

Community attitude towards sanitation practices during flooding in flood-prone informal settlement of Kisumu central sub-county, Kenya

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ABSTRACT

Flooding poses a significant challenge to safe sanitation management in informal settlements. While sanitation interventions often emphasise infrastructure and service provision, community attitudes may influence how households respond to sanitation risks during flood events. This study assessed community attitudes towards sanitation practices during flooding events in flood-prone informal settlements of Kisumu Central Sub-County, Kenya. A cross-sectional descriptive mixed-methods design guided by the Health Belief Model was employed with 395 households distributed across Nyalenda B, Manyatta A, Obunga and Bandani informal settlements. Household adults were selected using a combination of purposive and random sampling procedures. Quantitative data were collected using structured questionnaires, while qualitative information was obtained through eight key informant interviews with public health officers, community health promoters, local administrators and other relevant actors. Quantitative data were analysed using frequencies, percentages and binary logistic regression, while qualitative data were analysed thematically and triangulated with quantitative findings. The findings showed generally favourable attitudes towards individual aspects of sanitation during flooding. 74% of respondents agreed that flooding increased the risk of faecal contamination, 73.4% recognised increased household exposure, 79.4% considered children particularly vulnerable, and 74.6% agreed that proper sanitation was critical during floods. However, only 56% demonstrated an overall positive attitude towards sanitation practices. Regarding responsibility, 50.8% considered sanitation during floods an individual responsibility, while 73.6% agreed that the government should provide emergency support. Age was the only socio-demographic factor significantly associated with overall attitude, with respondents aged 45–64 years approximately three times more likely to have a positive attitude than those aged over 65 years (AOR = 3.04; 95% CI: 1.02–9.00; $p = 0.05$). Gender, location, household tenure, income, income regularity and receipt of support were not statistically significant predictors. The findings demonstrate a gap between awareness of sanitation risks and overall positive attitudes, suggesting that knowledge alone may be insufficient to promote resilient sanitation responses during floods. Strengthening flood-resilient sanitation infrastructure, institutional support, risk communication and community engagement is recommended.

Keywords: Attitude, Flooding, Flood Resilience, Informal Settlements, Sanitation Practices, WASH

I. INTRODUCTION

Unsafe sanitation remains a global public health challenge, with over millions of people still practising open defecation (World Health Organization WHO, 2023), despite sanitation being recognised as a basic human right. Attitudes toward sanitation reflect community beliefs and feelings regarding latrine use, faecal sludge management, hygiene, and sanitation practices. These attitudes are shaped by social norms, cultural practices, gender roles, stigma, and economic constraints, which may affect safe faecal waste handling and disposal, contributing to the persistence of unsafe practices where health risks are perceived to be low. Studies in Dar es Salaam demonstrate that negative attitudes, misconceptions about sanitation risks, and limited risk perception can contribute to unsafe sanitation practices, even where awareness of safe sanitation is relatively high (Mkude et al., 2021). This suggests that knowledge alone is insufficient to promote safe sanitation practices, as perceptions of risk, affordability, convenience, and social acceptability also influence sanitation decisions.

In flood-prone environments, perceptions of sanitation risks, affordability, convenience, and social acceptability influence community attitudes and decisions, with some households resorting to coping practices such as using plastic bags or disposing of waste in floodwater (United Nations International Children's Emergency Fund UNICEF & WHO, 2019; Othoo et al., 2021). Limited community engagement and weak enforcement may further contribute to negative attitudes and unsafe practices, particularly where sanitation management is not perceived as a shared community responsibility.

Therefore, there is a need for resilient, inclusive and context-specific sanitation systems that withstand flooding and other environmental shocks, mainly in flood-prone urban areas such as informal settlements of Kisumu Central Sub County. However, the effectiveness of existing interventions is constrained by limited understanding of community attitudes towards sanitation practices during floods; hence, knowing these factors is essential for designing sustainable sanitation interventions, informing policy and infrastructure planning. Promoting behaviour change and advancing equitable access to safe sanitation in line with SDG 6.2.

1.1 Statement of the Problem

Access to adequate and safe sanitation remains a global challenge, with over 419 million people still practising open defecation (WHO, 2023). This issue is particularly severe in flood-prone informal settlements, where recurring floods disrupt sanitation infrastructure, limit access to safe facilities, and increase the risk of environmental contamination and disease outbreaks (Pedro et al., 2020; WHO & UNICEF, 2021). Informal settlements, such as those in Kisumu Central Sub-County, are especially vulnerable due to overcrowding, poor infrastructure, and limited basic services, which hinder residents' ability to manage faecal waste safely during floods (UN-Habitat, 2015). Although sanitation is key to preventing disease and promoting public health, its effective management is often constrained by contextual factors, including risk perception, attitudes, cultural norms, and structural barriers (Cookey et al., 2020). While interventions like community-led sanitation and decentralised waste treatment have been implemented, their sustainability and acceptance during flooding remain questionable, particularly in low-resource settings (Pedro & Oliveira, 2020).

In Kenya, only 66% of the population is connected to a sewer system or practices safe excreta disposal (Kenya National Bureau of Statistics [KNBS], 2022), with factors such as education, income, and individual WASH attitude influencing sanitation engagement (Hsan et al., 2019). Climate change and increasing flood events further threaten progress towards SDG 6, which calls for universal access to safe and equitable sanitation (Howard et al., 2016). Negative attitudes toward handling faecal sludge, fear of contamination, social stigma, and cultural taboos often discourage proactive engagement in sanitation management, especially under emergency conditions (Simiyu et al., 2021). Moreover, households may perceive formal sanitation services as expensive or inconvenient, leading to unsafe alternatives that contribute to health and environmental risks. Understanding these attitudes is therefore essential for designing interventions that are socially acceptable, feasible, and resilient to flooding.

1.2 Research Objective

To identify community attitudes towards sanitation practices during flooding events in flood-prone areas of the informal settlements of Kisumu Central Sub-County, Kenya.

II. LITERATURE REVIEW

2.1 Theoretical Review

This study was guided by the Health Belief Model, a theoretical model on health promotion and disease prevention programs focusing on an individual's beliefs about health conditions, predicting individual health-related behaviour as an individual perceives susceptibility, severity, potential positive benefits of action, barriers to action, exposure to factors that prompt action and confidence in the ability to succeed (Rosenstock, 1990). The Model is a psychological framework that helps explain and predict health-related behaviour. Considering the management of faecal waste during flooding events, this study was conducted to understand why individuals/communities engage in or neglect sanitation practices in their areas during such events.

2.1.1 The Health Belief Model

The Health Belief Model (HBM) offers a valuable framework for understanding sanitation behaviour in informal settlements by highlighting how health-related attitudes influence individual/community actions (Rosenstock, 1990). When communities perceive a high susceptibility to faecal-related diseases such as cholera, diarrhoea, or typhoid, and recognise the severity of these illnesses, they are more likely to adopt protective behaviours such as proper waste disposal and handwashing, particularly during flooding events, when contamination risks are heightened. The perceived benefits of safe sanitation, such as disease prevention and improved well-being, further encourage positive practices. However, perceived barriers such as lack of latrines, overcrowding, or financial limitations can hinder action even when risk perception is high. Cues to action, such as public health campaigns, community illness, or visible faecal contamination, can trigger behaviour change, especially when individuals believe they have the ability (self-efficacy) to take preventive measures. Therefore, the HBM emphasises that improving sanitation in informal settlements requires not only infrastructure but also interventions that elevate faecal risk attitude and empower communities to act on that awareness.

2.2 Empirical Review

Attitudes toward sanitation reflect community values, beliefs, and levels of trust in existing services. They are often linked to convenience, affordability, and social norms rather than technical adequacy. In low-income informal settlements, shared latrines or open defecation may persist because they are perceived as more convenient or less costly compared to constructing and maintaining private facilities (Simiyu et al., 2017). Negative attitudes frequently arise when facilities are poorly maintained, unhygienic, or overcrowded, leading to reluctance to adopt, even when alternatives are available.

Community attitudes are also shaped by governance and service delivery. In contexts like Kenya's informal settlements, recurrent facility breakdowns and weak enforcement mechanisms erode trust in sanitation systems, fostering negative attitudes (Okaka & Odhiambo, 2019). Conversely, integrated approaches that combine traditional knowledge with modern innovations, as seen in Bangladesh, strengthen positive attitudes by aligning sanitation services with community values and resilience needs. (Islam, 2017). Overall, improving sanitation requires not only infrastructural solutions but also deliberate efforts to foster positive community attitudes through awareness, trust-building, and participatory planning.

Community perceptions of sanitation practices are shaped by cultural norms, lived experiences, and the availability of infrastructure. Kain, et al., (2016) argue that successful sanitation interventions often depend more on how communities perceive and interpret solutions than on their technical design. For instance, households may perceive sanitation facilities as unnecessary or inconvenient if they do not align with daily routines, social expectations, or household priorities. (Abubakar, 2018) identifies multiple determinants of perception, including lack of privacy for women, inadequate household latrines, geographical constraints, large family sizes, and limited education. These factors influence whether sanitation facilities are viewed as beneficial assets or as costly, burdensome investments.

Risk perception also plays an important role in shaping how communities view sanitation practices. Cookey et al., (2020) note that awareness of susceptibility to diseases such as cholera and diarrhoea influences perceptions of the importance of proper waste management, particularly in flood-prone areas. However, when communities perceive sanitation as the sole responsibility of individual households rather than a shared, citywide concern, adoption of safe practices remains limited (Hyde-Smith et al., 2022). In many cases, poor infrastructure, visible environmental contamination, or disease outbreaks raise community perceptions of risk and create demand for improved sanitation. Yet these perceptions often fade without consistent service delivery and public engagement.

III. METHODOLOGY

3.1 Research Design

A cross-sectional descriptive mixed-methods design was used. The study was conducted in four flood-prone informal settlements within Kisumu Central Sub-county, that is Nyalenda B, Manyatta A, Obunga and Bandani. These settlements experience recurrent flooding and sanitation challenges associated with geographical settings, inadequate infrastructure, environmental exposure and socioeconomic vulnerability. The cross-sectional approach was used to assess community attitudes towards sanitation practices during flooding at a particular point in time, while the qualitative component provided contextual explanations for the quantitative findings.

3.2 Study Area

The study area of Kisumu Central Sub-County informal settlements is an established slum suburb of Kenya's third-largest city, Kisumu. The study focused on the four informal settlements of Kisumu Central Subcounty that are prone to floods due to their low-lying terrain, adjustment to Lake Victoria tributaries, that is, River Nyamasari and River Auji, and their geological nature, which affects the quality and nature of sanitation, especially the onsite sanitation (Othoo et al., 2021). The settlements were Nyalenda B in Nyalenda B location, Manyatta A in Kondele location, Obunga located in the railways sublocation, and Bandani in Central Kisumu location.

The city is located on the shores of Lake Victoria at longitudes 34°20'E and 34°46'E, latitudes 0°20'S and 0°25'S and at an altitude of 1160 m, which rises to about 1400 m above sea level. (Simiyu et al., 2017). Kisumu has an annual precipitation between 1111 and 1407 mm received in two major rainy seasons; March, April and May and October, November and December and a subdued rainfall peak in August (Wandiga, 2007), which is affected by climate change. Temperature varies seasonally with a mean annual temperature range of 18°C to 20°C. The hot and dry season occurs in January and February, while the cool and dry season occurs in June and July.

3.3 Target Population

Kisumu Central sub-county is located within Kisumu City, and it has the highest population density of 4,737 people per km², with a total population of 174,145 within an area of 36.8 km² (Kenya National Bureau of Statistics [KNBS], 2019). The study population consisted of 30,043 households in informal settlements within Kisumu Central Sub-County, including adult residents aged 18 years and above who have lived in the area for more than a year. Most of

these residents are engaged in petty trading, fishing, subsistence farming, casual labour, or small-scale entrepreneurship. The dominant religious affiliations in the area are Christianity and Islam, alongside traditional belief systems and customary practices that influence sanitation behaviour. The study also involved key informants, such as local public health officers, community and religious leaders, NGO/CBO WASH coordinators, and community health workers, who have direct knowledge and influence over flood-related sanitation management in these communities.

3.4 Sampling and Sample Size

The sampling size was computed using the Yamane sample size determination formula (Yamane, 1967) presented below. The sampled households were distributed proportionally using the administrative units (sublocations).

$$n = \frac{N}{1 + N(MOE)^2}$$

Where

n = sample size

N = population size (total number of households), which is 30, 043

MOE = Margin of error, which is 5%

$n = 30,043 / 1 + 30,043(0.05)^2$

$n = 395$

Table 1

Sample Size Distribution to the Four Informal Settlements

Kisumu Central Sub-County	Location	Sublocation	Household population size	Household sample size
	Nyalenda B	Nyalenda B	10, 443	138
	Kondele	Manyatta A	14,086	185
	Kisumu Central/town	Obunga	3,677	24
		Bandani	1,837	48
	Total		30,043	395

Source for household population size (Kenya National Bureau of Statistics KNBS, 2019)

The four informal settlements were selected purposively, and the total number of households identified from the 2019 Kenya census was 30,043. Yamane formula was used to determine the sample size, which was 395 households. The households were then distributed proportionally to the four informal settlements, then selected randomly, with each having one representative. The population comprised adults who are above 18 years and have lived in the selected settlements for more than one year. Key informants were purposively selected from public health department and disaster response stakeholders who are actively involved in sanitation matters during flooding events in the study area.

3.5 Data Collection Instruments and Procedure

The data were collected from multiple sources and using multiple methods to triangulate the data and reduce bias. A standardized procedure was used on survey tool, where all the research assistants were trained together and a similar questionnaire was administered to all survey respondents to minimise external influences. Inter-rater reliability was also used to check the consistency of responses from different research assistants in the same informal settlement. Methodological triangulation cross-verified findings and increased the reliability of interpretations.

A structured questionnaire adapted from WHO/UNICEF Joint Monitoring Programme surveys and related studies was used to collect standardised data on community belief and attitudes on sanitation practices during floods, and socio-demographic characteristics guided by the Health Belief Model (HBM). The questionnaire covered HBM constructs including perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy, and was administered to 395 randomly selected households across sections covering household characteristics, water and sanitation access, flood exposure, sanitation beliefs and attitudes, and coping strategies during floods. Coping strategies were assessed using multiple-choice options, including flying toilets, raised latrines, waste diversion, and eco-toilets, while attitudes were measured using Likert-scale and structured response items. Key informant interviews were conducted during fieldwork using an informal and unstructured approach guided by a checklist to explore underlying beliefs, cultural practices, community narratives, barriers, motivations and institutional factors influencing sanitation practices during flooding events. Ten key informants were purposively identified based on their roles and relevance to sanitation and flooding in informal settlements of Kisumu Central Sub-County of whom eight participated comprising representatives from a faith-based organisation, County Public Health, Kenya Red Cross Society, two Community Health Promoters, a community-based organisation and two chiefs.

3.6 Data Analysis

Quantitative data were analysed using descriptive and inferential statistics. Frequencies and percentages were used to summarise respondents' attitudes. Overall attitude was determined from responses to the individual attitude statements, with respondents agreeing with all but one of the relevant statements classified as having a generally positive attitude.

Binary logistic regression was used to examine associations between overall attitude and selected social, demographic and economic factors. The predictors included gender, age, location, household tenure, monthly income, income regularity and receipt of flood-related information or support. Statistical significance was assessed at $p < 0.05$. Qualitative data were analysed thematically. Emerging themes were compared with quantitative results to strengthen interpretation through triangulation.

3.7 Ethical Considerations

Ethical approval was obtained from the Institutional Scientific and Ethics Review Committee (ISERC) of Masinde Muliro University (Ref: MMUST/IERC/178/2025), and research authorisation from NACOSTI (Ref: NACOSTI/P/25/4182299). Permissions were also granted by the Local National Administration Office (NGAO) of the four informal settlements in Kisumu Central Sub-County. Informed consent was obtained from all the respondents. Confidentiality, voluntary participation, and data protection procedures were strictly adhered to.

IV. FINDINGS & DISCUSSION

4.1 Findings of the Study

Multivariable analysis showed that age was the only factor significantly associated with attitudes toward sanitation practices during flooding events. Respondents aged 45–64 years had significantly higher odds of positive attitudes compared with those aged over 65 years (AOR = 3.04, 95% CI: 1.02–9.00, $p = 0.05$). Although respondents aged 18–24 years (AOR = 2.43, 95% CI: 0.79–7.47, $p = 0.12$) and 25–44 years (AOR = 2.26, 95% CI: 0.79–6.51, $p = 0.13$) also showed higher odds of positive attitudes, these associations were not statistically significant. Gender, location, length of residence, household monthly income, income regularity, and receipt of sanitation information or support were not significantly associated with attitudes toward sanitation practices ($p > 0.05$). Although respondents from Manyatta A showed a tendency toward lower odds of positive attitudes (AOR = 0.52, 95% CI: 0.27–1.03, $p = 0.06$), this did not reach statistical significance. The findings indicate that age was the principal sociodemographic factor associated with attitudes toward sanitation practices during flooding in the study population as shown in table 2 below.

Table 2

Determinants of Attitude towards Sanitation Practices With Regard to the Social, Demographic and Economic Factors

Factor	Response	AOR (95% CI)	P value
Gender	Male	0.86(0.56-1.33)	0.5
	Female	1(0-0)	
Age	18-24	2.43(0.79-7.47)	0.12
	25-44	2.26(0.79-6.51)	0.13
	45-64	3.04(1.02-9)	0.05
	Over 65	1(0-0)	
Location	Nyalenda B	0.81(0.41-1.62)	0.56
	Manyatta A	0.52(0.27-1.03)	0.06
	Obunga	1.21(0.44-3.35)	0.71
	Bandani	1(0-0)	
Tenure	Less Than 1 Year	0.79(0.39-1.58)	0.5
	1-2 Years	0.71(0.38-1.32)	0.28
	3-5 Years	0.69(0.38-1.26)	0.23
	Over 5 Years	1(0-0)	
Household monthly income	<5000	0.49(0.12-2.02)	0.33
	5000-10000	0.39(0.1-1.56)	0.18
	10001-15000	0.43(0.1-1.92)	0.27
	15001-20000	0.92(0.21-4.1)	0.92
	>20000	1(0-0)	
Income regularity (Month to Month)	Regular Steady	1.38(0.77-2.48)	0.28
	Irregular	1.17(0.66-2.08)	0.6
	Seasonal	1(0-0)	
Received information/support	Yes	1.04(0.68-1.57)	0.86
	No	1(0-0)	

4.1.1 Perception of Sanitation Facilities and Services

Most respondents perceived flooding as increasing sanitation-related health risks. 73.9% agreed that flooding increases the risk of faecal contamination, while 73.4% agreed that household exposure to sanitation-related risks is higher during floods. Similarly, 79.4% agreed that children are particularly vulnerable during flooding, and 73.5% reported being aware of health risks associated with poor sanitation during flooding. In addition, 74.6% agreed that proper sanitation is critical during flooding. As shown in table 3

Table 3

Determinants of attitudes towards sanitation practices during a flooding event

Factor	Response	Frequency	Percent
Flooding increases the risk of faecal contamination	Disagree	68	17.0
	Neutral	36	9.0
	Agree	294	73.9
Household exposure is higher during floods	Disagree	61	15.4
	Neutral	45	11.3
	Agree	292	73.4
Children especially vulnerable	Disagree	47	11.8
	Neutral	35	8.8
	Agree	316	79.4
Aware of the health risks	Disagree	52	13.1
	Neutral	51	12.9
	Agree	292	73.5
Proper sanitation critical in flooding	Disagree	53	13.3
	Neutral	48	12.1
	Agree	297	74.6
Responsibility for sanitation in floods	Landlord	87	21.9
	Individual	202	50.8
	Shared	109	27.4
The government should provide emergency support in flood events	Agree	293	73.6
	Disagree	105	26.4

The qualitative findings further showed variation in how community members perceived sanitation risks and services during flooding. Some key informants reported that flooding and associated contamination were regarded as ordinary or temporary events by some community members. One informant observed that flooding was perceived as “an ordinary event that will cease with time” (KI 01 7 January, 2026). In contrast, other informants described faecal contamination during flooding as a serious concern, particularly because floodwater could contaminate underground water sources and boreholes. (KI 03 5 January, 2026) reported that boreholes were often contaminated with faecal matter from latrines during floods, while (KI 04 6 January, 2026) indicated that recognition of health risks varied according to community experience, sanitation infrastructure, and awareness.

The informants also reported awareness of health conditions associated with poor sanitation during flooding. (KI 01 January, 2026) identified *cholera, malaria, diarrhoea, and typhoid as conditions associated with poor hygiene and improper disposal of faecal matter*, while (KI 06 6 January, 2026) reported increases in typhoid and *E. coli* cases following flooding. The interviews also identified existing sanitation interventions and services, including community training on Community-Led Total Sanitation (CLTS), construction of flood-resilient latrines, distribution of mobile toilets, expansion of sewer connections, construction of modern toilet blocks, and emergency response and risk-reduction programmes.

4.1.2 Sense of Responsibility for Sanitation Management

Respondents expressed different views regarding responsibility for sanitation management during flooding. More than half (50.8%) considered sanitation to be primarily an individual responsibility, while 27.4% considered it a shared responsibility and 21.9% attributed primary responsibility to landlords. At the same time, 73.6% agreed that the government should provide emergency sanitation support during flood events as shown in table 3.

The qualitative findings provided additional information on institutional responsibility and service provision. Key informants described activities undertaken by different organisations and authorities including community sanitation training, construction of modern and flood-resilient latrines, provision of mobile toilets, sewer expansion, construction of toilet blocks, and emergency response and risk-reduction activities. However, the informants also

identified gaps in implementation and service delivery. (KI 01 7 January 2026) noted that sanitation policy had not been adequately sensitised, KI 07 7 January, 2026 reported insufficient funds to cover all areas effectively, and (KI 04 6 January, 2026) identified gaps in policy and service delivery for flood-related sanitation in informal settlements.

4.1.3 Social Influence on Sanitation Practices

Social and cultural factors emerged as important influences on sanitation attitudes and practices during flooding. Key informants reported that community members held different interpretations of sanitation risks, with some beliefs influencing how seriously faecal contamination was perceived. KI 08 6 January, 2026 reported that waste that did not have a bad smell was sometimes considered less harmful, while KI 07 7 January, 2026 indicated that illness was sometimes attributed to weather rather than sanitation. (KI 01 7 January, 2026) also identified a cultural restriction in which in-laws were not expected to share toilets.

The interviews further indicated that community members adapted their sanitation practices during flooding, although some of the alternatives reported were not necessarily safe. (KI 01 7 January, 2026) reported that some households used plastic bags and disposed of the waste outside at night, while KI 07 7 January, 2026 reported that some residents used ash or soil in flooded latrines and, in some cases, avoided flooded latrines and resorted to open defecation. (KI 02 5 January, 2026) reported the use of water-treatment methods such as boiling and chemicals, as well as access to mobile toilets. Overall, the findings demonstrate that community attitudes towards sanitation during flooding were shaped not only by awareness of sanitation risks but also by perceptions of available facilities and services, understanding of responsibility for sanitation management, and social and cultural influences. The quantitative assessment found that 56% of respondents had an overall positive attitude, while 44% had negative or less supportive attitudes as shown in figure 1 below.

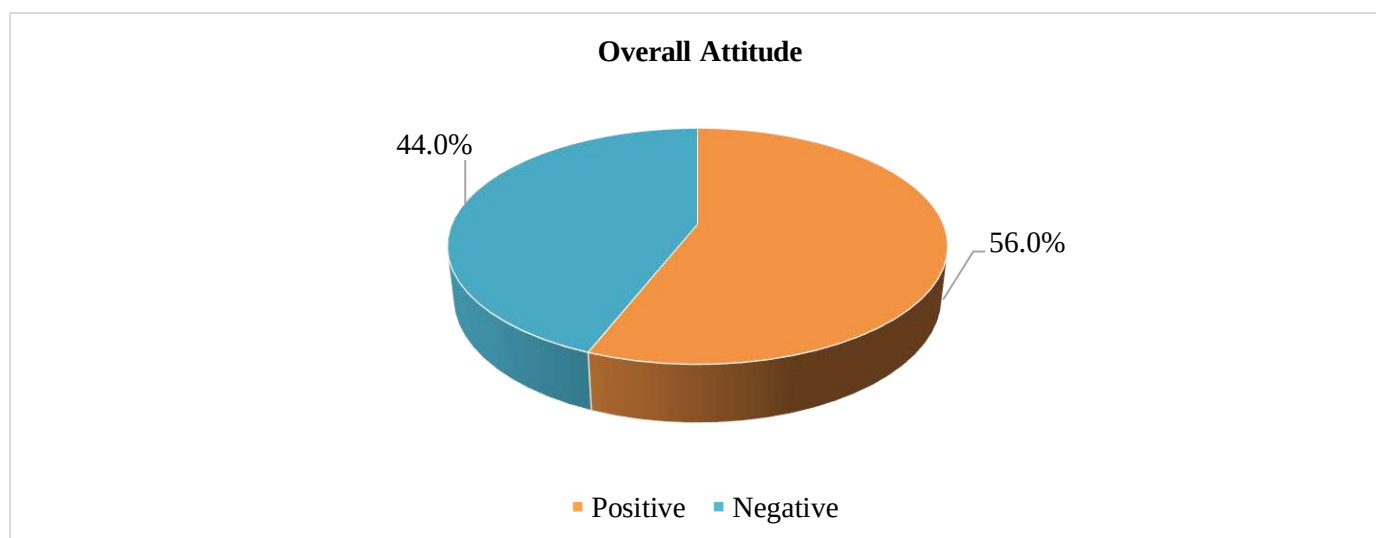


Figure 1
Overall attitude

4.2 Discussion

Multivariable analysis showed that age was the only factor significantly associated with attitudes toward sanitation practices during flooding events. Gender, location, length of residence, household income, income regularity and receipt of sanitation information or support were not significantly associated with attitudes. The association between age and attitudes may reflect differences in lived experience, responsibilities and exposure to recurrent flooding. Older adults within the 45–64-year category may have experienced repeated flooding and sanitation disruptions over a longer period, potentially strengthening their recognition of susceptibility to faecal contamination and sanitation-related diseases. This interpretation is consistent with the Health Belief Model (HBM), which proposes that perceived susceptibility, perceived severity and cues to action influence health-related beliefs and behaviour (Rosenstock, 1990). The finding also aligns with Cookey et al. (2020), who emphasised the importance of perceived susceptibility to diseases such as cholera and diarrhoea in shaping perceptions of sanitation risks in flood-prone environments. However, the finding contrasts with the broader literature that places greater emphasis on socioeconomic and infrastructural factors as determinants of sanitation attitudes. The lack of significant associations between income and attitudes in this study, differs from Abubakar (2018), who identified economic circumstances among the factors influencing perceptions of sanitation facilities. This may indicate that, in the present setting, recurrent exposure to flooding and common sanitation challenges may influence attitudes across income groups while age-related experience may be more important.

4.2.1 Perceptions of Sanitation Facilities and Services

The study found that 56% of respondents had positive attitudes toward sanitation practices during flooding while 44% had negative attitudes. This suggests that although a majority recognised the importance of appropriate sanitation, a substantial proportion remained dissatisfied with or concerned about sanitation conditions during flooding. The study found considerable reliance on shared sanitation facilities while some households experienced flooding of their sanitation facilities and subsequently used alternatives such as neighbours' facilities, containers or pay-per-use toilets. These circumstances are likely to influence how residents perceive the adequacy, accessibility and reliability of sanitation facilities and services during flood events.

The findings align with Simiyu et al. (2017), who reported that sanitation choices in low-income informal settlements are influenced by convenience, affordability and the condition of available facilities. They also support Kain et al. (2016), who argued that community responses to sanitation interventions depend on how residents perceive the suitability of sanitation solutions within their local circumstances rather than their technical design alone. Similarly, Abubakar (2018) identified inadequate latrines, geographical constraints, privacy concerns and economic limitations as determinants of sanitation perceptions. In the present study, dependence on shared facilities and the disruption caused by flooding may have reduced the perceived suitability of conventional sanitation facilities. The HBM provides further interpretation through perceived benefits and perceived barriers. Residents may recognise the benefits of safe sanitation in preventing disease but face barriers such as flooded toilets, inadequate alternatives and financial limitations. Consequently, positive attitudes toward sanitation facilities may not translate into safe practices unless residents have practical and affordable options available during flooding.

4.2.2 Sense of Responsibility for Sanitation

The findings indicate that sanitation management during flooding should not be viewed as an exclusively individual behavioural issue. Respondents recognised both individual and institutional roles in maintaining sanitation during flooding. This finding aligns with Hyde-Smith et al. (2022), who argued that sanitation should be regarded as a shared responsibility rather than solely an individual household concern. It also supports Okaka and Odhiambo (2019), who emphasised the influence of governance and service delivery on community attitudes towards sanitation. Although individual responsibility remains important, it operates within a broader institutional and environmental context. A person may recognise their responsibility for maintaining sanitation but lack the resources, facilities or control required to practise safely during flooding.

This finding is also consistent with the Health Belief Model (HBM), particularly the concepts of perceived barriers and self-efficacy. Flooding can damage sanitation facilities, restrict access to toilets, disrupt faecal waste management and increase dependence on emergency services. Therefore, promoting individual responsibility without addressing these structural constraints may have limited impact. Effective sanitation management requires households to practise safe sanitation, landlords to maintain sanitation facilities, and government and service providers to provide adequate infrastructure, emergency sanitation alternatives, drainage and appropriate faecal waste management services.

The qualitative findings further demonstrate the importance of institutional capacity in translating responsibility into effective service delivery. Key informants identified gaps in policy sensitisation, inadequate financial resources and weaknesses in policy implementation and service provision. These challenges may limit the ability of responsible institutions to respond adequately to sanitation needs during flood events. The findings therefore suggest that strengthening sanitation outcomes during flooding requires a combination of behaviour-change interventions and institutional measures. Addressing structural barriers, improving policy communication, ensuring adequate financing and strengthening coordination among households, landlords, government agencies and service providers may enhance residents' capacity to maintain safe sanitation practices during flooding.

4.2.3 Social Influence on Sanitation Attitudes

Social influence was reflected in the way respondents and key informants understood sanitation risks and responded to sanitation challenges during flooding. The qualitative findings showed variation in perceptions of faecal contamination, with some community members considering contamination a normal consequence of flooding, while others regarded it as a serious health threat. This finding aligns with Kain et al. (2016), who emphasised the role of community values, cultural norms and lived experiences in shaping sanitation attitudes. It also supports Cookey et al. (2020), who demonstrated the importance of risk perception in influencing attitudes toward sanitation and disease prevention. The reliance on neighbours' sanitation facilities during flooding also illustrates the influence of social relationships on sanitation responses. When household facilities become inaccessible, residents may depend on socially available alternatives within the community. This is consistent with Simiyu et al. (2017), who noted that sanitation practices in informal settlements are shaped not only by infrastructure but also by convenience, affordability and social norms.

The study, however, presents a contrast to the expectation that increased exposure to sanitation risks automatically strengthens positive attitudes. Although respondents demonstrated substantial awareness of contamination

risks and the vulnerability of children, some residents continued to normalise faecal contamination during flooding. Repeated exposure to flooding may therefore result in the normalisation of sanitation problems rather than consistently increasing risk perception. This finding adds an important dimension to the HBM because exposure to a risk does not necessarily function as an effective cue to action unless individuals perceive the risk as personally significant and believe that effective action is possible.

The lack of a significant association between receipt of sanitation information/support and attitudes further highlights this issue. The finding contrasts with the HBM concept of cues to action, under which information, health campaigns and other external prompts can encourage protective behaviour. It also differs from the emphasis placed by Okaka and Odhiambo (2019) on public engagement and service delivery. The absence of an association may indicate that simply receiving information does not guarantee a change in attitudes. The effectiveness of information may depend on its relevance, frequency, credibility, timing and whether households have the resources and facilities necessary to act on the information. Thus, health education may have limited influence where communities continue to face flooded facilities, inadequate alternatives and poor sanitation services.

The absence of significant associations between gender, location and length of residence and sanitation attitudes also provides contrasts. Local context, lived experience and social roles can influence sanitation perceptions (Kain et al., 2016; Abubakar, 2018). In the present study, however, these factors did not independently predict attitudes after adjustment for other variables. This may indicate that the common experience of recurrent flooding and similar sanitation challenges across the settlements reduced differences between population groups. Similarly, the absence of a significant relationship with length of residence suggests that prolonged exposure to sanitation challenges does not necessarily result in more favourable attitudes and may, in some circumstances, contribute to the normalisation of poor sanitation conditions.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

The study established that attitudes toward sanitation during flooding events were generally positive. Most respondents acknowledged the importance of maintaining sanitation and hygiene practices during floods and demonstrated concern about the health risks associated with poor sanitation. However, positive attitudes did not consistently result in the adoption of safe sanitation practices, indicating that favourable attitudes alone are insufficient when structural and economic barriers persist. The study further found that age significantly influenced attitudes toward sanitation during flooding events, with middle-aged adults exhibiting more positive attitudes compared to older adults. This suggests that attitudes toward sanitation resilience vary across demographic groups and may influence how households respond to sanitation challenges during flooding.

5.2 Recommendations

County authorities and WASH stakeholders should prioritise flood-resilient sanitation infrastructure and appropriate containment technologies that minimise the risk of faecal contamination during flooding. Flood preparedness plans should also incorporate sanitation as a core component with emergency sanitation facilities and safe faecal waste disposal mechanisms pre-positioned in highly flood-prone settlements. Health promotion programmes should address the gap between awareness of sanitation risks and actual practices by promoting practical behaviour-change interventions that households can implement during floods rather than relying solely on information dissemination. Sanitation interventions should further promote a shared-responsibility model involving households, landlords, community organisations, county government, and WASH service providers, with clearly defined roles for sanitation preparedness, emergency response, waste collection, and facility maintenance. Particular attention should be given to middle-aged adults as important actors in household and community flood preparedness and sanitation resilience. Finally, further longitudinal and mixed-methods research is needed to examine how community attitudes change before, during, and after flood events and how these attitudes interact with sanitation practices, household resources, infrastructure, and institutional support.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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