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REVIEW ARTICLE

A Narrative Review on Disinfection Tunnel for Covid-19: A Friend or Foe?

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Abstract

The use of a disinfection tunnel has become increasingly popular to eliminate the Covid-19 on the body particularly during the pandemic, however insufficient attention paid to its effectiveness and safety. We undertake a narrative review on the disinfection tunnel and evaluate their effectiveness and safety. The keyword searches of Medline, EMBASE, PubMed, EBM reviews database and manual searches of Google Scholar and US Food and Drug Administration (USFDA) was used. An analysis of the papers reviewed were categorized into three main themes: technical design of disinfection tunnel; effectiveness of disinfectant used; and safety or harmful effect. To date, no relevant specific scientific studies or evidence retrieved about disinfection tunnel for public usage including effectiveness and safety. We found a various designs of disinfection in the market today. It mainly originated from an innovative idea to assist in limiting the spread of Covid-19. However, current available evidence does not support its effectiveness and safety. Although it may lead to a false sense of security, this potential approach appears attractive thus creates an opportunity for further research.

Keywords: Disinfection tunnel, Sanitization, Safety, Effectiveness

Introduction

Coronavirus disease 2019 (Covid-19) was first identified in December 2019 in Wuhan, China (Hui et al., 2019). It is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) which is a new variant in the beta coronavirus family. The World Health Organization (WHO) had to announce a Public Health Emergency of International Concern (PHEIC) on 30th January 2020 due to its alarming spread followed by a pandemic state as the situation worsened (WHO situation report, April 2020).

The true Covid-19 spread is still under research and not fully understood but the majority of patients are observed to be infected through close contact via droplets commonly produced during coughing, sneezing, and talking (CDC, April 2020). Even though the size of the droplets relatively small but is heavy enough to travel far through the air. It may land onto the face or cloth leading a risk for a new foci of infection. Thus, the spread between humans is fast. Covid-19 may get through into the upper respiratory tract when someone touches the contaminated surfaces and unconsciously touched their face. Studies have shown that the first three days of symptomatic presentation are most crucial as is the most contagious period but the spread is still possible from asymptomatic patients (WHO, 2020). It was observed that, the patient with Covid-19 tested positive but remain asymptomatic was estimated to be around 20 to 40 percent (Bloomberg.com., March 2020). Therefore, it is warranted to establish a new innovative way of doing fast and effective measures to limit the spread of Covid-19 from humans to humans in the community.

The proven recommendation for spread prevention includes frequent hand washing, social distancing, home quarantine, practicing proper cough etiquette, and avoiding hand from touching the face (Nussbaumer-Streit et al., 2020; WHO, 2020). The facial mask is recommended for those with the risk of spreading the virus (CDC, 2020). The study had shown that the number of active virus decreases as time passed by until no longer infectious but it remains the unknown minimal amount of virus load to cause cross-infection via contaminated surfaces and can be decontaminated effectively using common household products (CDC, 2020). The finding from a previous study showed that the virus still is detected after four hours on copper, twenty-four hours on cardboard, and up to seventy-two hours on plastic material (Van Doremalen et al., 2020; NIH 2020). Improper use of disinfectants may cause harm especially when accidentally ingested or inhaled into the human body (NIH, 2020). One of the immediate emergency public health measures that aim to contain spread is via movement restriction order and even total lockdown. Undoubtedly, the fact is that one has to be out of home at some time of the day to have basic commodities for a living. Therefore, the risk is presumably higher in the remote area where the awareness and mature mind-set is lacking.

The fast spread of Covid-19 has a big impact on mankind that pushes them to a new norm. It came suddenly and challenge the authorities to improve and improvise the health protection strategy. Furthermore, WHO estimates that globally 3 billion people lack hand hygiene facilities at home, and two out of five health care facilities lack hand hygiene at points of care (WHO global baseline report, 2019). This had led to new ideas and innovation in the healthcare system including disinfectant tunnel and others such as digitally enabled online consultation, mobile sampling. Technology is required to help in disease management and this innovation was perceived as a technological gift to mankind. Recently, many countries design a disinfection tunnel to be installed at public-points where people get themselves sanitized when they walk through it (Peridot services, 2020; Giulio, 2020). The disinfection tunnel is designed on a concept of a small walkway where the persons are sprayed with a disinfectant. The properties of disinfectant sprayed will be landed onto the skin and cloth thus sanitized the person from microorganism including Covid-19. It is believed that it will eliminate the external microorganism and may provide prevention from further risk of infection to their family and other people when going home or enter crowded places respectively. The tunnel was innovatively designed to be user friendly, easy installation portable walk-through and use for community protection (Peridot, 2020; Giulio, 2020). The claimed-ability of effective mass public sanitization to reduce virus transmission within a short period had fascinated many people thus many manufacturers all over the globe go for mass production.

A disinfection tunnel becomes a topic of interest and creates an impetus for any organization to design their product. Various versions of these tunnels are springing up across the globe without regulatory guidelines or clear benefits. However, there are some organizations against the usage of disinfection tunnel (Salma, 2020). Initially, few of an organization advocate the use of a disinfection tunnel but later ceased or banned the operation (Marri, 2020; Edappadi, 2020). The public health experts quoted as saying that it may lead to a sense of false security

towards Covid-19 (Lokman, 2020). The main question to be answered regarding the usage of a disinfection tunnel is either it is effective or safe for public use. Thus, we intend to seek evidence regarding the disinfection tunnel particularly their effectiveness and safety.

Materials and Methods

An initial scoping exercise established that the qualitative research literature was too heterogeneous to permit a systematic review of qualitative studies along the lines proposed by Dixon-Woods et al., (2001), or a theoretical qualitative meta-synthesis using the methods proposed by Sandelowski et al., (1997). For this reason, a narrative review was undertaken.

The literature search was conducted in November 2020. The search focused on the period of 2015–2020 because it was during this period that coronavirus infection became a topic of concern in medical and public health practice. The objective of the review is to identify the type of disinfection tunnel and evaluate its effectiveness and safety.

The primary focus of the review is therefore on the latest Covid-19 concerning the effectiveness and safety of disinfectant tunnel usage to limit its spread used by the authorities in many parts of the world. Studies included in the review were by search of database Medline, EBM reviews, EMBASE via OVID, PubMed, and from the general search engines [google scholar and US Food and Drug Administration (USFDA). Keywords search included disinfection tunnel box or chamber or gate or walkaway or booth or partition and effective or effectiveness and safe or safety. Other keywords use includes sanitizer or disinfectant and effective or effectiveness and safety or safe. As this is not a systematic review and only a few relevant articles retrieved, evaluations of methodological quality were not used to exclude papers from the study.

Results and Discussion

There was no specific relevant article retrieved from the scientific databases such as Medline, EBM Reviews, EMBASE via OVID, and PubMed on disinfection tunnel concerning its effectiveness and safety. Manual search from general search engines (Google Scholar and US Food and Drug Administration, USFDA) on the type and technical specifications of a disinfection box or chamber or tunnel or booth or partition or gate revealed a few information. Malaysian Health Technology Assessment Section (MaHTAS, 2020), Ministry of Health, summarised the specification of the available disinfectant chamber as follows:

Table 1: The name and technical specifications of the disinfectant tunnel in Malaysia (Adapted from MaHTAS, 2020)

No	Name	Technical specification
1	Mobile Disinfectant Chamber (MDC) Penang, Malaysia	• Automatic system with sensors to activate and deactivate the disinfectant sprays
2	Virus Buster Nano Spray	• Chamber size: 2.2m (length) x 1.2m (width) x 2.0m (height) • A walk through the chamber • Automatic detection (infrared) • 14 nozzles to spray disinfectant
3	Disinfectant Box	• The disinfection box/cabin is equipped with an indicator light, tower light, water

		tank, water pump, host pipe and limit switch
4	Sterilization chamber	• A walk through the chamber • Automatic spraying of disinfectant within 3 seconds
5	Automated Disinfection Chamber, University Technology Malaysia (UTM)	• Motion sensor technology and fluid mechanics • Portable
6	Disinfectant Tunnel Universiti Malaysia Perlis (UniMAP), Malaysia	• Chamber size: 1.8 metre (6 ft)-wide, 2.7 metre (9 ft)- long and 2.4 metre (8 ft)-tall
7	Disinfection Tunnel Sabah Police	• Not available
8	Automatic Disinfectant Tunnel School of Electrical and Electronic Engineering (PPKEE), Universiti Sains Malaysia (USM) Malaysia	• A touchless temperature detector • No-touch soap dispenser and a hand dryer sonar detector
9	Sanitize Chamber, (Model CVD 901)	• Mist nozzle, plastic flexible tube • High-pressure water pump • Sanitize liquid 75% alcohol • Motion sensor disinfectants

Table 2: The name and technical specifications of the disinfectant tunnel outside Malaysia (Adapted from MaHTAS, 2020)

No	Name	Technical specification
1	Body disinfection Chamber from Turkey named IKARUS (Havva Dereagzi, 2020).	• An antibacterial and corrosion-resistant composite body • 60-degree swivel base • Fingerprint reading • Self-cleaning with ultraviolet • Body temperature detection with thermal camera
2	Human sanitizer Box (Product of Indonesia)	• A walk through the chamber • Fast auto spray disinfectants in 5 seconds • Use chlorine and chlorine compounds as disinfectants
3	Mobile sterilization chamber (Product of Vietnam)	• Divide into wet and dry chamber • In the chamber, automatic spray fog mist at 360 degrees with infrared sensor
4	Personal sanitization box (product of India)	• A portable walkthrough box • An automatic spray of sodium chloride mist • Duration of spray is 25 seconds and automatically stop

5	Personal Spray booth (Product of Thailand)	• Footswitch operation • Auto sensor operation lights • Fire retardant materials • Sprays 3-5 seconds pulse

Research on SARS-CoV and MERS-CoV revealed that coronavirus is sensitive to ultraviolet and heat e.g. exposure to 56 degrees celsius for 30 minutes will eliminate the virus. The type of disinfectant such as ether, 75% ethanol, chlorine-containing disinfectant, peracetic, and chloroform can effectively inactivate the virus but not chlorhexidine (National Health Commission & State Administration of Traditional Chinese Medicine, 2020). Therefore, the claimed effectiveness of disinfection tunnel usage largely depended on the type of disinfection.

The US CDC guidelines recommend the use of USEPA registered disinfectant to clean and disinfect facilities (US CDC, 2020). The USEPA has listed out types of disinfectants against SARS-CoV-2 such as thymol, quaternary ammonium, Isopropanol, ethanol, L-lactic acid, glutaraldehyde, hydrogen peroxide, phenolic, sodium hypochlorite, sodium chloride, sodium dichloroisocyanurate dehydrate, hypochlorous acid, citric acid, silver, peroxyoctanoic acid, peroxyacetic acid, peracetic acid, and octanoic acid. According to the USEPA, these products are for use on surfaces, not humans (USEPA, 2020). Most of the products listed are suitable for hard non-porous surfaces e.g. glass and metals.

The disinfection material use may be harmful to humans especially if accidentally ingested or get into contact with mucous membranes e.g. eyes, mouth. Spraying the body of a human externally does not kill the virus inside the body of an infected person as the disinfectant material need to be in physical contact to deactivate the virus (US CDC, 2020).

Presently, many organizations had come out with innovative inventions for a quick, easy, and user-friendly disinfection tunnel to prevent the spread of Covid-19 among humans. Disinfection describes a process that eliminates many or all-pathogenic microorganisms, except bacterial spores, on inanimate objects. Disinfectants can be classified into high, intermediate, and low-level disinfection. Low-level disinfectants can kill most vegetative bacteria, some fungi, and some viruses in a practical period (≤10 minutes).

This innovation is not to replace the guidelines by WHO to prevent the spread of Covid-19. It is used merely for the convenience of the public in limiting the spread of Covid-19. The technical design of the disinfection tunnel varies but the applied concept is the same. The manufacturing design concept is largely based on an innovative walkway or tunnel and even a confined space like a box in which a person is showered or sprayed a disinfectant aim towards the clothes and parts of the body. Some of the designs incorporate technology for automation and additional valuable features to the design. Interesting relevant valuable technical features include temperature sensing with alarm notification if febrile illness or high temperature is detected, an automatic spray of disinfectant focusing at commonly exposed area of the body, and a negative pressure environment in the box. Some of the designs serve with hand sanitization as a prerequisite before entering the tunnel. The current design can accommodate many people at one time but still adhere to the social distancing requirement for sanitization purposes. The majority of the manufacturer does not reveal the actual cost of the disinfectant tunnel. However, within limited available data, it was found that there are significant differences in cost per unit of the disinfection tunnel (MaHTAS, 2020). The cost incurred mostly due to additional function package with the unit e.g. infrared temperature screening, hand sanitizer, type of disinfectant use, and size of the tunnel. Some of the disinfection tunnels are fabricated with antibacterial properties.

Most of the disinfection tunnel is design to detect movement and automatically sprayed the disinfectant chemical once the user walks into the tunnel. The disinfectant used will get onto the exposed skin as well as the external clothing thus potentially eliminate the susceptible organisms' presence in that area. Disinfection is essential for ensuring that hosts do not transmit infectious pathogens to other people. Improper disinfection procedures not only create risk

associated with a breach of host barriers but also a risk for person-to-person transmission, and transmission of environmental pathogens. Factors that affect the efficacy of disinfection include prior cleaning of the object; organic and inorganic load present; type and level of microbial contamination; concentration of and exposure time to the germicide; physical nature of the object (e.g., crevices); the presence of biofilms; temperature and pH of the disinfection process; and in some cases, relative humidity (US CDC, 2020).

The majority of our clothing is made from either cotton, nylon, or synthetically manufactured thus is considered a porous material (NPIC,2020). The current recommendation by US CDC is for sanitization is to launder or wash the clothes using the warmest appropriate water setting and dry it completely (US CDC, 2020; NIH, 2020). Another option is to use disinfectant products that are suitable for porous materials and listed in EPA-registered for use against the SARS-CoV-2. However, it need five to ten minutes of contact time (to be used as laundry pre-soak) to be effective in deactivating human coronavirus (USEPA, 2020). Most of the spraying process in/at the disinfection box/chamber/tunnel/booth/partition/gate takes approximately 20 to 30 seconds in each round of disinfection that is not enough to deactivate coronavirus.

However, the type of disinfectant used in the devices plays a major role in the effectiveness of the devices. Disinfectants that are suitable for porous materials and listed in EPA-registered for use against SARS-CoV-2, for use on the surface need five to ten minutes of contact time (for all listed disinfectants, and for quaternary ammonium to be used as laundry pre-soak) to be effective in deactivating human coronavirus. Most of the spraying process in/at the disinfection box/chamber/tunnel/booth/partition/gate takes approximately 20 to 30 seconds in each round of disinfection that is not enough to deactivate coronavirus. Furthermore, spraying the external part of the body with alcohol or chlorine does not kill the virus inside the body of an infected person (US CDC, 2020).

In the era of new norms, the practice of social distancing slowly become our nature. The government mandates either a facial mask (Feng S. et. al, 2020) or hand sanitizing before entering premises with crowds and temperature screening e.g. religious center, restaurant, mosque, and supermarket. The awareness of the importance of cough etiquette was also been highlighted and instill at many schools or teaching institutions. These strategies no doubt have to reduce the chance of microorganism to get deposited onto our cloth especially through droplets. Moreover, the majority of microorganism is found onto our hands which can be easily eliminated via a proper hand sanitizing practice. The use of a disinfection tunnel will require a specific type and amount of sanitizer for cost-effectiveness. While these disinfectants may help remove viruses and bacteria on surfaces such as shirts and trousers, they would not be useful in killing the virus in an infected individual. A majority of the infected patient has the virus in the upper respiratory tract, providing a sprayed disinfectant outside of the body will not eliminate the virus. The person may be getting complications if the disinfectant gets into contact with the mucous membrane leading to inflammation and cell injuries. Furthermore, it will lead to a fall sense of security from the virus and ignore the importance of handwashing and personal hygiene, social distancing, and crowded places.

Conclusion

There was no evidence retrieved from the scientific databases on the effectiveness, safety, and cost-effectiveness of the disinfection box/chamber/tunnel/partition/gate to reduce transmission of Covid-19. It may lead to potential disinfectant hazards and a false sense of security. The disinfection box/chamber/tunnel/booth/partition/gate is an innovative approach that has the potential to assist in reducing the Covid-19 transmission, thus creates an opportunity for further research.

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