



Health Hazards and Protocol for Management of Used Facemasks Outside Hospitals during SARCOV-2 Pandemic

“Stay At Home, Maintain Social Distancing, Regularly Wash Your Hands & Keep Environment Clean”

Dr. Akash Kasatwar¹, Dr. Jayshri Nandanwar²

¹Consultant Oral & Maxillofacial Surgeon & Dental Surgeon

Institute/Organization: Directorate Health Services, District General Hospital, Chandrapur, Maharashtra, India

²Consultant Periodontist & Implantologist

Institute/Organization: Kasatwar Dental Hospital, Chandrapur, Maharashtra, India

ABSTRACT

Background: SARS-CoV-2 is highly infectious pathogenic disease leading to infection and death of millions of people all over the world till the date according to the data provided by John Hopkins University. Peoples have started using various types of mask to protect themselves from getting infected from the deadly corona virus. There has also been large amount of confusion in general public about disposal of the mask as most of them are using for first time in their life. Even healthcare professionals may be unaware of the methods of disposal of the masks outside their hospitals. This mask may carry infections from asymptomatic, SARS-CoV-2 patients that if it comes in contact with other peoples and animals may have severe bio health hazards.

Observation & Management of facemasks: Since the SARS-COV-2 pandemic outbreak since March 2020, personally, we found out that peoples a carelessly throwing masks everywhere including streets, parking lots, beaches, building complexes, sewages and homes. These masks may have been used by asymptomatic carriers or have got infected with these viruses is hazardous not only to the health of the public but also for the household waste collectors, pet animals and marine animals. Disinfecting with sodium hypochlorite * decontaminating methods like washing facemasks and drying in sunlight, pressure cooker sterilisation method, boiling, by using laundry detergent and hot dryer and cleaning in washing machine, etc.

Conclusion & Relevance: The objective of these articles is to alert the public & health care professionals to understand the hazards of throwing the facemasks at public places and preventive measure to be taken during this pandemic time and various methods of decontamination, pre-treatment and disposal of facemask avoiding severe health hazards.

KEYWORDS: SARS-Cov-2, Facemask, Pandemic, Health Hazards, Disposal, Decontamination

INTRODUCTION

SARS-CoV-2 has created a havoc and panic all over the world due to its deadly nature. According to John Hopkins University, till the date millions of peoples are infected and had died due to the infection of corona virus across the globe and is still progressive in nature[1]. World health organisation (WHO) declared SARS-CoV-2 as the sixth public health emergency of international concern following Swine flu (2009), polio (2014), Ebola (2014), Zika virus (2016) & Kivu Ebola (2019). WHO director Dr Tedros Adhanom Ghebreyesus later declared it as pandemic on 11th March 2020[2]. Since humans are not exposed to such viruses before, neither the existing vaccines nor the innate immunity can protect the human species. Its effects are basically determined by the complex interaction between the agent, host and environment. Once it enters into the human body, it is abundantly present in salivary and nasopharyngeal secretions and it predominantly thought to spread from respiratory droplets and surface contacts. The nature of these severely pathogenic virus is such that it transmits swiftly from person to person if proper precautions are not taken. To protect the peoples from this virus, Governments across the countries and states has strictly advised the people to take proper personal care and made mandatory to wear the facemask wherever possible in order to break the chain of transmission. At the same time, due to lack of care from the peoples, we can see number of facemasks has been thrown in the gardens, parking areas, roads and at times in homes without proper pre-treatment. Nowadays this has seen as the primary garbage all over the public places. This biomedical



waste can be hazardous to the health of general public, sanitary department workers, street dogs and pet animals. Used masks should be considered as potentially infected medical waste. The objective of this article is to understand the health hazards of throwing facemasks in general public places and precautions to be taken during this pandemic time and various methods for pre-treatment, decontamination and disposal of facemasks outside the hospitals avoiding the health hazards. To our knowledge this is the first reported preliminary article about decontamination and disposal of cloth mask, surgical mask and respirator mask outside hospitals.

Several studies have been conducted on the virulence and stability of the SARS-CoV-2 on the environmental surfaces. These studies stated that virus can be active on the inanimate objects and surfaces from hours to many days. SARS-CoV-2 can readily survive on cardboard, copper, stainless steel and plastic[3]. Respiratory secretions directly come in contact with the facemask where virus load can present up to 7 days[4]. So the masks may have maximum overload of the pathogenic virus. The appropriate use and disposal of facemask is a significant component of the overall strategy for individuals and communities not only during the pandemic but also under any circumstances where the mask wearer could be exposed to other infectious diseases. During SARS-CoV-2 Pandemic, surgical masks are a common sight in the city as the peoples protecting themselves from the virus and then cavalierly discarding in public places [Image 1]. Every place that remains open during the pandemic crisis is now seeing the new garbage "facemask". Most peoples and HCP are uncertain what to do with the potentially contaminated protective wear when they are done with it. Also, it is inappropriate to mix contaminated masks with household waste.

For the common peoples other than HCP face masks are difficult & uncomfortable to place as they are not trained for its proper use. In such cases they may frequently touch their masks and their face. If it comes in contact with contaminated surfaces or asymptomatic carriers, may unconsciously touch their eyes and mouth afterwards thereby increasing the risk of infection. Some people go out of their homes wearing facemasks for shopping groceries, food & vegetables, medical shops and may throw their masks at these public places [Image 2 & 3]. This facemask may retain moisture for a longer period of time and are potential source of infection to the peoples coming in the vicinity of masks. Sometimes it may come in contact with local pets and street animals. There is no evidence that pets are playing a role in spreading the disease to people.

In recent days, dozens of masks are seen at the beaches and rivers and domestic sewages and gutters. They can be easily swept from sewages into storm drains and finally end up in waterways and oceans. This may definitely be mistaken for the foodstuff and eaten up by fish, whales, turtles, marine mammals and seabirds like albatrosses. If the sanitary department workers clean the streets, sewages and drainages, they may have higher chances of getting infected. Most of the governments of various countries has made use of facemask necessary during their routine work. HCP sometimes may reach their home with masks and may directly discard it in household open dustbin without pre-treatment. This can be a health hazard for the poor sanitary workers that come to collect our daily waste garbage. They may definitely get contact with the infectious mask thus causing serious virus outbreak in the community. Several masks thrown outside the hospitals may also be a new business and source of income for the greedy peoples. They may recycle this facemask and sale to the needy peoples at low cost thus earning at the expense of risking and endangering a large group of peoples in the community.

There are generally two types of mask prevalent in literature, surgical mask and respirator mask (filtering face piece respirators or FFP) [Table 1]. Since there is a huge shortage of the supply of surgical mask and respirator mask, healthy common peoples using these masks may lead to further shortage of supply of these special masks to many health care professionals helping to combat SARS-CoV-2 in hospitals. CDC recommends the people to use third types of mask termed as non-surgical masks or cloth mask made of fabric in public places[5]. Bandanas, scarf and can also be used. Surgical mask is the most common type of facemasks used by HCP. These masks are used in the surgeries like management of maxillofacial trauma like simple dentoalveolar fracture to complex angle and parasymphysis fractures[6,6,8]. It is also used in soft tissue surgeries including periodontal surgery, oral pathology and chelioplasty[9,10,11]. Even in several hard tissue surgeries like cleft lip and palate, distraction osteogenesis, odontomes, these masks can be used[12,13,14]. Experimental studies, intensive care unit and minor dental surgeries like concrecence can be done by using surgical masks[15,16,17,18]. Surgical masks are made up of synthetic fibres and contain filters made of polyester or polypropylene[19]. Surgical masks provide protective function for wearers against large droplets, splatters, splashes, infected fluids as a part of universal precautions. It also reduces the exposure of our own saliva and respiratory secretions to others. Surgical masks should be changed when sneezing occurs as it is dampened. The maximum time for wearing mask should not be more than 2 hours since it is dampened from respirations causing degradation in its filterability [20]. Filtration capacity of the surgical mask can vary from 10 to 90% according to the manufacturer [21]. This are single use disposable masks. To the fact of our



information, no published data and studies have been quoted in the literature regarding decontamination and disposal of surgical facemask.

Respirator masks are classified according to their filtration efficiency capable of trapping particle size up to 0.3-microns. Respirator masks are tightly sealed around nose, mouth and lateral edges such that only air can pass through after filtration. N95 masks should be used by the frontline HCP who are at risks to get expose with the respiratory secretions of suspected and SARS-CoV-2 patients. They are used routinely during dental procedures, tracheostomy, endotracheal intubation, CPR, ventilation and bronchoscopy as these may expose the health care professional to other infectious transmissible diseases. Respirator masks should be discarded when it gets soiled and resistance of breathing is increased.

Currently there are no ideal guidelines regarding decontamination and disposal of cloth masks, surgical masks and respirator masks outside hospitals. The reason behind this may be the peoples, HCP and authorities may have encountered and faced this new dreaded global health emergency first time in their decade. According to regulation, only licensed companies should collect, transport and do the final disposal of the medical waste. All health care should discarded mask safely and immediately in the hospital itself .These HCF includes all medical personnel ,paramedical and nursing staff involving the screening area ,isolation ward, intensive care units, persons involved in mortuary handling dead bodies ,ambulance staff, laboratory personnel handling samples related to SARS-CoV-2, personnel involved in aerosol procedures like intubation, nebulisation ,nasal catheter placement. Also dental surgeons should also take proper precaution to dispose the mask as they are involved in most of the aerosol generating procedures may have a higher chance of getting infected. After removal of all personnel protective equipment's and mask, hands are cleaned with alcohol based hand rub. From the past few days, there has been increasing in number of the peoples wearing different types of the masks everywhere including grocery shop, super markets, shopping malls, offices and airports and also by army personnel's. This may prove fatal as the masks thrown away casually can be a source of severely pathogenic SARS-CoV-2 infections which may severely breakout in community and land the peoples in stage3(communitary transmission) and stage4 (pandemic).Government can make a demand to Public sanitary department as a part of their "short term management plan" to place at least one special trash cans or closed bins in the locality and make an arrangement to dispose them to the bio-waste facility through licenced companies. This will help in curbing the mask waste to the environment thereby reducing the chances of airborne transmission of infection. Educating, communicating & Informing, general public about the hazards of "masks waste" by various means like posters, TV commercials, radio jingle, printed advertisements, pamphlets, twitter, Instagram or any other means of social media, Government can also make a stern action against the peoples by making them fine heavy bugs for flinging masks at public places.

PROTOCOL FOR MANAGEMENT OF USED FACEMASKS OUTSIDE HOSPITALS

Decontamination methods for Nonsurgical or Cloth Mask:

1. The simplest way is to wash the mask in warm water and detergent for at least 3 to 5 minutes and make it dry in the sunlight for at least 5 to 6 hours. As we all know that sunlight (ultraviolet rays) is the best natural sterilisation method proved since years and eradicates all the pathogenic organism including viruses [22]. The underlying mechanism by which sunlight irradiation kills pathogenic organisms is by damaging their DNA. But its action may vary due to places. Because in tropical countries like India, the effect is better than seasoned countries like Europe where the sunlight rays may be masked by lot of clouds. This simple method can be used by all the peoples at homes.
2. Decontaminating mask in Pressure Cooker and adding salt to it for 15 to 20 minutes and left it to dry for 5 to 6 hours is effective method. Pressure cookers is smaller version of autoclave[23].The efficiency of pressure cooker is comparable to that of autoclave and it also reaches the temperatures needed to kill the pathogenic organisms. Pressure cooker method sterilisations are even superior to boiling water since the steam under pressure reaches a higher temperature. This method can be easily carried out at homes.
3. In case pressure cooker is not available boiling it for 15 minutes in hot water may be sufficient. Boiling water kills all the microorganisms [24]. Boiling water is not an effective method of sterilisation but a person not infected to coronavirus can used this method for decontaminating cloth mask. This method can be used by those peoples who stays away from homes or at remote areas where pressure cookers may not be available e.g. army personnel and poor peoples.
4. Before reusing a fabric nonsurgical cloth mask, wash it in normal laundry detergent and tumble dry in a hot dryer.



5. Cloth mask can be disinfected by regularly cleaning in washing machine as directed by CDC [25]. This clothed mask can be used repeatedly after washing till it is not soiled.

Decontamination and disposal method of Surgical and Respirator mask:

Various disinfectants are available in the market for regular use like alcohols, hydrogen peroxide, benzalkonium chloride containing compounds. Sodium hypochlorite and ethanol have a proven efficacy as disinfectant against SARS-CoV-2. The household bleach (Hypochlorite solution) has highly effective broad spectrum activity against bacteria, fungus and viruses. even it has highly effective against substantial virus like parvoviridae family[26]. This chlorine based formulations show fast and strong inactivation of virus and can be used as fine disinfectant with a very less or rare side-effects. So hypochlorite solutions should always be freshly prepared and used. Ministry of Health and Family Welfare(MOHFW), India have given the guidelines to make 1% sodium hypochlorite solution [Table.1] [27]. Make sure that bleach is not mixed with other household cleaners mainly toilet bowl cleaners and ammonia. This may result in release of chlorine gas that if it comes in contact with moist tissues like lungs and eyes, hydrochloric acid (HCL) is formed that may cause damage to airways and sometimes may cause asphyxiation and death. It should be kept away from children's. Sodium hypochlorite should not be ingested as it carries severe reaction and side effects. mechanism of toxicity of hypochlorite is due to its pH and oxidizing capacity that leads to irritation of skin and mucous membrane[28]. Prolong exposure of the skin by hypochlorite may cause immediate or delayed hypersensitivity skin reactions and chemical burns. The other rare side effects are metabolic acidosis, hypernatremia, hyperchloremia, mild to severe irritation of the eyes.

Systematic usage and disposal for any type of masks are critical to avoid any increase in transmission of SARS-CoV-2. Mask should always be considered as potentially pathogenic and infected medical waste. In community setting where bio-waste management protocol cannot be practiced precisely, it has to be disposed by different methods. In home care settings surgical masks and respirator masks should be pre-treated firstly by freshly prepared disinfectants such as household bleach (NaOCl) solution (1%) [Table 1][29] or by appropriate concentration of quaternary ammonium household disinfectant for at least 5 to 15 mins. Secondly once the masks are disinfected, the best method to disposal is burning in an open kettle with due precautions or deep burial.

Since surgical masks cannot be used for more than 2 hrs it has to be discarded and cannot reuse it. If surgical masks are worn beyond the recommended period of time, there are chances of bacterial and viral shedding from the nose mouth and face and may become potential source of infection. Due to corona pandemic, currently there is huge shortage of respirator mask for the health care professionals all over the world in treating a SARS-CoV-2, CDC has arrived to the conclusion that respirator masks can be reused after proper sterilization and disinfection methods under the terminology "crisis capacity strategy for continuous availability of respirator masks" so that health care professionals can confidently provide continuous service to the infected corona patients. This can be done by various methods namely, vaporous hydrogen peroxide, ultraviolet germicidal irradiation, moist heat, Microwave generated steam, Microwave steam bags, Moist heat incubation, Liquid hydrogen peroxide and Ethylene oxide. Decontamination and subsequent reuse of respirator masks should only be practiced where shortages exist. These reused FFRs should not be worn by HCP when performing an aerosol-generating procedure. To the current knowledge no data exist to support the efficacy of these decontamination methods precisely against SARS-CoV-2 on a respirator mask[30]. Any disinfection process is not capable of accomplishing ideal levels of reusability i.e. >6 log reduction of viable virus and bacterial spores. While reusing this respirator mask, same mask should be provided to the same person after decontamination of the mask. Thus, it will avoid cross infection between the individuals. This can be done by labelling the mask with specific code number or packing in special ziplock bags before decontamination process[31].

SARS-CoV-2 has changed the world we live in indifferent circumstances. According to WHO, SARS-CoV-2 infection is going to stay a long with us infecting many more people if proper precaution is not taken. Many more countries are still in the epidemics and other, that were infected early in pandemic like china and Singapore started resurgence in cases. So the present and future of the people is such that they may have to make wearing of the masks compulsory as a part of their routine life for the next few months or years to come. This can be done by taking precautions while disposing the mask in proper way rather than making garbage all over the places.



Table 1. GUIDELINES FOR PREPARATION OF 1% SODIUM HYPOCHLORITE SOLUTION (According To Ministry Of Health And Family Welfare, India (MOHFW))

PRODUCT	AVAILABLE CHLORINE	1 PERCENT
Sodium hypochlorite liquid bleach	3.5 %	1part bleach to 2.5 parts water
Sodium hypochlorite liquid	5%	1 part bleach to 4 parts water
NaDCC (sodium dichloro isocyanurate) powder	60%	17 grams to 1 litre of water
NaDCC (1.5 g/tablet)-tablets	60%	11 tablets to 1 litre of water
Chloramine powder	25%	80 g to 1 litre of water
Bleaching powder	70%	7g to 1 litre of water
CLOROX (US & UK)	0.01 to 5%	As Per Manufacturer’s Instructions
Any other	As Per Manufacturer’s Instructions	

Table 2. Various types of masks prevailing in India

Various types of Masks most prevalent in India	Cloth Mask(Nonmedical mask)	Surgical mask (medical mask)	N95 respirator Mask
1. Materials Used for fabrication	Cotton fabric	Made of synthetic fibres and contains filters made of polyester or polypropylene	multiple layers of nonwoven fabric, often made from polypropylene
2. Filtration Efficiency	2 % to 38%	10% to 90% for various manufactures	Greater than 95%
3. Function	Cotton mask can reduce respiratory droplet transmission but to a lesser extent	Designed to prevent infection in patients and a treating doctor from the wearers mouth and nose avoiding cross contamination	Protects the Personnel from Airborne Particles and Liquid Contaminants
4. Protection against	Large particle droplets (does not give protection in otherwise high-risk zone)	Large particle droplets, splashes, sprays, splatter	Very Small Particulate Droplets and Airborne Particles
5. When & who should Used	Can Be Use When Physical Distancing of at least 1metre Is Difficult To Maintain 2.In Public places, workplaces, shops in closed environments 3.For community use by Common peoples 4.Peoples without any symptoms of covid 5.Widespread of covid in community	Health Care Workers In Low Risk Areas’ Covid 19 Patients With Mild Symptoms Peoples Taking Care Of Covid 19 Patients Outside Hospitals Immunocompromised Peoples in low risk regions Peoples Above Age 60 Dental professionals in low risk or no risk regions	1.ICU (intensive care unit) facility 2.Critical care ward 3.SARI Ward or attending severely ill patients of SARI. 4.Sample collection or sample testing for Covid 19 5.Mortuary WHILE PERFORMING AUTOPSY ON Covid 19 patient 6.Aerosol generating procedures in Dental 7. Physicians attending SARI & Covid 19 patients in OPD 8. Intensivist in ICU & Critical care ward

				9.Dental Surgeons performing aerosol generating procedures 10.General Surgeons
6	Advantages	1.Can be washed and reused 2.No need to discard & can be repeatedly used	Less cost	NIOSH recommended tightly fits around mouth & nose
7	Disadvantages	Less effective than surgical mask Limited Evidence Of Their Effectiveness These Masks Alone Does Not Provide Adequate Protection during covid 19 DUE TO POOR FILTRATION & FIT PERFORMANCE	Not NIOSH RECOMMENDED Costlier than clothmask Does Not Have Airtight Seal Does Not Protect Against Airborne Particles Or Viruses Is Not Effective Against Very Small Particles In Air Generated During Coughing ,Sneezing And Aerosol Generating Procedures	Costlier than both clothmask & surgical mask DOES NOT PROVIDE PROTECTION AGAINST GASES & VAPOURS
8	Decontamination & disposal Methods (general)	1.Washing in warm water & detergent for 3 to 5 mins & sundrying for 5 to 6 hours 2.Using pressure cooker 3.Boiling for 15 min above 60 degree 4.Cleaning in washing machine along with detergent	1. Placing in a paper bag for a minimum of 72 hours prior to their disposal as general waste. 2. First decontaminate by bleach (5%) sodium hypochlorite(1%) and then burning or deep burial.	1.placing in airtight paper bag for 2 to 3 days and then disposing as general waste 2.decontamination by sodium hypochlorite and then burning or deep burial

Figure 1. Showing Masks at complex area



Figure 2. Masks on the streets



Figure 3. Mask at Hospital Complex area





REFERENCES

1. John Hopkins University coronavirus resource Centre. COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU).<https://coronavirus.jhu.edu/map.html>
2. World Health Organization. Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-1911---march-2020>
3. Doremalen N, Bushmaker T, Morris DH et al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1N Engl J Med 2020; 382:1564-1567.
4. Alex W H Chin, Julie T S Chu, Mahen R A Perera et al. Stability of SARS-COV-2 in different conditions. Lancet Microbe 2020.Published Online April 2, 2020 [https://doi.org/10.1016/S2666-5247\(20\)30003-3](https://doi.org/10.1016/S2666-5247(20)30003-3)
5. Centers for Disease Control & Prevention (CDC).Recommendation Regarding the Use of Cloth Face Coverings, Especially in Areas of Significant Community-Based TransmissionApril,3,2020.<https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover.html>
6. Kasatwar A, Bhola N, Borle R, Rajanikanth K. Displacement of lower third molar into the lateral pharyngeal space in a case of mandibular angle fracture: An unusual complication. Contemporary Clinical Dentistry, Apr-Jun 2016 | Vol 7 |,Issue 2,229-231
7. Dakshinkar P,Bhola N,Borle R,Jadhav A,Kasatwar A,Nawaoaria H.A Comparative Evaluation of Single strong plate versus two miniplates in interforaminal mandibular fractures : A Prospective Study. Journal of Dental research, DMIMS, Volm, 1,issue 1,20 -24
8. Kasatwar A , Surana S , Rajanikanth K , Kala A , Dakshinkar P , Nandanwar J .Management Of Dento-Alveolar Fractures With Trans-Gingival Lagscrews: A Novel Technique. International Journal of Medical and Oral Research July-December 2017; 2(2):1-6
9. ComparisonEffectivenessofHyaluronicAcidinCombinationwithPolylacticAcid/Polyglycolic Acid Membrane and Subepithelial Connective Tissue Graft for the Treatment of Multiple Gingival Recession Defects in Human: A Clinical Study. journal of Datta Meghe Institute of Medical Sciences University 13(1):48 • January 2018.
10. Pleomorphic Adenoma of the Cheek: Report of a Rarity. Journal of Datta Meghe Institute of Medical Sciences University | Volume 13 | Issue 1 | January-March 2018
11. Crab Claw Reduction Cheiloplasty: The Indian Way. Journal of Cutaneous and Aesthetic Surgery ,Volume 13 , Issue 2 ,April-June 2020
12. Prevalence of congenital cardiac anomalies in patients with cleft lip and palate – Its implications in surgical management. Journal of Oral Biology and Craniofacial Research 8 (2018) 241–244.
13. Secondary Mandibular Deformity Correction in TMJ Ankylosis Patients Using Distraction Osteogenesis IOSR-JDMS, Volume 16, Issue 6 Ver. VIII (June. 2017), PP 13-19.
14. Management of An Erupting Large Maxillary Complex Odontoma – Report of An Unusual Case. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS). Volume 16, Issue 8 Ver. X (Aug. 2017), PP 75-78
15. Role of Herbal Antioxidant Therapy on Healing of Traumatic Oral Ulcers and Oxidative Stress : An Animal study. Journal of DMIMSU, Vol. 11,No. 4,2016,438-44
16. Evaluation of role of propolis in healing of traumatic oral ulcers. An animal experimental study. PARIPEX - INDIAN JOURNAL OF RESEARCH, vol;6,issue 6,664-666.
17. Retrospective analysis of incidence of complications of central venous catheterization at an intensive care unit. International Journal of Biomedical Research 2015; 6(04): 279-284
18. Concrescence of Mandibular Second and Third Molar– A Rare Case Report.” IOSR-Journal of Medical and Dental Sciences, Volume 15,Issue 9,77-79
19. SmithDJ, MacDougall CC, Johnstone J, Copes RA, Schwartz B, and Garber G Effectiveness of N95 respirators versus surgical masks in protecting health care workers from acute respiratory infection: a systematic review and meta-analysis. CMAJ. 2016 May 17; 188(8): 567–574



20. Zhiqing L, Yongyun C, Wenxiang C et al. Surgical masks as source of bacterial contamination during operative procedures. *J Orthop Translate*. 2018 Jul; 14: 57–62. Published online 2018 Jun 27. doi: 10.1016/j.jot.2018.06.002
21. National Institute for Occupational Safety and Hygiene (NIOSH), NIOSH Guide to the Selection and Use of Particulate Respirators Certified Under 42CFR84, DHHS(NIOSH)Publication no. 96-101, National Institute for Occupational Safety and Hygiene(NIOSH), Cincinnati, Ohio, USA,1996.
22. AnLee S, ChirHwang D, He-YiLi, Tsai CF, Chen CW, Chen JK. Particle Size-Selective Assessment of Protection of European Standard FFP Respirators and Surgical Masks against Particles-Tested with Human Subjects. *Journal of Healthcare Engineering* Volume 2016, Article ID 8572493, 12 pages.
23. Hobday RA, and Cason JW, The Open-Air Treatment of PANDEMIC INFLUENZA. *Am J Public Health*. 2009 October; 99(Suppl 2): S236–S242. doi: 10.2105/AJPH.2008.134627
24. Swenson VA, Stacy AD, Gaylor MO et al. Assessment and verification of commercially available pressure cookers for laboratory sterilization. *PLoS One*. 2018; 13(12): e0208769. Published online 2018 Dec 11. doi: 10.1371/journal.pone.0208769
25. Carswell JW. Precautions against HIV transmission in hospitals. *Trop Doct*. 1989 Jul;19(3):131-2
26. Fathizadeh H, Maroufi H, Momen-Heravi M et al. Protection and disinfection policies against SARS-CoV-2 (COVID-19). *Le Infezioni in Medicina*, n. 2, 185-191, 2020
27. Centers for Disease Control & Prevention (CDC). Use of Cloth Face Coverings to Help Slow the Spread of COVID-19, April 13, 2020. <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.htm>
28. Kindermann J, Karbiener M, Leydold SM, Knotzer S, Modrof J, Kreil TR. Virus disinfection for biotechnology applications: Different effectiveness on surface versus in suspension. *Biologicals* 64 (2020) 1–9
29. Slaughter RJ, Watts M, Vale A, Grieve JR, Schep LJ. The Clinical Toxicology of Sodium Hypochlorite. *Clin Toxicol (Phila)*. 2019 May;57(5):303-311. doi: 10.1080/15563650.2018.1543889. Epub 2019 Jan 28
30. COVID-19: Guidelines on disinfection of common public places including offices, March 29 2020. <https://www.mohfw.gov.in/pdf/Guidelineson%20disinfectionofcommonpublicplacesincludingoffices.pdf>
31. Centers for Disease Control & Prevention (CDC). Decontamination and Reuse of Filtering Facepiece Respirators, April 9, 2020. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html#>

Cite this Article: Dr. Akash Kasatwar, Dr. Jayshri Nandanwar (2021). Health Hazards and Protocol for Management of Used Facemasks Outside Hospitals during SARCOV-2 Pandemic. International Journal of Current Science Research and Review, 4(4), 297-287