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Sanitation and Hygiene Monitoring System for Preventing Viral Infections in Orphanage Homes

Victoria Olusayo AINA [1], Oluwaseyi Abiodun AKPOR[1], Victor Olukayode EKUNDINA[1], Adeniran Sunday AFOLALU[2,3]

[1]*Faculty of Nursing, Afe Babalola University, Ado Ekiti, Ekiti State, Nigeria*
victoria.aina@tau.edu.ng/akporoa@abuad.com/ekudinavo@abuadedu.ng

[2]*Department of Mechanical Engineering, Afe Babalola University, Ado-Ekiti, Nigeria*
adeniran.afolalu@abuad.edu.ng

[3]*Department of Mechanical Engineering Science, University of Johannesburg, South Africa*

Corresponding Author: victoria.aina@tau.edu.ng, +2348033727615
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Abstract*: Maintaining proper sanitation and hygiene is crucial in preventing the spread of viral infections, especially in high-risk environments such as orphanage homes, where many children live in close proximity and have limited access to healthcare Maintenance of adequate sanitation and hygiene is significant in the prevention of the spreading of viral infection, particularly in high-risk environments like orphanage homes, where several children live closely and having limited access to healthcare. Thus, the review presents the forensic overview of how to the design process and standards of Smart Sanitation as well as Hygiene can help to reduce the risk of viral infections in orphanage facilities. From the results of the reviewed literatures, it was observed that adequate smart homes for the orphanage will require smart monitoring using internet of things and data analytics with certain parameters like level of compliance to hand washing, air quality, cleanliness of the rest room and usual disinfection of surfaces. Thus, real-time data help givers and administrators to take proactive action each time the hygiene level fall below standard. Furthermore, the system will have to include reports and educational guidelines for the purpose of reinforcing the practice of hygiene. Therefore, the study provides a great insight by establishing that leveraging on technology will help to develop a healthier environment, reduce the outbreak of infections while supporting the wellbeing of vulnerable children in the orphanages.*

Keywords: *Smart Hygiene Monitoring, Sanitation, Viral Infection and Prevention, Orphanage Health, Healthcare Maintenance*

1. INTRODUCTION

It was established that children formed the most vulnerable group who frequently die from poor sanitation occasioned illnesses [1]. According to a study, the joint program by UNICEF and world Health Organization reported that about 17% of the global population has inadequate access to good water resources while about 40% especially in rural areas suffers from inadequate basic sanitation services. Thus, these issues can cause the spread of several diseases [2]. Sanitation is known to be an important problem associated with internally displaced people in their camps where there is inadequate infrastructure and services [3]. This problem could result to poor health and dangers in the camp environment [4-5]. Several reports implied that the sanitation target is at risk in many developing nations due to the growth in population that is already outpacing the coverage of sanitation. One of the basic reasons for selecting this site as the area of study is that it consists of a wastewater treatment plant that makes use of primary and secondary treatment procedures which quite similar to most treatment plants [8]. Three different tools were deployed which include the shit flow diagram, citywide sanitation diagnostic assessment and the energy and carbon assessment of tools such as the use of technologies in many internally displaced people camp or environmental management [9-12]. Thus, Shukri et al. [6] developed a study to entail the comprehensive analysis of the sanitation situation in an internally displaced people camp in Iraq via the use of smart sanitation strategy as presented in Figure 1-3. Sanitation is quite crucial and is an important aspect of public health, particularly in the settings where access to safe and proper water and sanitation is limited. One of such areas is the Kabarto 2 internally displaced people camp located in the Dubok area in Iraq. This area, as shown in Figure 1, accommodates about 11,000 internally displaced people and the camp is associated with many challenges in making adequate sanitation services. This includes inadequate infrastructure, inadequate waste water management as well as environmental contamination [7]. The outcome showed that the camp's sanitation infrastructure was observed to be very unsafe having faecal sludge not adequately contained, emptied or treated. While figure 3 shows the methodology that can be adopted for the smart

sanitation solution, Figure 2 shows the blackwater containment for Kabarto 2. Mainly, the desludging operation of the trucks as well as the inadequate treatment was the actual causes of the sanitation system's greenhouse gas emission [13-14].

One of these technologies is the onsite-sanitation technologies which have been deployed widely to reduce the defecation as well as providing basic sanitation especially in low- and middle-income countries [25]. Some of the typical examples of the on-site technologies include aqua privies, composite toilets, single latrines, double latrines and flush and non-flush toilets having an integrated septic tank [26-28]. The study provided great recommendation for improving the design and fabrication of the containment system as well as restoring the plant treatment [15-21]. Also, the study suggested that improving data collection and monitoring, adequate responsibilities for the development of a faecal sludge management policy. Also, it was suggested that the important that technology usage in more internally displaced people's camp or humanitarian platforms that can produce more data and knowledge about sanitation provision services is necessary so as to enhance the improvement of services within the region [22-24]. It was established that about 10% of diseases are usually caused by sanitary problems which is the result of diseases caused by diarrheal [29-35]. In fact, it was established that one-third of the World population still do not have basic toilet facilities, adequate and accelerated development is needed to attain equitable sanitation [36].

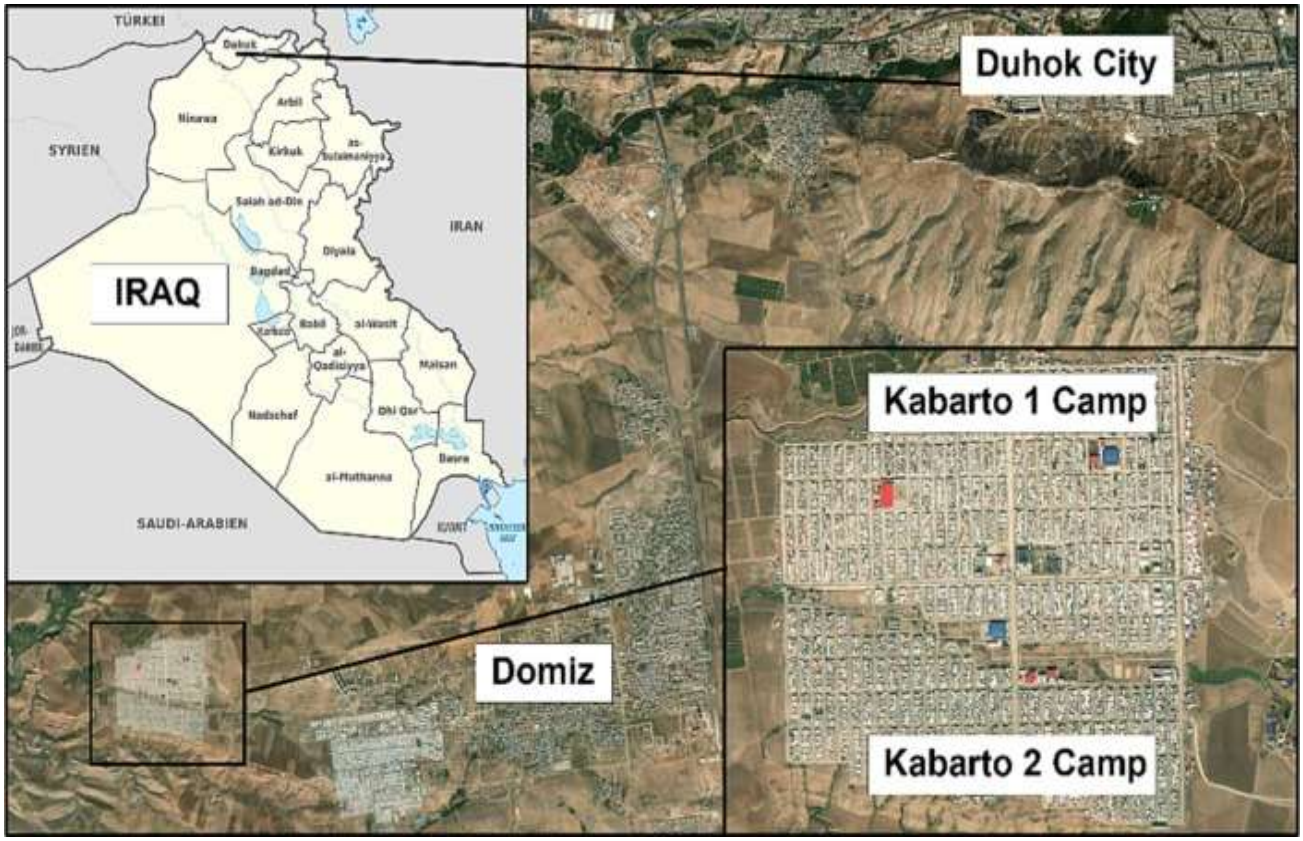

Figure 1: Internally displaced people's camp for Kabarto 2 [6]

2. SMART SANITATION AND HYGIENE MONITORING SYSTEM

Even with the availability international standard like the 2019 World Health Organization Implementation Manual for the resistance of carbapenem organism prevention and control as well as the 2021 World Health Organisation Aide-Memoire on environmental cleaning, there is still a persistent variation in the monitoring practices in healthcare facilities and regions [42-45]. Cleaning of environment is quite significant in the prevention of health-related infections as well as the mitigation of the spread of antimicrobial resistance. Recent advancement in the routine inspection of hospital cleaning practices have shown adequate potential in reducing viral infection rate [38]. For example, it has been established that the rate of survival and factors influencing human pathogens, particularly the critical role of cleaning effectively remain a good procedure [39-40].

Thus, recognizing housekeeping activities as a factor to patient safety has increased over the past years [41]. Even with the availability international standard like the 2019 World Health Organization Implementation Manual for the resistance of carbapenem organism prevention and control as well as the 2021 World Health Organisation Aide-Memoire on environmental cleaning, there is still a persistent variation in the monitoring practices in healthcare facilities and regions [42-45]. Thus, the inconsistency creates a challenge for having a reliable assessment of cleaning quality and comparison of outcome across different platforms [46-47].

Figure 2: Blackwater containment for Kabarto 2 [6]

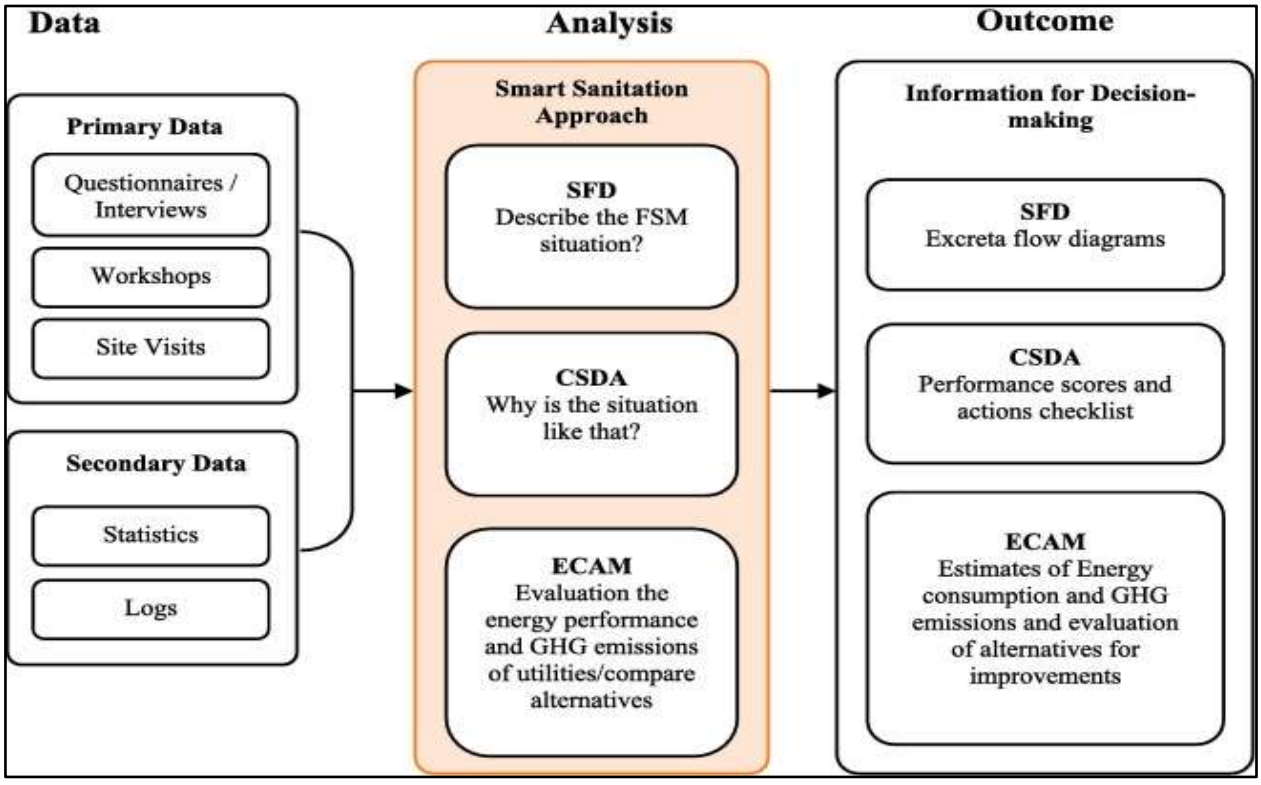

Figure 3: Methodology adopted for the smart sanitation solution [6]

However, getting achievement is quite an important challenge for many countries like India [57]. Thus, the aim of the study was to assess and progress made towards achieving sustainable development goal 6 in Indian districts, states and Union Territories and to identify the clusters by estimating the spatial inequality of water, sanitation and hygiene within the India coverage. Furthermore, the study deployed the household data which is a national representative survey that showed on household and individual category related health and nutrition [58-60]. The variables that are associated with water, sanitation and hygiene were identified and an index was created to estimate the coverage in both separate and combine manner [61-63].

In addition to this, there is constrain in resources in some healthcare which pose a barrier for the implementation of comprehensive programs for health monitoring [48]. Also, there are specific benchmarks and monitoring standards for the cleaning of the surfaces which vary from country to country and institutions. This variation is an issue based on the theory of economics difficult quality measurement will definitely define supplier's priority cost management over the quality assurance [49-50]. Therefore, it compromises the outcome. Thus, tackling these gaps using standard, evidenced based practices is important for achieving adequate cleaning and safeguarding of patient health [51-56]. Access to affordable and improved water, sanitation and hygiene facilities is significant for daily living and this is the main goal of sustainable development goal 6. The result revealed that there was high inequality in the improved water sources across the districts in India. Also, both western and northeastern were advised to meet up in other to be able to achieve sustainable development goal 6 [64-65]. However, it was further suggested that there is a need to have more of the government initiatives as well as investment so as to increase the accessibility, availability and affordability of water, sanitation and hygiene facilities so as to improve the water, sanitation and hygiene condition in both districts, that is, northeastern and western districts. Figure 4 depicts the concept of the methodology deployed in the study

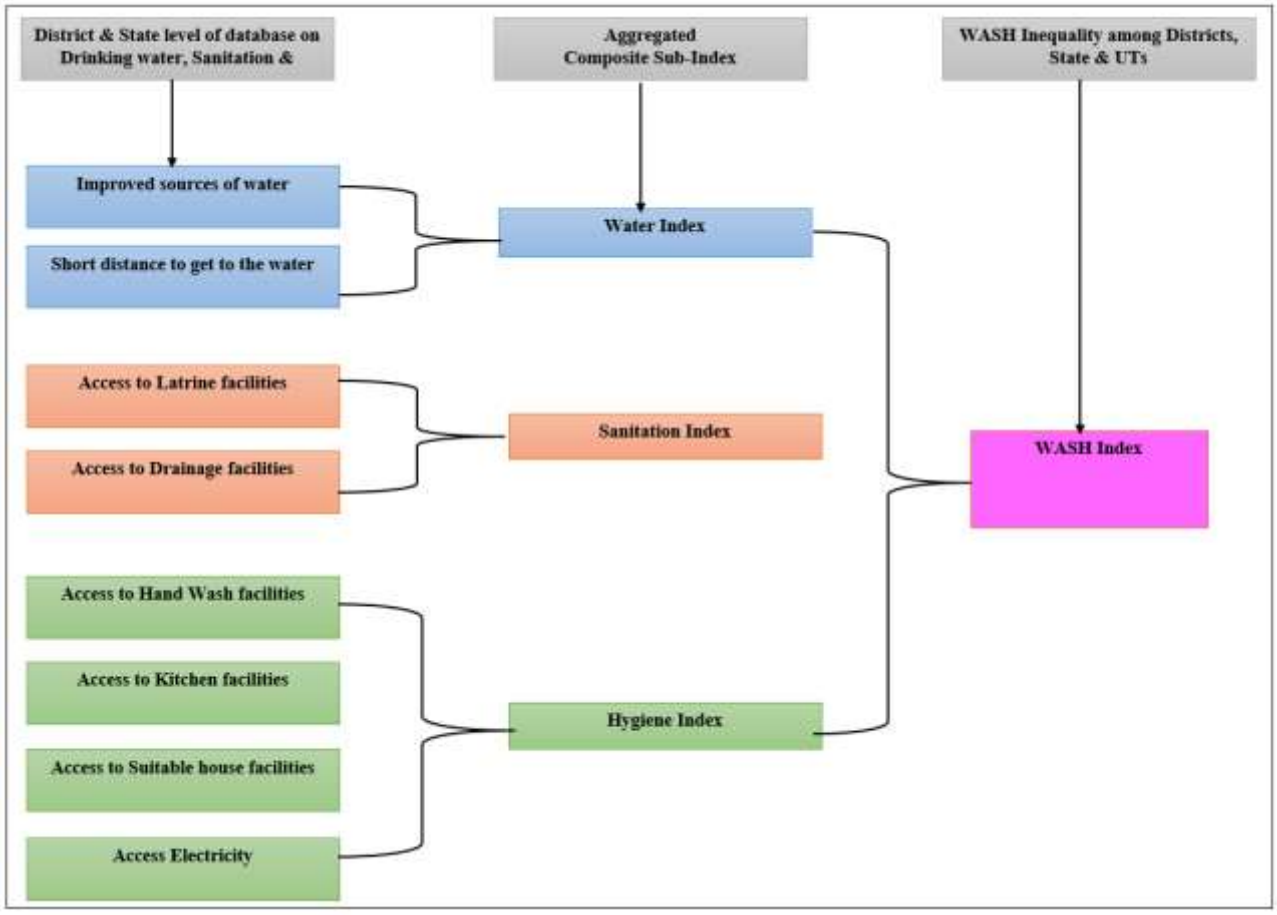

Figure 4: Methodology framework [57]

2.1 Prevention of Viral Infections in Orphanage Homes

According to a study by Wang et al. [66], it was reported that there was an increasing number in Coronavirus Diseases in 2019 which propelled many countries to take a preventive measure against the outbreak of the disease. It was observed that the transmission path of severe acute respiratory syndrome Coronavirus 2 consists of droplet and contact transmission. Additionally, transmission via aerosol generating procedure in special condition and settings exist [67]. Also, populations having no mobility as well as staying in close proximity with contacts that are not avoidable are quite vulnerable to the risks of COVID-19 infection. This includes the elderly ones in nursing homes, children in the orphanages and inmates in prison. Higher preventions and measures for control are greatly needed [68-70].

Pneumonia is one of the causes of mortality in children and there is a distinct immunological response to viral diseases or infection that will exist in children that can result in severe damage up to the important organs [73]. In fact, recent studies established that children having COVID-19 have the risk of having inflammatory syndrome in children with evidence of cardiovascular occurrences [74].

The outbreak of COVID-19 led an increased vigilance in the community where there is a need for extra responsibility of caring for children that needs protection as well as those that cannot be taken care of by their biological parents as an

orphanage [71]. However, for the children, the cases of COVID-19 was quite small, however, it was confirmed that children were susceptible to COVID-19. Infection [72]. Also, children in the orphanages live in congregated and relatively confined spaces having inadequate health protection awareness [77-77]. Hence, the significance of welfare promotion, protection and care for children as well as staff in the orphanages cannot be overemphasized.

It was reported that people are always encouraged to adequately wear their masks in corrugated places and ensure that hand hygiene is carried out appropriately [78]. People were encouraged to make use of hand sanitizer and keep hands clean all the time especially when there is condition of product supply from one person to the other or places to places due to multiple hands involved [85]. In fact, for orphanage homes, specific face shield should be encouraged due to the fact that adult mask usage might leak and expose to infection which was done to stop the spread of COVID-19. There must be avoidance of large gatherings, contact with people in the public facilities, maintaining adequate distance of at least 3 feet from other people, face touching with hands must be avoided to minimise the spread of the viral infection as well as another pathogen [79-80]. During coughing and sneezing conditions, people were instructed to cover their mouths using nose mask, as well as washing their hands with soap or liquid soap after the used napkin is properly disposed [81-83].

More so, in trying to communicate with other people, having direct communication without nose mask must not be allowed [84]. Care givers must guide children rationally to wear their mask in certain condition like before eating, before and after playing, sneezing, etc. Figure 5 showed the conceptual framework adopted for the prevention and control of COVID-19.

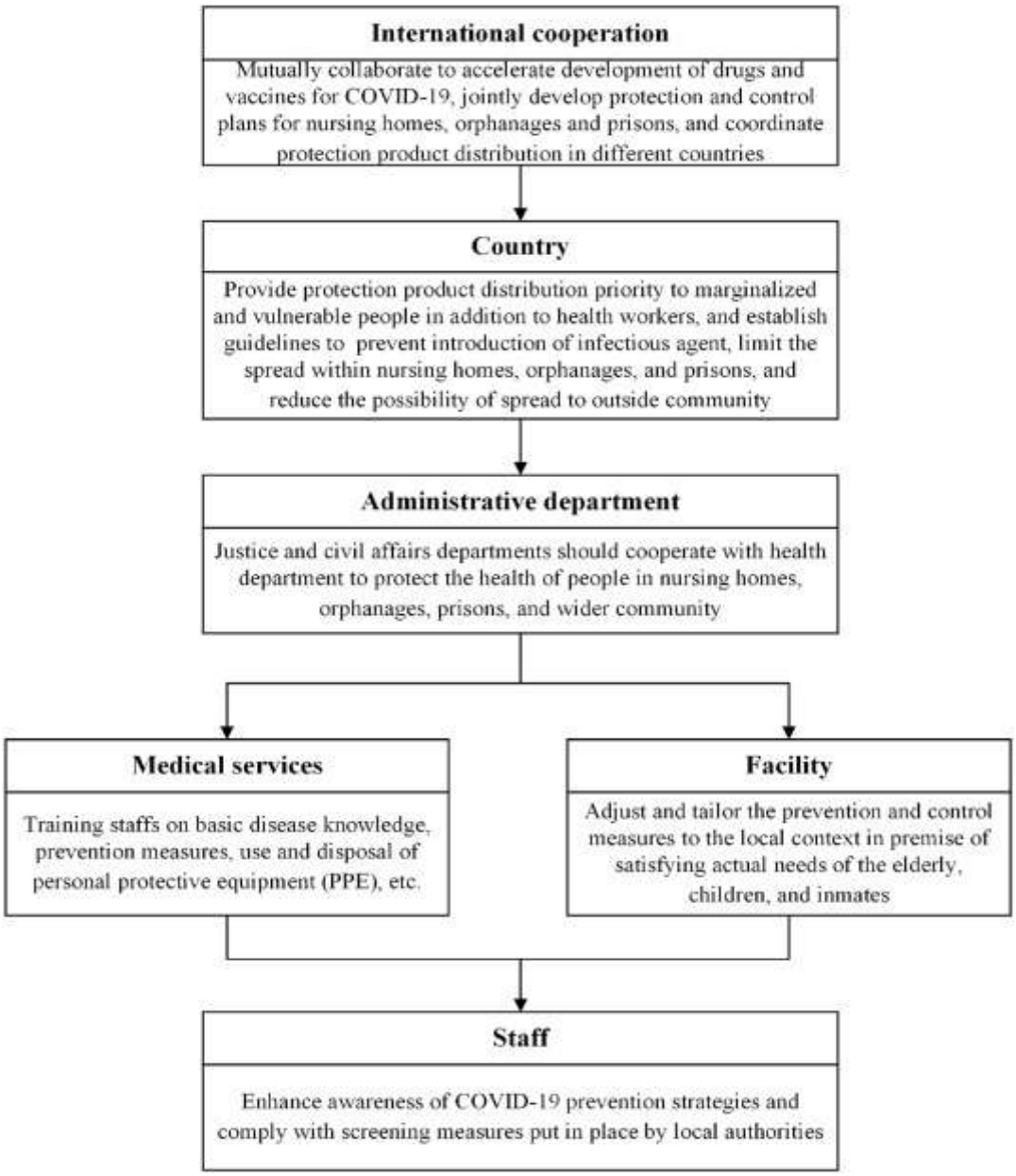

Figure 5: Conceptual framework for COVID-19 control and prevention

There must be inter and intra-national collaboration and cooperation with each country establishing a nationwide prevention and control strategies as well as setting up health departments, provide technical support for nursing homes, prisons and orphanages [87]. In addition to this, the facilities must have enough management oversight of practice which was proposed previously on a daily basis as well as arrangement on ground to ensure that there is adequate inspection of the well-being of the children, elders and inmates [88].

People in nursing homes like the elderly, children, in orphanages and inmates in prisons are usually subjected to marginalization as well as other groups in the society that are vulnerable. Also, they live in congregated environment and relatively small spaces as a result of specific management which indirectly increases the risk of exposure to COVID-19. Thus, it is important to adhere strictly to the routine cleaning and measures for disinfection which is already established and made public for health protection knowledge for the purpose of improving the awareness [86]. Hence, one of the best approaches for preventing illness is to avoid being exposed to the pathogens that requires all to work together as well as complying with the rules as observed in Figure 5.

Also, everyone must stay informed and vigilant and have updated information from the department of health or other channels always [89]. Also, the social activities and interaction must be reduced drastically during the outbreak as well as people within these facilities becoming isolated socially that resulted to psychological effect. Thus, close attention should be paid to the mental health, for the isolated people while improving the health monitoring of people in these facilities so as to improve the national scale. More recommendation was done to gain access to nursing homes, orphanages and prisons

3. CONCLUSION

In conclusion, the study established that smart sanitation as well as hygiene system monitoring in orphanage homes will provide a strategy for the prevention of viral infections. Leveraging on this technology to monitor the sanitation practices as well as hygiene behaviours, water quality will make these systems to help in identifying and tracking potential problems in a proactive manner. The recognition of housekeeping activities as a key contributor to patient safety has significantly increased. Although international guidelines such as the WHO's 2019 *Implementation Manual for the Prevention and Control of Carbapenem-Resistant Organisms* and the 2021 *Aide-Memoire on Environmental Cleaning* provide clear standards, wide disparities still exist in how healthcare facilities and regions monitor cleaning practices. These inconsistencies hinder the ability to reliably assess cleaning quality and compare outcomes across various healthcare systems. Thus, helping to reduce the risk of viral outbreaks so as to promote the wellbeing of the children in orphanage homes. Overall, this systematic review presented potential and effective interventions for reducing infections in orphanage homes

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