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Handwashing practices among urban households during the COVID-19 in Ghana

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ABSTRACT

Access to handwashing facilities on the one hand and their effective use on the other are critical in the fight against the spread of water, sanitation, and hygiene-related diseases, including COVID-19. However, access to and effective use of handwashing facilities prior to the COVID-19 was not prioritised in Ghana. Using an online survey of 4,257 urban households, this study examined access to handwashing facilities, the motivation to acquire such facilities, and their effective utilisation following the introduction of the government of Ghana's free water delivery as part of measures to combat the pandemic. We employed descriptive statistics, Chi-square, and Pearson correlation to analyse the data. Our findings reveal a significant increase in the construction of handwashing facilities and handwashing frequencies among households, driven by heightened awareness and fear of the COVID-19 infection. About 83.2 percent of households had handwashing facilities. Despite improvement in handwashing practices among 89.13 percent of households with handwashing facilities, disparities persist as 16.8 percent of the households lacked handwashing facilities. The risk of infections among these vulnerable households could impede efforts to maintain hygiene standards during the period due to the communicability of the disease. In terms of post-COVID-19 sustainability of handwashing facilities and practices, female respondents were more likely to sustain them than male respondents. The pandemic underscored hand hygiene's critical importance in spreading infectious diseases and promoting public health. Within the water, sanitation, and hygiene arena, the COVID-19 pandemic leaves a legacy of providing an opportunity and motivating households to promote hand hygiene globally.

1. Introduction

Globally, many preventable diseases are attributed to unhygienic practices (Pandey et al., 2020). Specifically, human hands are central pathways of transmitting microorganisms (Edmonds-Wilson et al., 2015). Dirty hands can be a vector for several gastrointestinal infections such as diarrhoea (Ejemot-Nwadiaro et al., 2021; Grant & Hofmann, 2011) and respiratory infections such as influenza and coronavirus disease 2019 (COVID-19) (Jefferson et al., 2020). Before the COVID-19 pandemic, washing hands as a preventive measure against sanitation-related diseases was not a daily practice in Africa (Amegah, 2020). Water, Sanitation, and Hygiene (WASH) interventions such as handwashing are an effective ancient strategy used to prevent the transmission of diseases and infectious outbreaks (Yates et al., 2017). Handwashing with soap, according to the Centre for Disease Control (CDC, 2020), is a primary preventive measure people can practice independently. The significance of handwashing as an effective approach to stopping the spread of prevalent diseases such as COVID-19 has been emphasised globally (Alzyood et al., 2020; Brauer et al., 2020; Jefferson et al., 2020; WHO, 2020). Although WASH interventions during disease outbreaks provide rapid relief to minimise spread (Sphere Project, 2011; Yates et al., 2017; WHO, 2020), handwashing facilities required to facilitate successful implementation remain a challenge.

According to the WHO/UNICEF (2019), about 3 billion people lack basic handwashing facilities at home; 1.6 billion people have limited facilities without soap or water; and 1.4

billion people have no handwashing facility at all with water. About 28 percent of people in less-developed countries have access to handwashing facilities with water and soap (United Nations, 2020). The WHO/UNICEF (2019) found that 42 percent of Ghanaians have limited access to handwashing facilities, and 17 percent of the respondents do not have access at all. Despite the low access to handwashing facilities, the WHO emphasised that handwashing is extremely significant in preventing the spread of the COVID-19 pandemic (WHO, 2020). The statistics on access to handwashing facilities raise critical questions for the COVID-19 pandemic prevention measures in developing countries (Brauer et al., 2020). Individuals are required to wash hands with soap under clean running water for at least 20 seconds (WHO/UNICEF, 2020). Given the low access to handwashing facilities in Ghana and the need to practice handwashing during the COVID-19 pandemic, examining the state of handwashing facilities and practices among households provides insights into managing hygiene-related diseases, including the COVID-19 pandemic.

Effective handwashing requires a regular and reliable supply of water (WHO/UNICEF, 2019). Paradoxically, it is posited that poor and vulnerable people, *especially in urban areas*, are more likely to be disproportionately affected by disease outbreaks due to a lack of access to water, sanitation, and hygiene (WASH) (Cooper, 2020, emphasis added). As such, several governments, including the Government of Ghana, announced the absorption of user water bills for the COVID-19 pandemic period and the provision of water through water tanker services at a cost of GH¢280m (US$48.42m) (Fielmua & Mengba, 2022). The provision of government-free water was to reinforce handwashing practices among households in Ghana during the pandemic. Handwashing is considered a behavioural phenomenon, *and behaviour is influenced by several factors such as the capability of the individual and motivation* (Fielmua et al., 2021; Zheng et al., 2022, emphasis added). This study examined access to handwashing facilities, the motivation to acquire such facilities, and effective utilisation of the facilities following the introduction of the government of Ghana's free water delivery as part of measures to combat the pandemic. Aside from fighting the COVID-19 pandemic, access to sustainable handwashing facilities contributes to Sustainable Development Goal 6 (ensuring availability and sustainable management of water and sanitation for all) (Brauer et al., 2020). A study on the duration and symptomatology of the COVID-19 in patients over a 2-year follow-up period in the United States showed that 23.1 percent of patients still experienced one symptom, and women were more likely to have persistent symptoms at two years as compared to men (Millet et al., 2022). This underscores the relevance of the study beyond the immediate context of the COVID-19 pandemic.

2. Conceptualising handwashing and personal hygiene

Understanding the concept of handwashing is central to establishing an appropriate theoretical framework for this study. Handwashing is a procedure that involves thorough cleansing with water and soap to keep the hands free of disease-causing microorganisms such as bacteria, viruses, and fungi (Damilare, 2020). Effective handwashing requires facilities/stations with their accessories to achieve proper hand hygiene. Effectiveness in this context means the facility serving the purpose or objective for which it was set up. Hulland et al. (2013) defined a handwashing station and facility as a dedicated, convenient location with soap and water available for handwashing. The handwashing facility as a device can either be fixed or mobile and includes a sink with tap water, a bucket with taps, tippy taps, and jugs or basins, and it is designated for handwashing (WHO/UNICEF, 2020). Besides soap, ash is also used as a handwashing agent in some poor households since it has proven to be microbiologically effective in removing organisms from hands (Nizame et al., 2015). Though literature supports the use of ash and alcohol-based hand sanitisers (ABHS) to achieve hand hygiene in the absence of soap and water, opinions are polarised on the effectiveness of ash and AHBS over traditional handwashing with soap and water (Damilare, 2020). For instance, despite the efficacy of ash and ABHS in fighting bacterial and viral disease transmission (Nizame et al., 2015; WHO, 2020), Singh et al. (2020) contested their efficacies, pointing out the compositions/constituents of AHBS (between 60 and90 percent isopropanol or ethanol) and the level of alkaline contained in ash as having challenges. The emergence of the COVID-19 pandemic resulted in the reinvention of *appropriate* handwashing facilities and stations with different designs and technologies considering several factors (Oppong et al., 2021; CWSA/UNICEF, 2021; Hulland et al., 2013). This is because studies have established that the design of the facility and associated accessories influence the acceptability of handwashing facilities.

Empirically, handwashing with soap and water has also been found to provide equitable and lasting protection in future epidemics and nonepidemic transmission of diarrhoeal diseases (Wolf et al., 2018) and lower respiratory infections if sufficiently maintained (Mbakaya et al., 2020). For instance, about 35 percent and 9.7 percent of global diarrhoeal disease and lower respiratory infection, respectively, were attributed to inadequate handwashing (Brauer et al., 2020). Studies have therefore shown that effective/proper handwashing interrupts the transmission of pathogens and microorganisms and can reduce the risk of: diarrhoea-related illness by 30 percent (Ejemot-Nwadiaro et al., 2021); respiratory infections by 45-55 percent (Jefferson et al., 2020); and typhoid infections by 62 percent (Alba et al., 2016). A systematic review by Saunders-Hastings et al.

(2017) on the effectiveness of personal protection measures in preventing H1N1 pandemic influenza transmission in human populations found a 38 percent reduction in transmission through proper handwashing, while wearing a nose mask was found less effective.

Despite the significance of handwashing in the fight against WASH-related diseases, studies have also revealed that handwashing in its simplest form is not a panacea to combating the related diseases. For instance, Torner et al., (2015) and Mangklakeree et al. (2014) found no statistical correlation in the prevention of diseases being attributable to the frequency of handwashing. Fielmua et al. (2021) also contend that people could practice handwashing regularly; however, due to the high cost of tissue, hand hygiene may not be guaranteed because they observed that most people, after washing hands, dry their hands with used clothes, vehicle dusters, or even on their bodies. It has been established that poor compliance with hand hygiene is due to the complexity of hand hygiene behaviour emanating from multiple determinants such as skills, infrastructure, motivation, and knowledge (Zheng et al., 2022). This calls for critical reflection of theoretical lenses to understand handwashing among households during the peak of the COVID-19 pandemic, where handwashing was touted as a critical pandemic management strategy.

3. The theoretical framework for studying hand hygiene

WASH behaviours have been examined by several scholars using multiple behaviour change models and frameworks. The paper draws on the Capability-Opportunity-Motivation and Behaviour (COM-B) framework by Michie et al. (2011) to provide an intuitive and flexible approach to understanding behaviours in a different context and identify what needs to change for a behaviour change intervention to be effective. The framework provides the basis for developing behaviour change interventions that recognises the importance of all relevant factors influencing behaviour (West & Michie, 2020). The COM-B model posits behaviour as an outcome of an interaction between three components: capability, opportunity, and motivation. Our study is centred on handwashing practices during the COVID-19 pandemic. As such, we define *capability* as an individual's psychological and physical ability to engage in a behavioural action (handwashing); *opportunity* as external factors including physical (time, location, and resources) and social opportunity (cultural norms and social cues) required to implement handwashing. *Motivation* consists of the internal processes that influence an individual's decision-making and behaviour (Michie et al., 2011). The model suggests that a particular behaviour will occur only when the person involved has the capability (e.g., handwashing skills, knowledge, and self-efficacy) and opportunity (e.g., soap, water, and handwashing facilities) to engage in it and is more motivated (e.g., beliefs, habits, intuition, goals, optimism, and emotions) to enact that behaviour than other behaviours at any given time. They found that people are motivated to wash their hands because of public education on the positive link between handwashing and good health (Okello et al., 2019).

A key requirement of the COM-B model is that one or more of the components of the model must be changed to facilitate effective and long-standing behaviour change. Capability and opportunity are considered to have an influencing relationship with motivation and behaviour. This means that by changing capability and opportunity, we can influence a person's motivation to enact a particular behaviour and encourage behaviour change. For instance, motivation for handwashing comprised an increased understanding of the link between handwashing and good health that encourages positive feelings about handwashing (Okello et. al., 2019). The more people are capable or believe to be capable of enacting a behaviour and the more conducive the environment is to enact it, the more they tend to want to do it. Conversely, people are less motivated to enact a behaviour when they perceive such behaviour to be difficult. For instance, in Tanzania, it was established that inconsistent availability of soap and water was seen as barriers to handwashing (Okello et al., 2019).

4. Description of research study area

We conducted the study in Ghana, using urban households in all 16 administrative regions. Ghana is a West African country located on the coast of the Gulf of Guinea with approximately 30.83 million people. About 56.7 percent constitute the urban population, with 43.3 percent representing rural population (Ghana Statistical Service, 2021). In Ghana, two main bodies, Ghana Water Company Limited (GWCL) and Community Water and Sanitation Agency (CWSA), are mandated to provide potable water to urban and rural/small towns, respectively. Water infrastructure provision varies significantly between urban and rural areas, with more pipe water connections in urban areas and boreholes in rural areas. The type of water infrastructure and the ability to afford water services can influence the construction of handwashing facilities and the motivation to perform regular hand hygiene. For example, households with pipe water within the premises are more likely to perform hand hygiene during a pandemic than people who rely on boreholes and surface water sources.

Ghana recorded the first case of COVID-19 on 12 March 2020, and as of May 31, 2020, the cases increased dramatically to 8,297, comprising 5,273 active cases, 38 deaths, and 2,986 recoveries. By 17 January 2023, Ghana had 171,088 cases with 1,462 deaths (WHO, 2023). Two densely populated geographical regions, Greater Accra (the

national capital) and Ashanti Region, were initially affected, followed by the other regions.

5. Methodology

The data for this paper was part of a broader online data collection on water consumption and hygiene behaviour among urban households during the government of Ghana's COVID-19 free water delivery. The focus of the study was on the free water period, and, as such, a cross-sectional design was used. A cross-sectional design is more suitable when dealing with short-term timescales and studying a phenomenon at a particular period (Gray, 2019). The variables that were measured in line with the COM-B framework are the availability of handwashing facilities; effectiveness of the handwashing facility; alternative handwashing facilities at homes; contribution of the COVID-19 towards improved personal hygiene; and perception of sustainability of handwashing facilities in the Post-COVID-19. This design also examines the association between variables (Bryman, 2012; Gray, 2019), and we consequently established a relationship between gender and sustainability of handwashing facilities, improved personal hygiene, and the availability of handwashing facilities.

A total of 4,257 urban households in all of Ghana's 16 regions voluntarily participated in the survey by answering an online semi-structured questionnaire. The survey was designed with Google Forms and distributed through internet channels, including emails and WhatsApp groups. WhatsApp is an encrypted smartphone application that allows users to send and receive text, audio, and images and conduct individual or group conversations. WhatsApp has evolved into a communication and data collection tool in recent years (Kauta et al., 2020). The data was collected during the peak of the COVID-19 in Ghana, and we used online questionnaire administration as a strategy to adhere to protocol, particularly in avoiding physical contact with respondents. In terms of access to the questionnaire, an open survey was used; the questionnaire was accessible to anyone who opened the link (Eysenbach, 2004). The respondents were, however, admonished not to participate more than once in the survey, and this was to minimise survey fraud. Studies on handwashing require observation as a method (Gould et al., 2017). However, in this study, observation was not done because of the need to practically observe the COVID-19 protocol. Our inability to practically observe is a limitation of the study.

Although telephone interviews could generate the required data, we opted to use WhatsApp because respondents could respond to the questionnaire at their convenience. Also, WhatsApp and emails were appropriate over telephones because of the cost and convenience involved in conducting interviews via telephones. We, however, provided telephone numbers such that respondents could contact us for clarification as and when necessary. The front title of the questionnaire contained the focus of the study, inclusion criteria (persons above 18 years and knowledgeable of household WASH issues, persons who used piped water or tanker services), and instructions (Do not answer the questionnaire more than once).

The survey was conducted during the government of Ghana's free water delivery (April 1, 2020, to December 31, 2020). Before the survey, the questionnaire was pre-tested using 20 respondents via WhatsApp. The analysis of the pre-test led to the modification of the instrument for the main survey. The survey lasted for four months (from 1 June to 30 September 2020). Our monitoring of the online responses (database) showed that between 20 September and 30 September 2020, only 15 households responded, indicating that few additions were made to the data and it was appropriate to end the survey. We downloaded the data on 30 September 2020 for analysis when a total of 4,257 households had responded. The data obtained using Google Forms were transmitted to SPSS software version 21 for analysis. When the data were transmitted to SPSS, it was manually checked, and only completed questionnaires were included in the analysis. Again, given the participants of the survey (adults) and the fact that data were cleaned (checking for consistency in the responses), we were able to minimise survey fraud (Gray, 2019) and thus ensured the reliability and validity of the data. The data were analysed using descriptive statistics, chi-square, and Pearson correlation

6. Results

6.1 Participants

A total of 4,257 respondents, comprising 78 percent of men and 22 percent of women participated in the study. The average number of respondents in 16 regions of Ghana was 266.06 with a minimum of 105 and a maximum of 705 respondents. The average household size in the study was 4.72 with a 3.102 standard deviation. The distribution of the respondents in all the 16 administrative regions is shown in Figure 1.

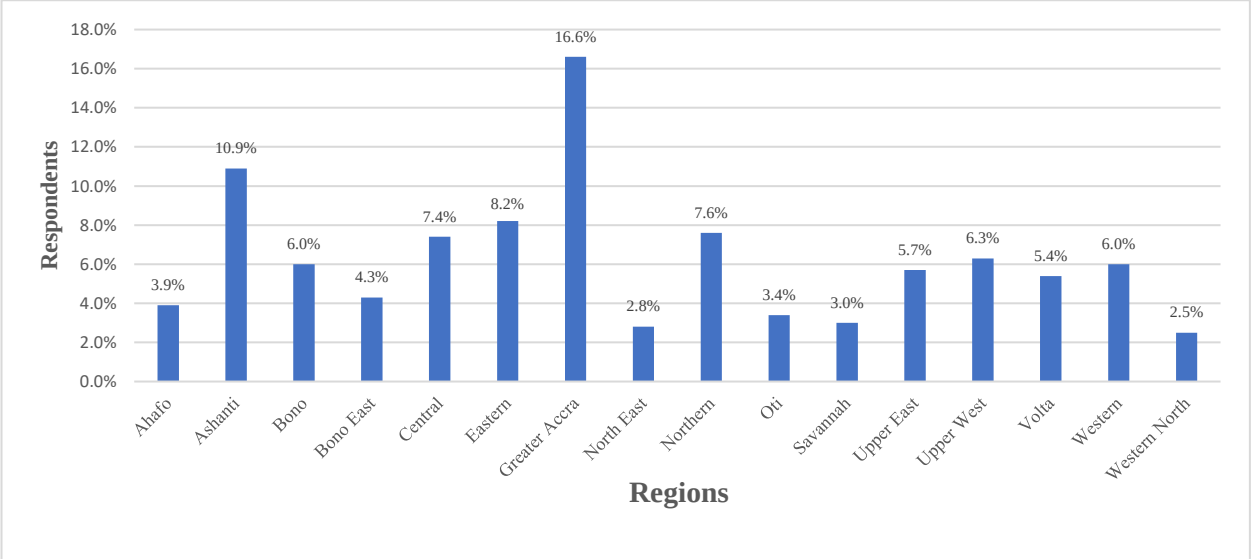

Figure 1: Distribution of Respondents in the Regions

As shown in Figure 1, 16.6 percent of the respondents were from the Greater Accra Region, and this was followed by the Ashanti Region. These were also the regions that were the first to be affected by the COVID-19. Western North Region recorded the least number of respondents (2.5 percent) (Figure 1).

6.2 Availability of handwashing facilities

Access to water is vital in performing handwashing. About 86.9 percent of the respondents indicated having regular water supply services (continuous supply for 24 hours/week for a month) during the COVID-19 pandemic. The respondents were asked to indicate whether they had a facility at home designated for handwashing or not. Of the 4,257 respondents that participated in the study, 83.2 percent had handwashing facilities, whereas 16.8 percent did not have any type of handwashing facility. A bivariant analysis of gender and availability of handwashing facilities shows that 84.17 percent of female household respondents had handwashing facilities, while 15.83 percent did not. Amongst the male respondents, 82.96 percent had handwashing facilities, whereas 17.04 percent did not have them. Despite the slight gender difference in access to handwashing facilities, the Chi square test suggests that gender is not significantly associated with the availability of handwashing facilities at a significance level of $p= 0.382 > \alpha= 0.05$. This means that the availability of handwashing facilities was not dependent on the gender of a respondent.

6.3 Effectiveness of the handwashing facilities

It is not enough to have handwashing facilities–its effectiveness is critical in achieving the intended outcome of establishing the facility. As such, we sought the views of respondents on the effectiveness of the available facilities. That is, whether the handwashing facilities are actually used for the intended purpose (to facilitate handwashing practices). The results show that handwashing facilities were effectively used by household members during the COVID-19 pandemic, according to 89.13 percent of the respondents, while the effective use of the facilities remained a challenge among 7.79 percent of the respondents. Although a small percentage of the respondents indicated that the household members did not effectively utilise the facilities, there was still the risk of infections since the COVID-19 disease is communicable. About 3.08 percent of the respondents were indifferent and could not indicate the effective use of the handwashing facilities by household members. Different types of handwashing facilities were used by households to perform handwashing during the COVID-19 period. Table 1 shows the effectiveness of the handwashing facilities.

Table 1: Effective use of handwashing facilities

Type of Facility used for handwashing	Proportion of respondents		Effectiveness in the use of handwashing facilities							
			Effectively use		Not effectively use		Don't Know		Total	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Handwash basin only	1,328	37.5	1,166	87.80	115	8.66	47	3.54	1,328	100
Tippy taps only	1,074	30.3	986	91.80	78	7.26	10	0.93	1,074	100
Tippy tap and handwash basin	5	2.1	40	53.4	25	33.3	10	13.3	75	100
Veronica bucket only	33	26.3	67	92.92	58	6.22	8	0.86	933	100
Veronica bucket & handwash basin	33	3.8	9	74.44	0	0.00	34	25.56	133	100
Total	3,543	100	3,158	89.13	276	7.79	109	3.08	3,543	100

In particular, 92.92 percent of the respondents who use Veronica buckets indicated that it was effectively used by household members for handwashing practices. This was followed by tippy taps (91.80 percent) and handwash basins (87.80 percent). Although some households had multiple handwashing facilities, their effective use remained low compared to households with single handwashing facilities. Ineffective use of handwashing facilities was higher (33.3 percent) among households that use both tippy taps and handwash basins (Table 1). Handwashing facilities were largely mounted at the entrance of households. In the case of households with multiple handwashing facilities, one facility is situated at the entrance or outside of the house, with the second facility mounted inside or within the compound of the house. The majority of respondents used tippy taps and veronica buckets because they were easy to construct, simple to use, and, more importantly, cost-efficient, which makes them affordable to many households.

6.4 Adaptation to handwashing in the absence of facilities

The results show that 714 (16.77 percent) out of the 4,257 people interviewed did not have handwashing facilities at home but used different alternative facilities to help combat the spread of the COVID-19 virus. The alternative handwashing facilities are shown in Table 2.

Table 2: Main Alternative Handwashing Facilities

Alternative Facilities	**Frequency**	**Percent**
Ablution cans (buta)	79	11.06
Fetch water with cup and wash with soap	124	17.37
Alcohol hand-based sanitizer (AHBS)	208	29.13
Nothing (do not wash)	8	1.12
Standpipe within yard	250	35.01
Polytank	17	2.38
Wash in a blow with soap	28	3.92
Total	**714**	**100.00**

Out of the 714 respondents, about 29.13 percent of them used alcohol-based hand sanitisers (ABHS), 11.06 percent used ablution cans (buta), and 1.12 percent did not use any form of facility to perform hand hygiene. For households that use standpipes within yards, the standpipes are connected to water distribution networks and are strategically erected within households to provide water for domestic use. Poly tanks are also water reservoirs situated within a household and used to store water with a basement tap for drawing water for domestic use. Although standpipes and poly tanks primarily provide water for domestic use, they served multiple purposes at the time of the pandemic. Households used it for handwashing in the absence of handwashing facilities. Ablution cans (buta) are used by Muslims to perform ablution before prayers but were used to perform handwashing in the absence of handwashing facilities.

6.5 Influence of the COVID-19 emergence on improved personal hygiene

The research participants were asked to indicate whether the COVID-19 pandemic has influenced the behaviour and practice towards personnel hygiene. We found that the motive of 85.7 percent of the respondents to enact handwashing facilities was influenced by the pandemic, and 14.3 percent of the respondents did not enact handwashing facilities because of the pandemic. Respondents whose attitudes towards handwashing remained the same and were not influenced by the pandemic comprised people who prior to the pandemic observed personal hygiene and practiced handwashing. The study found no significant relationship between gender and attitude towards handwashing during COVID-19 at $p= 0.781>\alpha= 0.05$, although the pandemic has reinforced handwashing, which was being championed by the WASH sector players.

6.6 Perception of the sustainability of handwashing services in the post-COVID-19

The preceding sections showed that some households constructed or established handwashing facilities because of the pandemic. As such, the study also sought the views of respondents on their willingness and ability to sustain handwashing services in the post-COVID-19 pandemic. The majority of females (90.48 percent) indicated that handwashing would be sustained after the pandemic, while 8.24 percent of them were not sure if they would sustain handwashing practices and services after the pandemic. Whereas 81.28 percent of males would continue to practice handwashing, 1.28 percent and 2.98 percent of females and males, respectively, could not tell whether they could sustain handwashing practices in the post-COVID-19 pandemic. About 15.74 percent were categorical that handwashing practice would be discontinued after the pandemic. The Chi-square test of independence conducted showed a statistically significant relationship between gender and sustainability of handwashing practices in post-COVID-19 at $P= 0.000 < a= 0.05$. That is, female respondents are more likely to sustain the handwashing facilities and practices than male respondents.

7. Discussions

The overarching aim of the study was to examine handwashing practices during the COVID-19 pandemic in urban households in Ghana. Methodologically, this study did not observe handwashing practices due to the approach to data collection (online) and the need to observe the COVID-19 prevention protocols. Nonetheless, we supported and relied on the assumption of Kisaakye et al. (2021) that households with handwashing facilities are more likely to practice handwashing behaviours.

The study recorded a 4.72 average household size, which is higher than the 3.6 national figure recorded in the 2021 population and housing census (Ghana Statistical Service, 2021). We considered household size because of its relationship with handwashing. In a study in Indonesia, Hirai et al. (2016) found a high (59.6 percent) prevalence of handwashing with soap in larger households (4-6 people) than in small household sizes (1-3 people), which had a prevalence rate of 51.9 percent. Pradhan and Mondal (2021) found higher use of soap and water for handwashing in larger households in India, as such households are deemed to have old and experienced people with better knowledge of the associated benefits of handwashing. Our study revealed that larger households' sizes mounted more than one handwashing facility for the purposes of handwashing than small households. The several handwashing facilities mounted by larger households in our study are within the opportunity and motivation dimension of the COM-B framework.

The handwash basin was the dominant facility used by the households. Two main factors contributed to its dominance: uninterrupted piped water supply to households during the government of Ghana's free water delivery (Fielmua & Mengba, 2022) and the urban focus of the study, whereby handwash basins are a common facility in many households. Our findings on the availability of handwashing facilities in households are similar to those of UNICEF/WHO (2019). About 16.8 percent of respondents in our study did not have any type of handwashing facility, which confirms the WHO/UNICEF JMP (2019) report that 17 percent of Ghanaians have no access to handwashing facilities, while 42 percent have limited access. Handwashing. These households used alcohol-based hand sanitisers, ablution cans (buta), domestic standpipes, and poly tanks for handwashing. While 16.8 percent of respondents did not have the opportunity (handwashing stations or facilities) to enact handwashing, their knowledge of hands being a pathway to transmitting infectious diseases motivated the use of alternative handwashing facilities.

The majority of female respondents (84.17 percent) in the study mounted handwashing facilities than male respondents (82.96 percent) to perform handwashing. Similar to our findings, Suen et al. (2019) revealed that female-headed households are more likely to engage in effective handwashing than men due to females' high knowledge of hand hygiene. In several jurisdictions, gender has played a role in hand hygiene over the years. Female respondents have often been found to be more conscious of hand hygiene as compared to their male counterparts (Wise et al., 2020; Zickfield et al., 2020; Dwipayanti et al., 2021). Our findings have been consistent with previous studies because we established that, unlike the male respondents, a higher proportion of female respondents effectively practiced handwashing before the COVID-19 pandemic and are committed to sustaining the practice after the pandemic.

An earlier publication from this study, which focused on urban households' perspective on the government of Ghana's free water supply, showed a substantial improvement in water flow during the period (see Fielmua & Mengba, 2022). This means that effective handwashing by households was facilitated and possibly by the reliability of water flow. Studies suggested that the socioeconomic status of a household is an important predictor of handwashing: affluent households were more likely to engage in handwashing, especially with soap, than poorer households (Fielmua et al., 2019; Pradhan & Mondal, 2021). The test between uninterrupted water supply services and frequent handwashing shows a correlation coefficient of r = 0.117, with P > 0.01 and N = 4,257. This coefficient, (r) = 0.117, indicates a weak but positive relationship, suggesting that any improved water supply could slightly encourage more frequent handwashing. Despite the weak relationship, it is statistically significant at P > 0.01, indicating a low probability that the observed correlation occurred by chance. This reaffirms the three dimensions of the COM-B framework and findings in four countries in East Africa (Kenya, Rwanda, Tanzania, and Uganda), where it was established that during the COVID-19 pandemic, households with a regular water supply were more likely to have handwashing facilities than those who had an irregular supply (Kisaakye et al., 2021).

Hand hygiene is important not only during the COVID-19 pandemic but on a daily basis because it is a key requirement in preventing communicable diseases (Dwipayanti et al., 2021). Despite the significance of handwashing, intriguingly, even in the wage of the COVID-19 pandemic, hand hygiene is not universal (Kisaakye et al., 2021). It is not all households that recognised the importance of handwashing practices despite the WHO campaign on handwashing as a low-cost strategy in the fight against the pandemic. Nonetheless, handwashing, which was rarely practiced in Africa, has increased with the outbreak of the COVID-19 disease (Amegah, 2020). Our findings showed that the number of households with handwashing facilities has increased as a result of the pandemic. Although we did not specifically measure the frequency of handwashing practices, the construction of the facilities suggests that handwashing has increased, especially since 89.13 percent of the respondents indicated that the facilities were effectively used.

The WHO (2020) has demonstrated how access to water influences hand hygiene practices. This and other empirical studies on the relationship between access to reliable water and hand hygiene pushed many governments to institute free water delivery as part of measures to curb the COVID-19 pandemic. In that regard, the government of Ghana's free water delivery was a motivational factor for households to construct handwashing facilities and increase handwashing practices. However, the free water policy did not include point sources (boreholes with hand pumps) and rural communities. As such, the physical opportunity did not exist for rural households to increase handwashing behaviour relative to their urban counterparts. The presence of adequate water and soap are opportunity factors that influence handwashing behaviour. In the absence of soap, ash is used together with water in handwashing (Fielmua et al., 2019). Ash has shown to be effective for cleaning hands, especially when soap is scarce (Bloomfield & Nath, 2009), but its effectiveness against SARS-CoV-2 needs to be established (Freeman & Caruso, 2020). Though ash has been acknowledged to be microbiologically effective in handwashing (Nizame et al., 2015), no household in our study used ash to perform handwashing.

The emergence of the COVID-19 pandemic reignited handwashing practices amongst urban households in Ghana and influenced people's attitudes toward personal hygiene. The pandemic has increased the practice of handwashing (Dwipayanti et al., 2021), but sustaining the practice in the post-COVID-19 period is critical in sustaining the gains made in handwashing during the pandemic. While 95.4 percent of respondents in Indonesia reported their intention to maintain their current handwashing frequencies when the COVID-19 pandemic ends (Dwipayanti et al., 2021), 85.9 percent in Ghana were likely to sustain handwashing in the post-COVID-19. The likelihood of women sustaining handwashing practices more than men is because of women's significant and better understanding of hygiene practices compared to men (Suen et al., 2019). The intention of some households to discontinue handwashing practices as regular exercise after the COVID-19 pandemic will have consequences for fighting the existing WASH-related diseases, such as cholera and typhoid. The sustainability of personal hygiene practices in post-COVID-19 in this study thus provides a clue for the management of future pandemics and diseases in general. This will require a rigorous campaign on hand hygiene as a low-cost strategy to fight contagious diseases.

8. Limitations

Direct observation as a measurement of handwashing behaviour was not carried out in this study. To observe the WHO protocols of social distancing, the study adopted the online approach to data collection, which remains a key limitation of the study. Thus, the act of handwashing, resources for handwashing (soap and water), type of facilities used, and how such facilities were used in the process of handwashing were not observed. Whilst direct observation has the tendency of influencing respondents' handwashing behaviour, this potential bias was eliminated in this study as observation was not carried out. Urban households that do

not have internet and people in rural areas without access to smartphones and internet services (Siaw et al., 2020) did not have the opportunity to participate in the survey due to the online administration of the questionnaire. Finally, participants identify themselves as urban residents without the possibility of the authors to confirm so, as the data was collected online.

9. Conclusion

This paper examined handwashing practices, households' access to handwashing facilities, and the motivations for acquiring the facilities. The practice of personal hygiene, especially hand hygiene, was reignited at the height of COVID-19. This could serve as a point of reference for health practitioners and hygiene promoters to devise strategies to ensure the continuous practice of handwashing and hygiene practices even in the post-COVID-19 period pandemic. People's ability to practice and maintain good personal hygiene and proper handwashing in the post-COVID-19 lies heavily on WASH interventions such as uninterrupted water supply and the capacity to continually provide and maintain access to water, handwashing facilities, and soap. Therefore, integrating the COM-B framework in planning WASH interventions is key to achieving target 6.2.1 of Sustainable Development Goal Six.

The post-COVID-19 sustainability of handwashing is not guaranteed in all households because some households were unwilling to sustain the handwashing facilities after the pandemic. This implies that handwashing was largely influenced by COVID-19 and their knowledge of the dangers of the disease. As such, as the physical opportunity minimises, the behaviour of performing handwashing remains a challenge. Despite the possible return to the practice of not washing hands after the COVID-19 pandemic, the pandemic will, for the time being, remain the global pandemic that significantly contributed to improved handwashing behaviour in sub-Saharan Africa in general. This legacy of the pandemic will serve as a motivation to promote hand hygiene.

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