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Beware the Trojan horse!

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ABSTRACT

Introduction: In this era of social distancing, dependence on electronic gadgets and devices is ever increasing. Possibility of transmission of COVID -19 from these devices cannot be ruled out. Currently, prevention is the only antidote; considering the mounting evidence of transmission of COVID-19 virus primarily through respiratory droplets and fomites. Gadgets are one of the most frequently touched appliances; being often used during or after patient examination, while handling specimens or during various patient procedures. Collecting data regarding mobile sanitization is prudent at these times. The aim of this systematic review is to summarize published evidence on mobile sanitization in these COVID times.
Methods: PubMed search on "COVID and mobile phone" revealed only 4 articles related to this topic; therefore we have assimilated data from various organizations, websites and articles and have suggested methodology for sanitization of mobile phones and other gadgets.
Results: Infection control practices which include information, communication, education and evaluation are the pre-eminent weapons in the fight against hospital transmitted SARS-CoV-2. Minimizing mobile phone usage, sanitizing them with endorsed biocidal agents and advancements in the field of ultraviolet cabinets is a priority.
Conclusion: At the same time we shouldn't forget that sanitization is only one aspect of prevention of this disease; maintaining hand hygiene, use of masks and social distancing must be followed at all times.

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Introduction

Averting and reducing the transmission of infectious diseases that pose global threats, such as Corona virus 19 (COVID -19), now named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is of paramount importance. Though most of the people infected with SARS-CoV-2 experience mild to moderate illness, some people especially those with co-morbid conditions are more likely to develop severe symptoms (1). Despite multiple ongoing clinical trials, evaluation of potential vaccine candidates and treatment modalities there are currently no vaccines available for COVID 19 (2). Hence the best way to circumvent the disease is to avoid exposure. While diagnosing and treating a COVID-19 patient is a priority, equally important is protection of visitors and health care workers; which actually is the fundamental basis of achieving quality care, patient safety and health security (3). Current evidence suggests transmission of COVID-19 virus is primarily through respiratory droplets and fomites (4).

Mobiles phones, keyboards, touch screens on

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tablets and equipment interfaces, laptops and pens are among the most frequently touched surfaces in any health care setting (5). The obligatory use of COVID related app in our country has made it imperative for us to sanitize these devices in a comprehensive manner. This is especially true for our mobile phones, which are frequently used for socializing, video conferencing and shopping. It is of utmost importance that these devices are sanitized, as these are not disposable and are carried to our household from work place. They can't be left unattended for 72 hours, and not everyone can own multiple set of devices in order to use them in a staggered manner. Collecting data in relation to mobile sanitization is prudent at these times. The aim of this systematic review is to summarize published evidence on mobile sanitization in these COVID times.

Methods

A systematic search conducted on PubMed database using key terms 'Covid', 'Corona Virus', 'Decontamination', 'Hygiene', 'Sanitization, 'Cell Phone' and 'Mobile Phone' revealed one manuscript on recommendations for sanitizing mobile phones (6). However, on simple Google search several newspaper and online articles could be found on the subject. But upon replacing 'Corona virus' with 'bacteria' multiple studies were found.

We also collected information derived from PubMed, healthcare websites, and disinfection recommendations by mobile companies for this review. We referenced the role of mobile phones in infection transmission and mobile phone hygiene recommendations made for bacterial contamination studies.

Results

A systematic search was conducted on PubMed electronic database using key terms 'mobile phone', hygiene' and 'COVID 19'. Since only three articles were found the search scope was increased by using the terms 'mobile phone' and 'hygiene'. The initial results of the database search revealed 118 articles. Multiple International Health Care Agency guidelines, newspaper articles, mobile phone company support guidelines and online articles were found on simple google search. After two stages of screening, checking the references and removing duplicate articles, 15 articles were finally selected for current review as being relevant, original research studies on mobile phones contamination in health care settings with recommendations on infection prevention. All the articles were published during 2011-2020 (Figure 1).

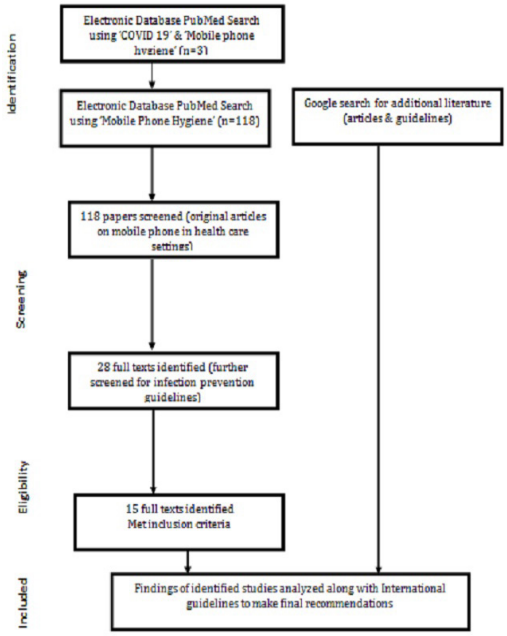

Figure 1. PRISMA flowchart for mobile phone hygiene during COVID 19.

Discussion

Emergence of COVID 19

Coronavirus (CoV) have been known to cause human and veterinary disease. 2% of the population are healthy carriers of a CoV (1) and these viruses are the second most common cause of common cold and self-limiting upper respiratory illness particularly in winter, in immuno-competent individuals. It also causes infectious bronchitis, hepatitis and transmissible gastroenteritis in birds, mouse and pigs respectively (7). Virulent human stains can emerge either due to mutation in the existing CoV human strains or due to acquisition of mutation conferring human infectivity property to an existing animal strain or due to genetic recombination of existing strains (Figure 2). Genomic analysis of SARS-CoV-2 suggests the virus has probably evolved from strains found in bats or pangolins, but the amplifying host between bats and humans remains unknown.

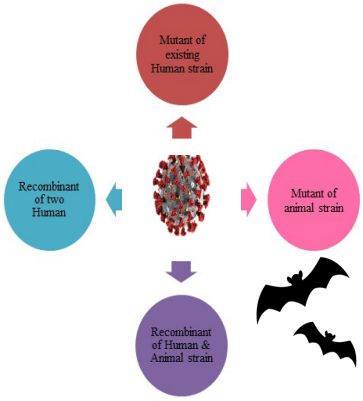

Figure 2. Emergence of COVID 19.

Resistance of SARS-CoV-2

Like other CoVs, SARS-CoV-2 is sensitive to UVC light. The germicidal effects of UVC irradiation with a peak intensity at 254 nm result in cellular damage of the virus, thereby inhibiting cellular replication (8). Newer innovations have come up, with Defence Research and Development Organization (DRDO) coming up with an innovative design of UVC sanitization cabinet which could be used to sanitize mobiles, currency notes, laptops etc (9).

At room temperature virus reduction in 2 days is by one log only. High temperatures decrease its replication. Quick reduction of SARS-CoV-2 occurs with heat at 56^0C that kills in 15 minutes (10).

Furthermore, these viruses can be effectively inactivated by lipid solvents including ether (75%), ethanol, chlorine-containing disinfectant, peroxyacetic acid, and chloroform except for chlorhexidine. Soap is especially effective against COVID 19 - when applied for 20 seconds the hydrophobic tail of soap molecules are known to penetrate the lipid envelope of SARS-CoV-2 leaving the virus deflated and inactive (11).

The stability of SARS-CoV-2 at room temperature varies with the type of surface. According to a study published in NEJM, COVID-19 was more stable on plastic and stainless steel than on cop and cardboard, and viable virus was detected up to 72 hours after application to these surfaces (12).

Role of Electronic devices in transmission of COVID 19

Most electronic devices have plastic surfaces, upon which SARS-CoV-2 is most stable; these devices may thus serve as reservoirs of the pathogen and a plausible source of disease spread. This underscores the significance of sanitization of these devices.

Table 1. Studies evaluating mobile phone contamination in health care settings

Authors Reference Years	Country	Common organisms	High prevalence areas	Factors decreasing contamination rate
Panigarhi SK 6 2020	India			Less mobile use, hand hygiene, mobile phone hygiene
Qureshi NQ 13 2020	Pakistan	*CONS, Micrococcus*	Anaesthesia technician	Cleaning mobile phones, absence of covers and cracks
Bodena D 14 2019	Ethiopia	CONS, Staph. Aureus, Klebsiella	Nurse, Male sex	Hand washing, Cleaning mobile phone
Singh G 15 2018	India	*Staph. Aureus, Bacillus*	Lab Technicians and nurses	Disinfect mobile phones, Hand hygiene, restrict use of mobile phones
Morubagal RR 16 2017	India	*Acinetobacter, MRSA*	Nurses	Hand washing, regulate use of mobile phone
Chen CH 17 2017	Taiwan	*CONS, Streptococcus*		Regulate use of mobile phones, Cleaning mobile phones
Heyba M 18 2015	Kuwait	*CONS, Micrococcus*	NICU	Cleaning mobile phones
Foong YC 19 2015	Australia	*CONS, Diptheroid*	Interns (Junior Medical Staff)	Cleaning mobile phones daily
Selim HS 20 2015	Egypt	*MRSA, CONS*	Laboratory, Dialysis units	Hand hygiene, cleaning mobile phones
Angadi KM 21 2014	India	*Staph. Aureus*		Infection control practices, hand hygiene, decontamination of mobile phones with alcohol
Lee YJ 22 2013	South Korea	*Citrullus colocynthis*		Non-smart phone use
Beckstrom AC 23 2013	Sweden	*CONS, Staph. Aureus*	NICU	Hand hygiene, prohibit use, decontamination of cell phone
Ustun C 24 2012	Turkey	*MRSA, ESBL*	ICU	Disinfection of mobile phones
Brady RR SK 25 2011	Scotland	CONS, Staph. Aureus, Corynebacterium		Hand hygiene, cleaning mobile phones, avoid sharing

Since decades various studies have documented the presence and colonization of microbial flora on telephone receivers, pagers and mobile phones of health care workers (Table 1). Most of these studies have evaluated the presence of bacteria and fungi; none of them have evaluated the prevalence of viral agents which are frequent inhabitants of environmental surfaces. The reason for this discrepancy may be the requirement of highly sophisticated and expensive tests to detect viral agents; these tests are not freely available and require skilled manpower and high end equipment.

(CONS- Coagulase Negative Staphylococcus Aureus, NICU- Neonatal Intensive Care Unit, MRSA-methicillin Resistant Staphylococcus Aureus, ICU-Intensive Care Unit, ESBL- Extended spectrum beta-lactamases, Staph. Aureus- Staphylococcus Aureus)

In the studies by Heyba M et al (18), Beckstrom AC et al (23) and Ustun C et al (24) higher rate of microbial contamination was observed in high risk areas such as ICUs. ICU patients are usually seriously ill with possibility of accompanying hospital acquired infections. They are likely to harbour drug resistant bacteria and have a higher bacterial load. Laboratories are the second high-risk sites from where greater microbial numbers on mobile phones were reported. Laboratories deal with testing infected patient samples. Also culture isolation and sensitivity are associated with presence of high microbial load in laboratories. Therefore, regarding COVID-19, the ICU and laboratories can be predicted to have maximum infection risk; and hence use of mobile phones in these areas should be restricted.

Most of the studies in Table 1 recommend hand hygiene and disinfection of mobile phones as the two most important factors for preventing contamination of mobile phones and consequent fomite borne infection. Therefore, hand hygiene and mobile phone disinfection would go a long way in reducing transmission of COVID 19 virus to health care workers, visitors and their families. Restricted use of mobile phones in high risk areas such as ICUs and laboratories is also advocated. Since the mobile covers and cracks on them have been shown to harbour microorganisms, disposable covers must be used (26). Lee YJ et al. (22) demonstrated/documented the higher incidence of microbial contamination with smart phone devices. Compared to non-smart phones, smart phones are handled more frequently due to more functionality, thereby explaining the higher microbial load and risk of transmission. Thus, restricted use of smart phones can be a strategy in reducing microbial exposure.

Recommendations

Based upon the inference drawn from various studies we recommend the following:-

Dos and don'ts

Mobile phone, pen and key board hygiene (Figure 3)

1. Restrict use of mobile phones in hospital.
2. Avoid scrolling the mobile during public transit. Use disposable plastic water proof cases to carry these items in high risk areas.
3. Use of ear phones, thereby avoiding frequent touch contact with mobile phone.
4. Use voice commands and virtual assistants like Siri, Google voice assistant, Alexa and Cortana for touch free operation of electronic devices and mobile. Smart switches are now available to turn on and turn off electronic devices.
5. Avoid sharing of devices.
6. Practice hand hygiene before and after use.
7. Sanitize mobile phones, pens, ear phones and key boards regularly and every time you leave a high risk area, and at least once a day. The frequency would depend upon the rate of exposure to infection.

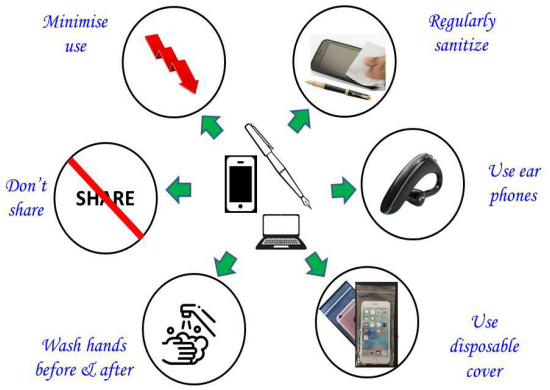

Figure 3. Ways to prevent transmission of COVID 19 infection via mobile phones, pens and key boards.

Sanitization of electronic items

Power down your device and remove them from cover if any. Gently wipe the exterior; clean with a soft, lint free, microfiber cloth to free the surface of dirt. Next dampen a microfiber cloth with a biocide or use a disinfectant wipe to clean the front and back of your phone gently without too much pressure. Avoid wiping the device excessively. CDC (27) and well known mobile brands, (28, 29) recommend use of 70% isopropyl alcohol, hypochlorous acid-based product (50-80ppm) or wipes containing Alkyl C12-18 Dimethylbenzyl Ammonium Chloride (Lysol/ Clorox wipes) with a contact time of at least 5 seconds, as effective surface disinfectants. No functional or cosmetic damage have been reported by their repeated application30. Let it air dry for 10 minutes. Repeat the same procedure with the

equipment cover. Dirty microfiber cloths should be cleaned regularly with soap and water.

Avoid getting moisture in openings. Never spray a disinfectant directly on the devise. Don't use compressed air, household cleaners, solvents, ammonia, bleaching agents and cleaners containing hydrogen peroxide - these may damage your products (28).

Newer advances for electronic equipment sterilization are now available such as UV C lamps and sterilization chambers (9, 31).

Conclusion

Electronic devices are used for communication, data entry, accessing patient reports, updating management guidelines, sharing documents and teleconsulting. With time our dependency on use of these gadgets has only increased. Information, education and awareness regarding dangers posed by these Trojan horses and their sanitization are the need of the hour. Minimizing mobile phone usage, avoiding use of smart phones, sanitizing them with recommended biocidal agents and development in the field of ultraviolet cabinets is essential.

Conflict of Interest

The authors declare no conflict of interest.

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