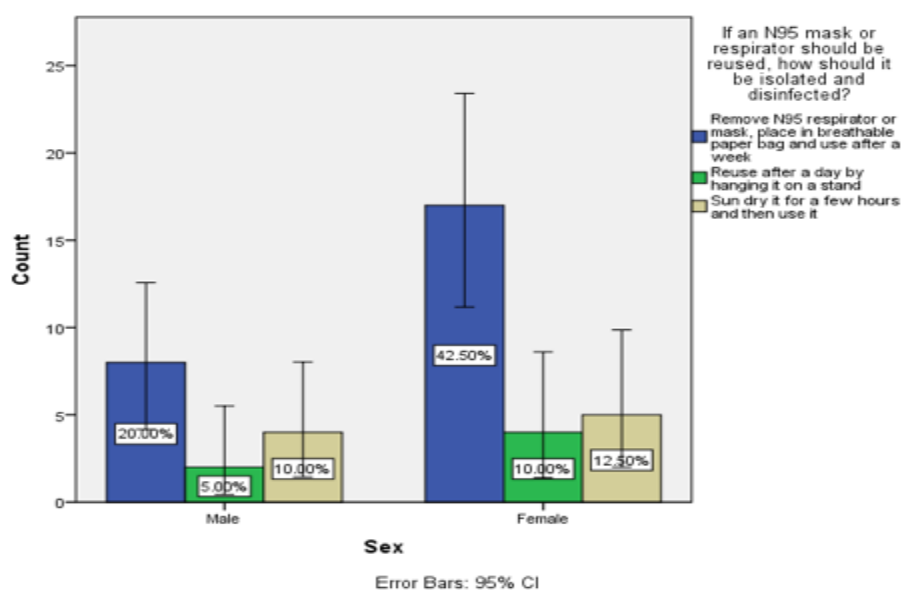


Figure. 15: The above bar graph represents the association between N95 or respirator which can be reused and how it should be isolated and disinfected and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue represents removing the N95 respirator, placing it in a breathable paper bag and using it after a week. Green is reused after a day by hanging it on a stand. Brown indicates to sun dry it for a few hours and then use it. 20% of males and 42.50% of females prefer removing the N95 respirator, placing it in a breathable paper bag and using it after a week. 5% of males and 10% of females say that they reuse it after a day by hanging it on a stand and 10% of males and 12.5% of females prefer sun drying it for a few hours and then use it. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 0.459 (>0.05) hence statistically not significant hence proving that there was no significant association between N95 or respirator which can be reused and how it should be isolated and disinfected and gender.

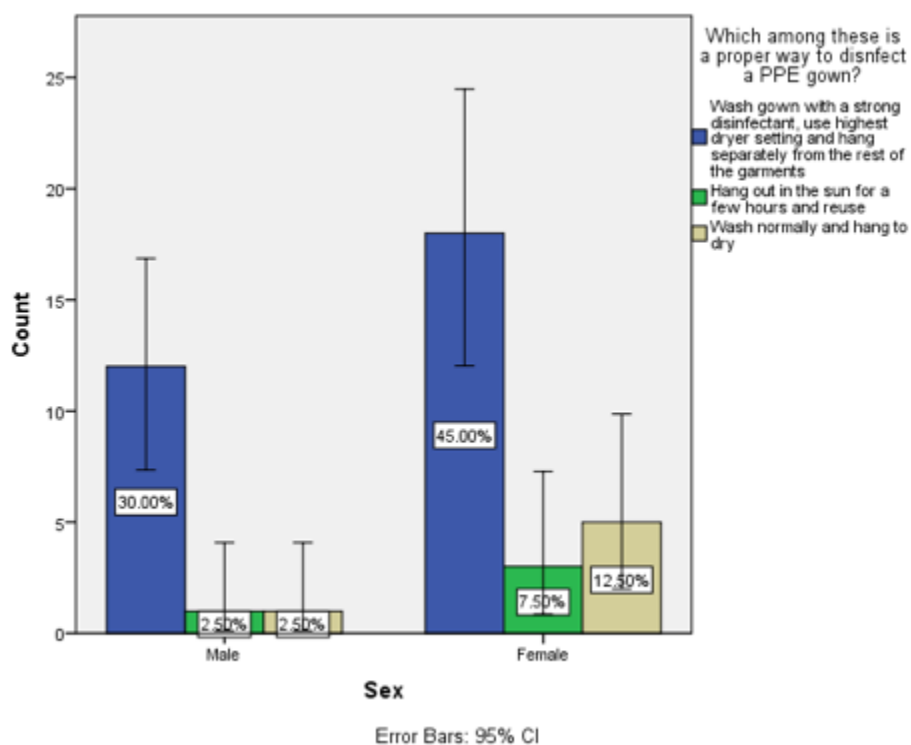


Figure. 16: The above bar graph represents the association between which one is the best way of disinfecting the PPE gown and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue is washing the gown using a strong disinfectant, using the highest dryer setting and hanging separately from the rest of the garments. Green represents hanging out in the sun for a few hours and reusing it. Brown represents washing it normally and hanging it to dry. 30% of males and 45% of females prefer washing the gown using a strong disinfectant, using the highest dryer setting and hanging separately from the rest of the garments. 2.50% of males and 7.50% of females prefer hanging out in the sun for a few hours and reusing it and 2.50% of males and 12.50% of females suggest washing it normally and hanging it to dry. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 1.392 (>0.05) hence statistically not significant hence proving that there was no significant association between which one is the best way of disinfecting the PPE gown and gender.

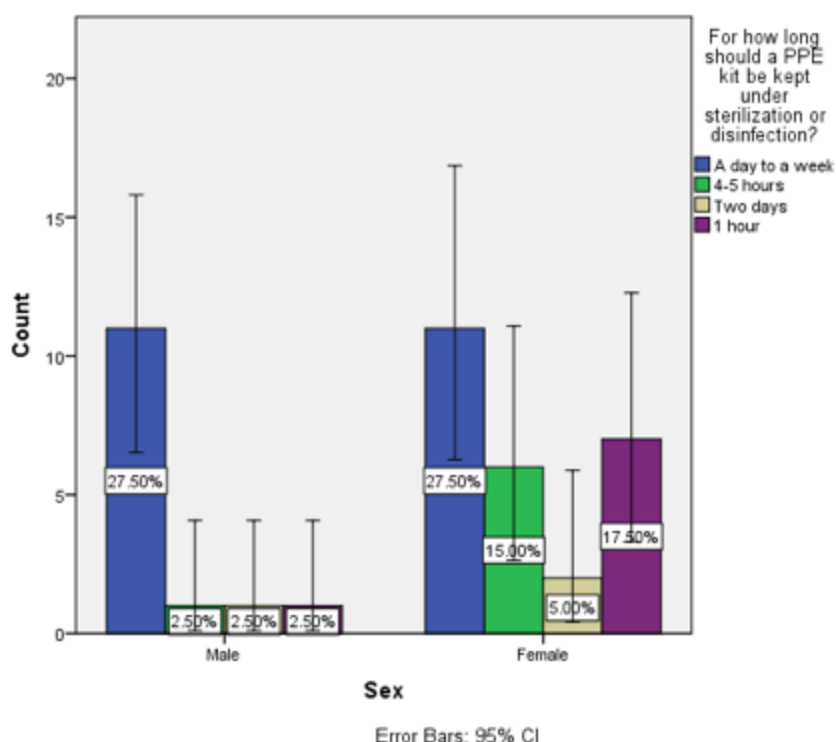


Figure. 17: The above bar graph represents the association between how long a PPE kit has to be kept under sterilisation or disinfection and gender. X-axis indicates the gender and Y-axis indicates the responses. Blue is a day to a week, green is 4-5 hours, brown is 2 days and purple indicates 1 hour. 27.50% of males and females say that it takes a day to a week. 2.50% of males and 15% of females say it takes 4-5 hours. 2.50% of males and 5% of females say it can take 2 days and 2.50% of males and 17.50% of females say that it only takes 1 hour. Chi square test was done and the association was found to be statistically not significant. The Pearson chi square value was 5.280 (>0.05) hence statistically not significant hence proving that there was no significant association between how long a PPE kit has to be kept under sterilisation or disinfection and gender.

DISCUSSION:

The frequency of enhanced cleaning and disinfection must increase since the resistance of the strain has also risen with passing days of the pandemic[5]. Many studies even state that[7,11] cleaning and disinfection must be done at least thrice a day in occupied spaces especially in hospitals and clinical environments. The frequency of cleaning and disinfection[43] should be decided based on occupancy and use conditions. The PPE kits help in keeping the various strains of viruses at bay especially the SARS-CoV-2 virus. Thus sterilization and disinfection in the correct manner[43,44] is very much required. Not the entire population within the healthcare environment are fully aware of the intensity of infection[45,46] and hence aren't aware of the right methods of sterilisation and disinfection. Use of hydrogen peroxide and UV rays are very helpful if done at the right frequency and proper durations[45–47]. There is high risk while cleaning and disinfecting the various equipment used under the PPE kit. Gloves must be worn at all times during the disinfection process and proper removal and disposal of the gloves must be done. Right after disposal of the gloves, hands must be washed with highly [46]disinfecting soap or hand wash. Special care must be taken when treating a probable covid patient. The highly potent disinfection methods such as ultrasonic waves, high intensity UV radiation, and LED blue light against the corona virus can help in reducing the risk of infection or even eliminate it[48]. If and when required, methods such as fogging or fumigation can also be undertaken in case of large amounts of PPE or PPE kit disinfection[49,50] but certain safety risks must be considered. Proper seminars and and in the current times of lockdown, webinars must be held for health care workers to constantly remind and provide them with

various new and current methods to safeguard themselves from infection through proper sterilisation and disinfection of their work areas but most importantly, their PPE kit and it's equipments[51].

CONCLUSION:

From the above results and discussion, we can come to a conclusion that most of the dental students in Chennai are aware of the proper disinfection methods of the PPE kit and it's equipment but when broken down to the comparison, the female dental students are much more aware. Hence awareness regarding the same must be created among the male dental students too without bias. Knowledge and awareness of the various methods is not just enough since everyone need not be well versed about the leading technology of disinfection especially with the onset of the pandemic.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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REFERENCES:

- [1] Jordan T, Dolata R. Electric arc protection - PPE, selection of PPE, high performance PPE beyond class 2. 2014 11th International Conference on Live Maintenance (ICOLIM) 2014. <https://doi.org/10.1109/icolim.2014.6934365>.
- [2] Poller B. Standardising PPE in cat 4 infection lessons for “routine” PPE. Healthcare Infection Society 2019. <https://doi.org/10.33325/ipc0015>.
- [3] Gudgin Dickson EF. Personal Protective Equipment for Chemical, Biological, and Radiological Hazards: Design, Evaluation, and Selection. John Wiley & Sons; 2012.
- [4] Institute of Medicine, Board on Health Sciences Policy, Committee on Personal Protective Equipment for Healthcare Workers During an Influenza Pandemic. Preparing for an Influenza Pandemic: Personal Protective Equipment for Healthcare Workers. National Academies Press; 2007.
- [5] Klemes JJ, Van Fan Y, Jiang P. The energy and environmental footprints of COVID-19 fighting measures – PPE, disinfection, supply chains. Energy 2020;211:118701. <https://doi.org/10.1016/j.energy.2020.118701>.
- [6] Everaert V, Groeninckx G, Pionteck J, Favis BD, Aerts L, Moldenaers P, et al. Miscible PS/PPE compounds: an alternative for blend phase morphology studies? Influence of the PPE content on the surface tension of PS/PPE and on the interfacial tension in PP/(PS/PPE) and POM/(PS/PPE) blends. Polymer 2000;41:1011–25. [https://doi.org/10.1016/s0032-3861\(99\)00239-6](https://doi.org/10.1016/s0032-3861(99)00239-6).
- [7] Kothekar AT, Kulkarni AP. Basic Principles of Disinfection and Sterilization in Intensive Care and Anesthesia and Their Applications during COVID-19 Pandemic. Indian J Crit Care Med 2020;24:1114–24. <https://doi.org/10.5005/jp-journals-10071-23562>.
- [8] Thamilselvan S, Abilasha R, Ramani P, Gheena S, Hannah R. Evaluation of Accuracy between Habit History and Incidence of Oral Squamous Cell Carcinoma. International Journal of Current Research and Review 2020;30–5. <https://doi.org/10.31782/ijcrr.2020.122503>.
- [9] Wash L. 137. PPE Wizard—An Expert System for PPE Selection. AIHce 2003 2003. <https://doi.org/10.3320/1.2757805>.
- [10] Staff A, AWWA Staff. Protect Yourself With PPE. Opflow 2018;44:26–7. <https://doi.org/10.1002/opfl.1053>.
- [11] Toigo S, Jacques M, Razek T, Rajda E, Omelon S, Dankoff F, et al. Fit Testing Retrofitted Full-Face Snorkel Masks as a Form of Novel Personal Protective Equipment During the COVID-19 Pandemic. Disaster Med Public Health Prep 2021;1–16. <https://doi.org/10.1017/dmp.2021.133>.
- [12] Gelardi M, Fiore V, Giancaspro R, La Gatta E, Fortunato F, Resta O, et al. Surgical mask and N95 in healthcare workers of Covid-19

- departments: clinical and social aspects. *Acta Biomed* 2020;91:e2020171. <https://doi.org/10.23750/abm.v91i4.10660>.
- [13] Yamunadevi A, Pratibha R, Rajmohan M, Ganapathy N, Porkodisudha J, Pavithrah D, et al. Molecular insight into odontogenesis in hyperglycemic environment: A systematic review. *Journal of Pharmacy And Bioallied Sciences* 2020;12:49. https://doi.org/10.4103/jpbs.jpbs_159_20.
 - [14] Antony JVM, Vini Mary Antony J, Ramani P, Ramasubramanian A, Sukumaran G. Particle size, penetration rate and effects of smoke and smokeless tobacco products – an invitro analysis. *Heliyon* 2021;7:e06455. <https://doi.org/10.1016/j.heliyon.2021.e06455>.
 - [15] R H, Hannah R, Ramani P, Ramanathan A, Jancy MR, Gheena S, et al. CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology* 2020;130:306–12. <https://doi.org/10.1016/j.oooo.2020.06.021>.
 - [16] Umashankar K, R. A, R. H, Ramani P, S. G. Knowledge and Attitude About COVID-19 Pathogenesis Among Oral Pathologists in Chennai. *International Journal of Current Research and Review* 2020;12:143–51. <https://doi.org/10.31782/ijcrr.2020.sp17>.
 - [17] Analysis of Prevalence of Oral Squamous Cell Carcinoma in Patients with History of Chronic Irritation of Oral Tissues - A Retrospective Study. *Indian Journal of Forensic Medicine & Toxicology* 2020. <https://doi.org/10.37506/ijfimt.v14i4.12511>.
 - [18] K M, Monica K, Vijayashree PJ, Gheena S, Ramani P, Abhilasha R, et al. IN SILICO GENE EXPRESSION ANALYSIS OF CRUCIAL CELL CYCLE CONTROL GENE CDKN2A AND CDKN2B IN HEAD AND NECK SQUAMOUS CELL CARCINOMA. *Annals of Tropical Medicine & Public Health* 2020;23. <https://doi.org/10.36295/asro.2020.232323>.
 - [19] Sinduja P, Ramani P, Gheena S, Ramasubramanian A. Expression of metallothionein in oral squamous cell carcinoma: A systematic review. *Journal of Oral and Maxillofacial Pathology* 2020;24:143. https://doi.org/10.4103/jomfp.jomfp_137_19.
 - [20] Ramani P, Krishnan R, Karunakaran M, Muthusekhar MR. Odontogenic sarcoma: First report after new who nomenclature with systematic review. *Journal of Oral and Maxillofacial Pathology* 2020;24:157. https://doi.org/10.4103/jomfp.jomfp_14_20.
 - [21] Princeton B, Santhakumar P, Prathap L. Awareness on Preventive Measures taken by Health Care Professionals Attending COVID-19 Patients among Dental Students. *Eur J Dent* 2020;14:S105–9. <https://doi.org/10.1055/s-0040-1721296>.
 - [22] Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of *Streptococcus mutans*, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: randomized controlled trial. *Clin Oral Investig* 2020;24:3275–80. <https://doi.org/10.1007/s00784-020-03204-9>.
 - [23] Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. *J Oral Pathol Med* 2019;48:299–306. <https://doi.org/10.1111/jop.12835>.
 - [24] Hannah R, Ramani P, WM Tilakaratne, Sukumaran G, Ramasubramanian A, Krishnan RP. Author response for “Critical appraisal of different triggering pathways for the pathobiology of pemphigus vulgaris—A review” 2021. <https://doi.org/10.1111/odi.13937/v2/response1>.
 - [25] Chandrasekar R, Chandrasekhar S, Sundari KKS, Ravi P. Development and validation of a formula for objective assessment of cervical vertebral bone age. *Prog Orthod* 2020;21:38. <https://doi.org/10.1186/s40510-020-00338-0>.
 - [26] Subramanyam D, Gurunathan D, Gaayathri R, Vishnu Priya V. Comparative evaluation of salivary malondialdehyde levels as a marker of lipid peroxidation in early childhood caries. *Eur J Dent* 2018;12:67–70. https://doi.org/10.4103/ejd.ejd_266_17.
 - [27] Jeevanandan G, Thomas E. Volumetric analysis of hand, reciprocating and rotary instrumentation techniques in primary molars using spiral computed tomography: An in vitro comparative study. *Eur J Dent* 2018;12:21–6. https://doi.org/10.4103/ejd.ejd_247_17.
 - [28] Ponnulakshmi R, Shyamaladevi B, Vijayalakshmi P, Selvaraj J. In silico and in vivo analysis to identify the antidiabetic activity of beta sitosterol in adipose tissue of high fat diet and sucrose induced type-2 diabetic experimental rats. *Toxicol Mech Methods* 2019;29:276–90. <https://doi.org/10.1080/15376516.2018.1545815>.
 - [29] Ramani P, Gheena S, Karunakaran M, Hannah R. Clear-cell variant of oral squamous cell carcinoma: A rare entity. *J Oral Maxillofac Pathol* 2021;25:22. https://doi.org/10.4103/jomfp.JOMFP_295_20.
 - [30] Ramasubramanian A, Ramani P, Sherlin H, Premkumar P, Natesan A, Thiruvengadam C. Immunohistochemical evaluation of oral epithelial dysplasia using cyclin-D1, p27 and p63 expression as predictors of malignant transformation. *Journal of Natural Science, Biology and Medicine* 2013;4:349. <https://doi.org/10.4103/0976-9668.117011>.
 - [31] E A, Aswani E, Gheena S, Pratibha R, Abilasha R, Hannah R, et al. Overexpression of HNRNPA2B1 is Associated with Poor Prognosis in Head and Neck Squamous Cell Carcinoma. *International Journal of Current Research and Review* 2020;15–8. <https://doi.org/10.31782/ijcrr.2020.122502>.
 - [32] Behera A, Hannah R. Association of the Depth of Invasion with Lymph Node Metastasis in Oral Squamous Cell Carcinoma Patients-A Retrospective Study. *Indian Journal of* 2020.
 - [33] Sukumaran G, Ramani P, Ramasubramanian A, Karunakaran M, Ravikumar H. Implantation Dermoid Cyst. *Journal of Evolution of Medical and Dental Sciences* 2019;8:4023–5. <https://doi.org/10.14260/jemds/2019/871>.
 - [34] A study on the variability of drug responsiveness to anti inflammatory drugs - A pilot survey. *International Journal of Pharmaceutical Research* 2020;12. <https://doi.org/10.31838/ijpr/2020.12.02.0261>.
 - [35] Krishnan R, Ramani P, Sukumaran G, Ramasubramanian A, Karunakaran M, Hannah R. Workplace violence among dental surgeons - A survey. *Indian Journal of Dental Research* 2021;0:0. https://doi.org/10.4103/ijdr.ijdr_880_19.
 - [36] Sundaram R, Nandhakumar E, Haseena Banu H. Hesperidin, a citrus flavonoid ameliorates hyperglycemia by regulating key enzymes of carbohydrate metabolism in streptozotocin-induced diabetic rats. *Toxicol Mech Methods* 2019;29:644–53. <https://doi.org/10.1080/15376516.2019.1646370>.
 - [37] Tang X, Yu J, Li M, Zhan D, Shi C, Fang L, et al. Inhibitory effects of triterpenoid betulin on inflammatory mediators inducible nitric oxide synthase, cyclooxygenase-2, tumor necrosis factor-alpha, interleukin-6, and proliferating cell nuclear antigen in 1,2-dimethylhydrazine-induced rat colon carcinogenesis. *Pharmacognosy Magazine* 2020;16:841. https://doi.org/10.4103/pm.pm_516_19.

- [38] Shree KH, Hema Shree K, Ramani P, Herald Sherlin, Sukumaran G, Jeyaraj G, et al. Saliva as a Diagnostic Tool in Oral Squamous Cell Carcinoma – a Systematic Review with Meta Analysis. *Pathology & Oncology Research* 2019;25:447–53. <https://doi.org/10.1007/s12253-019-00588-2>.
- [39] Zafar A, Sherlin HJ, Jayaraj G, Ramani P, Don KR, Santhanam A. Diagnostic utility of touch imprint cytology for intraoperative assessment of surgical margins and sentinel lymph nodes in oral squamous cell carcinoma patients using four different cytological stains. *Diagn Cytopathol* 2020;48:101–10. <https://doi.org/10.1002/dc.24329>.
- [40] Karunakaran M, Murali P, Palaniappan V, Sivapathasundharam B. Expression and distribution pattern of podoplanin in oral submucous fibrosis with varying degrees of dysplasia – an immunohistochemical study. *Journal of Histotechnology* 2019;42:80–6. <https://doi.org/10.1080/01478885.2019.1594543>.
- [41] Sarode SC, Gondivkar S, Gadgil A, Sarode GS, Yuwanati M. Oral submucous fibrosis and heterogeneity in outcome measures: a critical viewpoint. *Future Oncol* 2021;17:2123–6. <https://doi.org/10.2217/fon-2021-0287>.
- [42] Raj Preeth D, Saravanan S, Shairam M, Selvakumar N, Selestina Raja I, Dhanasekaran A, et al. Bioactive Zinc(II) complex incorporated PCL/gelatin electrospun nanofiber enhanced bone tissue regeneration. *Eur J Pharm Sci* 2021;160:105768. <https://doi.org/10.1016/j.ejps.2021.105768>.
- [43] Derraik JGB, Anderson WA, Connelly EA, Anderson YC. Rapid evidence summary on SARS-CoV-2 survivorship and disinfection, and a reusable PPE protocol using a double-hit process n.d. <https://doi.org/10.1101/2020.04.02.20051409>.
- [44] Kumar P, Roy S, Sarkar A, Jaiswal A. Reusable MoS-Modified Antibacterial Fabrics with Photothermal Disinfection Properties for Repurposing of Personal Protective Masks. *ACS Appl Mater Interfaces* 2021;13:12912–27. <https://doi.org/10.1021/acsami.1c00083>.
- [45] Awareness about Common Disinfection Procedures among Undergraduate Students in Clinics. *Indian Journal of Forensic Medicine & Toxicology* 2020. <https://doi.org/10.37506/ijfmt.v14i4.12492>.
- [46] Agbor MA, Azodo CC. Sterilization and Disinfection Practices in Selected Dental Clinics in Cameroon. *Nigerian Hospital Practice* 2010;6. <https://doi.org/10.4314/nhp.v6i1-2.62332>.
- [47] Aston M. UV disinfection use in ensuring biosecurity. *Filtration Separation* 2014;51:34–6. [https://doi.org/10.1016/s0015-1882\(14\)70071-0](https://doi.org/10.1016/s0015-1882(14)70071-0).
- [48] Villani FA, Aiuto R, Paglia L, Re D. COVID-19 and Dentistry: Prevention in Dental Practice, a Literature Review. *Int J Environ Res Public Health* 2020;17. <https://doi.org/10.3390/ijerph17124609>.
- [49] Wingrove Z. Changing perceptions of PPE. *Dental Nursing* 2020;16:378–9. <https://doi.org/10.12968/denn.2020.16.8.378>.
- [50] PPE: at the heart of dentistry. *Dental Nursing* 2020;16:414–414. <https://doi.org/10.12968/denn.2020.16.8.414>.
- [51] Sibley MJ. Disinfection Solutions. *International Ophthalmology Clinics* 1981;21:237–47. <https://doi.org/10.1097/00004397-198102120-00024>.