



# **Adherence to COVID-19 Mitigation Measures among Kilifi and Mombasa Residents - An Observational Study in Coastal Kenya**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Aim:** Corona Virus Disease-19 (COVID-19) pandemic led countries into engaging public health guidelines as a strategy towards preventing infections. Hand washing, social distancing and masking remains key measures for infection control and prevention of the COVID-19. Strict adherence to public health infection control and prevention protocols is necessary to contain the spread at the community stage of the virus. National and County governments in Kenya directed efforts and resources in implementing numerous infection control and prevention measures in public places and institutions. The study assessed adherence to water, sanitation and hygiene (WASH) guidelines among the residents of Kilifi and Mombasa County in combating COVID-19 infections.

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**Methodology:** A cross sectional study was conducted between 25th November and 4th December 2020 in ten sub-counties in Mombasa and Kilifi counties, Kenya. Data was collected using Open Data Kit (ODK) mobile application.

**Results:** Forty observations were done in Kilifi (45 percent) and Mombasa (55.0 percent). More than a third (37.5 percent) of the observations were done at the household level, followed by public buildings (30.0 percent), market/shopping centers (30.0 percent) and bus terminus (2.5 percent). More than half of the occupants in both Kilifi 55.6 percent and Mombasa 68.2 percent observed physical distancing of 1.5 meters, however, low screening of temperature at the entrance was noted. The general observation shows only 55.6 percent of the premises visited had a hand-washing station in Kilifi while 68.2 percent in Mombasa County. Most of the hand washing stations had running water and people did proper handwashing in both Counties. Only 30.0 percent of the hand station at Kilifi County had soaps.

**Conclusion:** COVID – 19 will continue to pose serious public health challenges as many premises still don't adhere to some of the guidelines. Multi-sectoral feasible approaches towards ensuring further adherence on all the public health guidelines should be given priority to control and prevent COVID-19 infection

*Keywords: COVID-19; observation; wash; hand washing; screening; social distancing and public health measures.*

## 1. INTRODUCTION

Globally, it is estimated that 844 million people have no access to basic sources of water while 2.3 billion people do not have access to a basic sanitation service. It is also estimated that 10percent of the global burden of disease results from unsafe water, poor sanitation or inadequate hygiene [1]. Sub-Saharan Africa (SSA) has among the lowest levels of access to both drinking water and sanitation globally. (Howard et al., 2020). SSA also has the lowest regional rate of coverage of improved sanitation, with an estimated 695 million people still using unimproved facilities [2].

The question of hand washing is particularly important in low-income countries where over half of the population do not have access to a handwashing station in their homes [3]. The lack of water and sanitation greatly compromises the hygiene efforts, which in turn affects the control and prevention of COVID-19. While the media attention has been on the impossibility of social distancing in crowded settlements and market places, much less attention has been paid to the hand washing. Over half of the Kenyan population (58.0 percent) have access to drinking water from improved sources with less than 30-minute round trip to fetch water [4]. These challenges are amplified in the informal settlements where water, sanitation and waste collection are rare or none existent [5].

During all infectious disease outbreaks including COVID-19, the provision of safe water, sanitation

and hygienic conditions is essential for protecting human health [6]. Consistent application of WASH and waste management practices in communities, homes, schools, marketplaces, and healthcare facilities helps in prevention of human-to-human transmission of, COVID-19 [7]. The following WASH related actions are particularly important for prevention and control of COVID-19 infections; Engaging in frequent hand hygiene using appropriate techniques, implementing regular environmental cleaning and disinfection practices and managing excreta safely are some of the recommended protocols [8].

In Kenya, the regional county governments are at the epicenter of this prevention and control strategies since the health docket was devolved. With only 58.0 percent of Kenyans having access to basic water services and only 30.0 percent having access to basic sanitation services [9] would be important to observe adherence to public health guidelines by premises occupant both in households and public places.

This paper contributes to the emerging literature on WASH and COVID-19 control and prevention by providing empirical work on WASH practices of the population in Mombasa and Kilifi counties of Kenya. Secondly, from a policy perspective, this study would enable the National and county governments of Kenya to implement mitigation strategies for the gaps identified to prevent and control the spread of COVID-19. Regarding COVID-19 information dissemination, the government may consider using multiple

channels in order to get vital information to various segments of the population.

### 1.1 Related Work

In countries without adequate access to improved water and sanitation, government-imposed restrictions and lockdowns during the COVID-19 pandemic impacts on toilet usage and hygiene practices. The study by [10] looks at the sanitation and hygiene practices among the Peri-Urban Communities in Tamil Nadu, India. The study findings show that among 2,044 respondents, 60percent had access to a private toilet, 11percent to a public or community toilet, whereas 29percent lacked access to any toilet facility. In countries with prevalent open defecation and a high reliance on shared toilets or for those without private toilets, the study recommends a careful messaging to sustain safe sanitation facilities during the COVID-19 pandemic. The study notes that control strategy in peri-urban India and in low-income urban communities should include enhanced sanitation facility management that includes adequate handwashing facilities and widespread messages to promote safe usage.

A similar study in Bangladesh by [11] focused on WASH and waste disposal practices as well as the factors which influence these practices found that gender, occupation, area of residence, and level of education of the participants mainly influence the WASH and waste disposal practices.

A similar study was also done in Ethiopia among residents of Gondar City, it was found that control measures reduced physical and non-physical contacts, reducing the R0 from around 2.6 to between 0.5 and 0.7, depending on the pre-COVID-19 comparison matrix used [8].

### 1.2 Rationale

The provision of safe water, sanitation and hygienic conditions is essential to protecting human health during all infectious disease outbreaks [6], including the COVID-19 outbreak. Ensuring good and consistently applied WASH and waste management practices in communities, homes, schools, marketplaces and health care facilities will further help to prevent human-to-human transmission of the COVID-19 virus [12]. Mombasa and Kilifi are two counties along the Kenyan coast. Both counties are a leading tourism destination in Kenya. Mombasa

is served with an international sea and air ports. The two counties have made tremendous effort in creating awareness and implementing numerous infection control and prevention measures in public place and institutions. Despite those efforts, several people are being reported to be getting infected and dying of the disease in the two coastal towns. Specifically, the populations of the two counties have openly opposed testing, isolation and quarantining of the infected [13]. The findings from this study will go a long way in informing policy makers and public health stakeholders on the situation regarding adherence to the guidelines in order to develop appropriate strategies of addressing and improving on the gaps on the same.

## 2. MATERIALS AND METHODS

### 3.1 Study Sites

The study was carried out in coastal Counties of Mombasa and Kilifi between 25th November and 4th December, 2020. Mombasa County is one of the six counties in the coast region that have reported the highest number of cases with a population of 1,208,303 persons [9]. The County is divided into six sub-counties, namely: Mvita, Jomvu, Changamwe, Kisauni, Nyali and Likoni. Kilifi County is also a coastal town of Kenya with a population at 1,453,787 [9]. The county has six sub-counties namely, Kilifi, Ganze, Malindi, Magarini, Rabai and Kaloleni. A total of forty observations were done with Kilifi having seventeen while Mombasa comprised of twenty-two observations distributed as one Bus terminus, fifteen Households, twelve Market/shopping Centre and twelve public buildings.

### 3.2 Study Design

This was a cross sectional study that used an observation checklist to assess key areas of WASH and evaluate the basic practices like social distancing, ventilation, thermal screening at the gate, proper wearing of mask and waste disposal at the premises. The premises occupants were asked on training COVID-19 prevention and if the premises were fumigated. The checklist was used to certain setting like homes, markets, buildings, offices and bus terminus/stages. Overall, a total of 40 observations were done with Kilifi having 45.0 percent and Mombasa 55.0 percent. The study covered a total of 10 sub-counties and 20 villages comprised of the sites. Observation sites

composes of Market place 30.0 percent, Households 37.5 percent, Public building 30.0 percent, Bus terminus 2.5 percent. In Kilifi County 7 market places, 7 households, 3 public building and one bus terminus were observed while in Mombasa 5 Market places, 8 households, and 12 public buildings. The markets, buildings and the bus terminus were representative given the high number of people that visit these places on a daily basis.

### 3.3 Data Management

Data was collected using validated WASH checklist and captured in an ODK kit and stored in Comma Separated Values (CSV) file formats. Data was exported to Epidata Version 3.1 (EpiData Association) and Statistical Package for Social Sciences (SPSS) version 25.0 for analysis. Summary/descriptive statistics was used to describe the data and generate summary tables for each level-factor. In addition, the population parameter estimates were determined as measures of central tendency and measures of dispersion. Frequencies were done in percentages and measures of central tendency, measures of association/ relationships among variables determined.

### 3.4 Defining Criteria

The criteria used was advised by the national and country governments market protocols and guidelines during Corona Virus pandemic released by the Ministry of Industrialization, Trade and Enterprise Development Kenya [14].

A clean environment was a building or a market place where regular collection of garbage was done and traders wares were put on raised stands.

Fumigation- According to the Ministry of Health, fumigation of the markets were to be done every day well before the traders set up their wares.

Proper ventilation was when both the exit and entry are controlled to avoid overcrowding. All windows and doors were to stay open for the entire period of the market time.

## 3. RESULTS AND DISCUSSION

The following section provides a summary of the findings. The non-participatory observation study comprised of general hygiene, hand hygiene stations, social distancing, screening, ventilation,

personal protective gear and waste disposal practices.

### 3.1 General Hygiene

The researchers observed for general cleanliness of the premises (free of dirt) and availability of water, soaps or disinfectant for handwashing at the entrance of homes, bus terminus, buildings or marketplaces. The occupants were asked whether they had fumigated the building/ area in the last one weeks and whether they had received any training/ messages on COVID-19 prevention.

It was observed that general cleanness in both Counties was relatively low. In Kilifi County 71.4 percent of market, 66.0 percent of public building and all households observed to be clean. Half of the households observed in Mombasa County were not clean but 77.8 percent of public building observed were clean. Majority of the premises occupants reported to have fumigated their buildings in the last one-week with all the markets places in both Counties fumigated. All the households visited had no form of disinfectants or bleach to disinfect the surface. Slightly more than half 57.1 percent markets occupants in Kilifi County and less than half 40.0 percent in Mombasa County reported to have been trained on COVID-19 prevention.

### 3.2 Hand Hygiene Stations

The observations at the hand washing stations included presence of running water, proper handwashing by user, and accessibility to the elderly and the disabled, availability of soaps and other detergent at hand washing station and the availability of alcohol-based hand sanitizers. The general observation shows only 55.6 percent of the premises visited had hand-washing station in Kilifi while 68.2 percent had in Mombasa County. Most of the hand washing station had running water and people do proper handwashing in both Counties. Less than half 30.0 percent of the hand station at Kilifi County and more than half at 66.7 percent of the handwashing station had soaps as shown in table 2.

### 3.3 Adherence to Public Health Guidelines in Prevention of COVID-19 Infection at the Premises

The researchers observed general adherence to public health guidelines in prevention of COVID-19 infection by the premises' occupants that

included social distancing by occupants, Screening of temperature at the gate, ventilation free air flow, wearing of masks and proper waste disposal. More than half of the occupants in both Counties Kilifi (55.6 percent) and Mombasa (68.2 percent) observed social distancing of 1.5 meters away from each other. There was limited thermal screening with less than 30.0 percent of public buildings or markets in both counties having of the building undertaking the screening.

In both counties, at home and in public places people were generally wearing masks, with 61.1 percent in Kilifi and 54.5 percent in Mombasa the researcher observed whether the people wore masks properly (covering mouth and nose). Some premises have no proper ventilation with free flow of air in Kilifi 44.4 percent and Mombasa 41.0 percent. There was poor waste disposal in Mombasa County at 54.5 percent compared to Kilifi County as shown in table 3.

**Table 1. General hygiene observation**

Variables	County	Observation area	Response (%)		
			Yes	No	
Cleanness	Kilifi	Market place	28.6	71.4	
		Households	0.0	100.0	
		Public building	33.3	66.7	
		Bus terminus	0.0	100.0	
	Mombasa	Market place	60.0	40.0	
		Households	50.0	50.0	
Fumigation	Kilifi	Public building	22.2	77.8	
		Market place	100.0	0.0	
		Households	71.4	28.6	
		Public building	66.7	33.3	
	Mombasa	Bus terminus	100.0	0.0	
		Market place	100.0	0.0	
		Households	100.0	0.0	
	Presence of disinfectants/bleach	Kilifi	Public building	33.3	66.7
			Market place	28.6	71.4
			Households	0.0	100.0
Mombasa		Public building	33.3	66.7	
		Bus terminus	0.0	100.0	
		Households	0.0	100.0	
	Mombasa	Market place	12.5	87.5	
		Households	0.0	100.0	
		Public building	11.1	88.9	

**Table 2. Observation of hand washing stations**

Variables	County	Response (%)	
		Yes	No
Presence of hand washing station	Kilifi	55.6	44.4
	Mombasa	68.2	31.8
Presence running water at hand washing station	Kilifi	80.0	20.0
	Mombasa	100.0	0.0
Proper handwashing at the station	Kilifi	60.0	40.0
	Mombasa	73.3	26.7
Hand washing station accessible to elderly and disabled	Kilifi	90.0	10.0
	Mombasa	93.3	6.7
Hand washing station with soaps and other detergents.	Kilifi	30.0	70.0
	Mombasa	66.7	33.3
Availability of alcohol-based sanitizer at the premises	Kilifi	72.2	27.8
	Mombasa	81.8	18.2

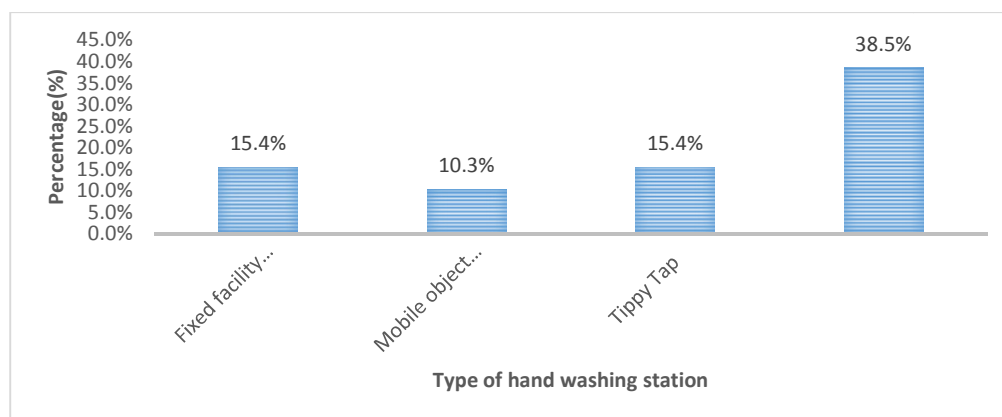


Fig. 1. Type of hand washing station

Table 3. Observation of hand washing stations

Variables	County	Response (%)	
		Yes	No
Social distancing	Kilifi	55.6	44.4
	Mombasa	68.2	1.8
Screening at the gate	Kilifi	22.2	77.8
	Mombasa	13.6	86.4
Ventilation	Kilifi	55.6	44.4
	Mombasa	59.0	41.0
Wearing of mask	Kilifi	61.1	38.9
	Mombasa	54.5	45.5
Proper waste disposal	Kilifi	61.1	38.9
	Mombasa	45.5	54.5

## 4. DISCUSSION

### 4.1 Uptake of General Hygiene in the Area of Observation

Good WASH and waste management practices, that are consistently applied, serve as barriers to human-to-human transmission of the COVID-19 virus in homes, communities, health care facilities, schools, and other public space [15]. General cleanness was low with all the households in Kilifi County being considered not clean. Environmental cleaning is a key infection Prevention and Control measure for preventing the transmission of COVID-19, for premises WHO recommends for schools the use of commercial detergent with water, to remove dirt, followed by commercial chlorine-based disinfectants, ensuring a concentration equivalent to 0.1 percent of active chlorine for surfaces and 70.0 percent of ethyl alcohol for disinfection of objects [16]. Most of the premises visited were fumigated for the last one week with a concerted effort by different agencies involved. Availability of soaps for handwashing at their

premises are low at market place in both Counties. More than half of the premises occupant at market places have reported to have been trained on COVID-19 infection prevention in both Counties.

### 4.2 Availability of Handwashing Facilities at the Premises

Hand hygiene is extremely important. Cleaning hands with soap and water or an alcohol-based hand rub should be performed. Hand hygiene (HH) involves the use of water and soap or alcohol-based hand rub or any other product, to prevent the transmission of infections from one person to the other [17]. Majority of the premise observed had hand washing station. Majority of the hand washing stations had running water and accessible to all segments of the population. Most handwashing station in Kilifi County had no soaps or other detergent similar to a study which is done in Sub-Saharan Africa estimating low the prevalence of handwashing with soap at critical times (after defecation and before eating) at just 14.0 percent. Majority of those observed hand

washing at the station were washing hands properly based on the World Health Organization guidelines contrary to earlier studies from Bangladesh reported low handwashing behaviors at key times [18].

#### **4.3 Adherence of Public Health Guidelines in Prevention of COVID-19 Infection**

The World Health Organization recommended public health measures such as: Regularly and thoroughly handwashing with water and soap or with alcohol sanitizer. Covering of the mouth and nose with a mask in crowded areas. Physical distancing for at least 6 feet. Covering of mouth and nose when sneezing or coughing with a bent elbow or tissue and avoid visiting crowded places [19]. Majority of the premises' occupants were observed to make some form of social distancing. However, there is low uptake of screening for thermal monitoring at the entrance. Slightly more than half of the premises are well ventilated with free flow of air. Almost all the occupants wear mask with few not wearing it properly as recommended. There is poor waste disposal in Mombasa County similar to another study finding which indicated management of wastes following standard procedures is a challenge in most low-income countries and this increases the potential for SARS-CoV-2 transmission [1].

#### **5. CONCLUSION**

The impact of COVID-19 disease from the household to the County level will continue to pose serious social, economic and health concerns as adherence to WASH practices regarding all COVID-19 guidelines continues to be low. Multi-sectoral feasible approaches towards ensuring further adherence on all the guidelines should be given priority. Protracted effort in implementing public health measures like proper hand washing, wearing of mask, social distancing and wearing of protective gear during waste disposal handling is urgently needed to control and prevent COVID-19 infection. Further research to assess implementation of the COVID-19 prevention and control measures in National Government offices is recommended.

#### **ETHICAL APPROVAL AND CONSENT**

The study obtained ethical clearance from Scientific Ethics Review Unit (SERU) of Kenya Medical Research Institute (KEMRI). Research

permits obtained from National Commission for Science, Technology and Innovation (NACOSTI). Research authorization was obtained from the responsible County government departments. The study participation was voluntary with full informed consent and no respondent subjected to harm. Protection of privacy, anonymity and confidentiality guaranteed.

#### **LIMITATIONS**

Given the nature of the study, there may be bias depending on how one conducted the observation.

Much information might have not been collected given the nature of the study hence the study could have missed critical information to back up the observed indicators.

#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

#### **REFERENCES**

1. Adelodun B, Ajibade FO, Ibrahim RG, Bakare HO, Choi KS. Snowballing transmission of COVID-19 (SARS-CoV-2) through wastewater: Any sustainable preventive measures to curtail the scourge in low-income countries? *Sci Total Environ.* 2020;742:14068.
2. Karijo E, Wamugi S, Lemanyishoe S, Njuki J, Boit F, Kibui V, et al. Knowledge, attitudes, practices, and the effects of COVID-19 among the youth in Kenya; 2021.
3. Ray I. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information; 2020.
4. Abu TZ, Bisung E ES. What if your husband doesn't feel the pressure? An exploration of women's involvement in WaSH decision making in Nyanchwa, Kenya. *Int J Environ Res public Heal.* 16(10):176.
5. Howard G, Bartram J, Brocklehurst C, Colford JM, Costa F, Cunliffe D, et al. COVID-19: Urgent actions, critical reflections and future relevance of 'WaSH': Lessons for the current and future pandemics. *J Water Health.*

- 2020;18(5):613–30.
6. WHO. Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19. Interim Guid [Internet]. 2020;(29 July):1–11. Available:<https://www.who.int/publications/i/item/water-sanitation-hygiene-and-waste-management-for-the-covid-19-virus-interim-guidance>
  7. Yakubu. Additionally, the knowledge and practice of BSE will improve early detection in themselves and the community. *Materials and Methods*; 11(2).
  8. Quaife M, van Zandvoort K, Gimma A, Shah K, McCreesh N, Prem K, et al. The impact of COVID-19 control measures on social contacts and transmission in Kenyan informal settlements. *medRxiv*. 2020;1–11.
  9. UNICEF. Make A Splash Partnership Progress Report [Internet]. Geneva, Switzerland; 2020. Available:[https://www.unicef.org/kenya/media/1861/file/UNICEF-LIXIL\\_report2020.pdf](https://www.unicef.org/kenya/media/1861/file/UNICEF-LIXIL_report2020.pdf)
  10. Ashraf S, Kuang J, Das U, Bicchieri C. Sanitation Practices during Early Phases of COVID-19 Lockdown in Peri-Urban Communities in Tamil Nadu, India. *Am J Trop Med Hyg*. 2020;103(5):2012–8.
  11. Islam SMD-U, Mondal PK, Ojong N, Bodrud-Doza M, Siddique MAB, Hossain M, et al. Water, sanitation, hygiene and waste disposal practices as COVID-19 response strategy: insights from Bangladesh. *Environ Dev Sustain* [Internet]. 2021;23(8):11953–74. Available:<https://doi.org/10.1007/s10668-020-01151-9>
  12. WHO U&. State of the World’s Sanitation: An urgent call to transform sanitation for better health, environments, economies and societies. New York, U.S.A; 2020.
  13. Ministry of Health. Press Statements on COVID-19. [www.health.go.ke](http://www.health.go.ke). 2021. Available:<https://wp-content/uploads/2020/11/NERC-MOH-CS-CO>.
  14. Ministry of Industrialization. National and County Governments Market Protocols and Guidelines During Corona Virus Pandemic. Nairobi Kenya.: Ministry Of Health; 2020.
  15. WHO. U&. Progress on drinking water, sanitation and hygiene: 2017 update and SDG baselines, Joint Monitoring Programme; 2017.
  16. UNICEF. UNICEF. WASH-COVID-19-infection-prevention-and-control-in-schools; 2020. Available:<https://www.unicef.org/media/66356/file/WASH-COVID-19-infection-prevention-and-control-in-schools-2020.pdf>. 2020.
  17. Organization. WH. World Health Organization. WHO/UNICEF Joint Water Supply, Sanitation Monitoring Programme. Progress on sanitation and drinking water: 2015 update and MDG assessment 2015.
  18. Nizame FA, Unicomb L, Sanghvi T, Roy S, Nuruzzaman M, Ghosh PK, Winch PJ LS. Handwashing before food preparation and child feeding: a missed opportunity for hygiene promotion. *Am J Trop Med Hyg*. 2013;89:1179–85.
  19. World Health Organization. Advice for Public.

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