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Article in *Journal of Scientific Research and Reports* · November 2020

DOI: 10.9734/JSRR/2020/v2i6i830302

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# Physical and Social Demographic Factors Affecting Utilization of Pit Latrine in Tigania East, Meru County, Kenya

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## Authors' contributions

This work was carried out in collaboration among all authors. Authors SMN, EMM, JR and PK designed the study. Author SMN performed the statistical analysis. Authors SMN and EMM wrote the protocol. Author SMN wrote the first draft of the manuscript. Author SMN managed the analyses of the study. Author SMN managed the literature searches. All authors read and approved the final manuscript.

## Article Information

DOI: 10.9734/JSRR/2020/v26i830302

### Editor(s):

(1) Dr. Tzasna Hernandez Delgado, Universidad Nacional Autónoma de México, Mexico.

### Reviewers:

(1) Eugene Appiah-Effah, Kwame Nkrumah University of Science and Technology, Ghana.

(2) Andesikuteb Yakubu Ali, Bingham University, Nigeria.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/61817>

Original Research Article

Received 10 August 2020  
Accepted 13 October 2020  
Published 09 November 2020

## ABSTRACT

**Introduction:** Globally, poor sanitation is the cause of childhood diseases. Annually, more than 19,500 people die from diarrhea of which 17,100 are children. Diarrhea, which accounts for 16% of deaths among the children below 5 years, is highly linked to open defecation (OD). Poor excreta disposal remains a major challenge to improved sanitation and hygiene in many communities of Kenya and therefore they continue to practice open defecation. Construction and utilization of a latrine at home is a protective factor for communicable diseases. About 52% of the population practice proper utilization of latrine in low-income countries. Improper utilization of latrines leads to the contamination of the water sources. Availability of a pit latrine does not guarantee utilization because other factors like functionality and distance influence its use. Furthermore, the availability and use of the latrine depends on maintenance practices of the latrines and cleanliness as well as the quality of housing and household compound.

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**Aims:** To analyze the physical and social demographic factors influencing the utilization of pit latrines in Tigania East Sub-County, Meru County, Kenya.

**Study Design:** The study was a descriptive cross-sectional survey.

**Place and Duration of Study:** The study was carried out in Tigania East Sub-County, Meru County, Kenya shown in Fig. 3. Household survey was carried out between June 2018 and December 2019.

**Methodology:** This was a descriptive cross-sectional survey involving 369 respondents selected by systematic random sampling from different households across the sub-county was utilized. Data collection was done using a structured questionnaire administered in English and a spot observation checklist. All data generated was entered, validated and analyzed using SPSS using SPSS Software Version 23. Descriptive analysis was done during the calculation of measures of central tendency and proportions. Regression analysis was used in the determination of any association between the socio-demographic factors and the utilization of latrines.

**Results:** Ownership, location and functionality of the pit latrine were positively associated with utilization (OR=2.127, OR=1.53, OR=4.36, P=.00). Households that owned pit latrines were 2 times likely to utilize the pit latrines than those without a pit latrine. Moreover, household size, gender, and employment were positively related to utilization (R=0.502, P=.00). High construction costs challenges were 7 times linked to open defecation practices. Households with less than 6 members were 2.35 times more likely to utilize the pit latrine compared to those with 7-12 members (OR=2.35,  $X^2=13.573$ , P=.00).

**Conclusion:** Interventions should target households with more than 7 members. A call for partnerships between government and donors to improve household income, water sources, and sanitation practices in Tigania East Sub-County is necessary. A call for funding projects related to pour-flush pit latrines and wet technologies to enhance utilization.

*Keywords: Pit latrine; utilization; open defecation; social demographic and households.*

## ABBREVIATIONS

OD : Open Defecation  
ODF : Open Defecation Free  
WHO : World Health Organization  
SPSS : Statistical Package for Social Studies

## 1. INTRODUCTION

Sanitation and hygiene issues are the major causes of many childhood diseases in Kenya. In Kenya, at least 14% (7.5 million people) of the total population (approx. 47,500,000 people) practice open defecation [1]. Diarrhoea and related illnesses account for 16% of deaths among the children below 5 years and stand second to pneumonia in Meru County [2]. Further, in most health facilities in Tigania East Sub County, diarrhoea diseases rank as the third cause of outpatient illness among outpatient attendance [3]. There is an extensive association between diarrhoea and open defecation. This is the case since; open defecation contaminates the environment with microorganisms, which are causative agents for diarrhoea [4].

Based on Meru County Ministry of Health reports 2013, inadequate sanitation is common in many rural settings within the County despite

numerous efforts to address the matter [5]. In Kenya, there is no clarity as to why latrine coverage remains low with 35% of households lacking latrines; 44% of them in the rural areas and 21% in the urban centres [6]. Therefore, sanitation is an important aspect in the sustainable development goals that covers a vital aspect of human excreta management [7].

A study by WHO [8] revealed that in 2014, 4 out of 10 people had no access to improved sanitation globally with Africa and South East Asia being the most affected regions. The study further showed that 88% of diarrhoea-related deaths globally are caused by the consumption of unsafe water and poor sanitation. The same study revealed that by 2008, 2.6 billion people (40% of the world's population) had no access to improved sanitation facilities while those who had access shared them as shown in Fig. 2. Further, WHO [8] stated that 1.5 million children die annually because of diarrhoea. These deaths are attributed to the combined impacts of inadequate sanitation, and poor personal hygiene.

Although the seventh Millennium Development Goal about environmental sustainability targeted to halve by 2015 the proportion of the population

without access to basic sanitation and safe drinking water, this goal was not achieved [9]. Social demographic factors, social-cultural factors, and knowledge gaps are assumed to cause this increasing trend [10,11,7, 12,9,1,3,6,13]. Moreover, lack of proper knowledge of the construction and maintenance of pit latrines within the household is another factor hindering the utilization of latrines [14]. This has resulted in poor quality construction, basic design faults, unsafe pits, and poor maintenance [15]. This study, therefore, sought to analyse the factors influencing the utilization of pit latrines in Tigania East Sub-County.

## 2. MATERIALS AND METHODS

This study was conducted in Meru County, Tigania East Sub-County between June and December 2019. The study is a descriptive cross-sectional survey. A sample of 369 respondents comprising of the household heads was selected by systematic random sampling method across the Tigania East Sub-County. Descriptive analysis, multiple regression, and Odds ratios were pulled from SPSS 23. The utilization of pit latrines was used as the dependent variable. Independent variables such as ownership, functionality, location, age, income, education, marital status, and employment were used.

### 2.1 Sampling Method

Out of the 29,810 households in Tigania East Sub-County, 369 households were sampled with the household heads being the respondents hence 369 respondents. Tigania East Sub-County has a population of 157,246 people. However, a single latrine block is shared amongst household members hence the reason for sampling households. The sample size calculation was done using the Cochran formula and samples selected using systematic random sampling method [16].

$$n = \frac{p(1-p)z^2}{d^2},$$

Using Kerlinger, Kth household, an Interval of 1 household in every 80 household were used. The required sample size was 369 households (where the head of household was picked as the respondent). Information on household numbers was obtained from the Kenya National Bureau of Statistics Meru County.

## 2.2 Data Collection and Analysis

A structured questionnaire was administered. The questionnaire was pre-tested in 37 households at the Gankere market in North Imenti Sub-County, which borders Tigania East Sub-County. The instruments were tested for reliability yielding a Cronbach's alpha of 0.75 and therefore considered reliable. The data were entered and analyzed using SPSS Software Version 23. Descriptive analysis, multiple regression, and Odds ratios were pulled with the utilization of pit latrine being the dependent variable. The results were presented using descriptive and inferential statistics.

## 3. RESULTS

### 3.1 Physical Factors

#### 3.1.1 Ownership, functionality of pit latrine, and utilization

The study found that households that owned pit latrines were 2 times likely to utilize the pit latrines compared to those that didn't own a pit latrine (Odds ratio 2.127), ( $X^2=7.641$ ,  $P=.00$ ). Those households with functional pit latrines were 4 times likely to utilize the pit latrines compared to those which were not (AOR=4.236,  $P=.04$ ). Among the households selected, most of the pit latrines were semi-permanent (Fig. 1).

#### 3.2 Constraints in Pit Latrine Construction and Utilization

The study explored some of the major challenges faced by households in installing a pit latrine. Some of the challenges found include; high construction costs, the most common challenge (98%). Other reasons included; No person available to construct, savings/credit issues, competing priorities, and limited space with a 2% cumulative occurrence. The study revealed that constraints in installing a pit latrine were associated with utilization ( $X^2=7.283$ ,  $P=.026$ ). Households that faced high construction costs challenges were 7 times likely to practice open defecation compared to those households that had mentioned other challenges (LR=7.34,  $P=.21$ ). This, therefore, signifies that households that are incapable of building pit latrines due to high cost of construction incurred were unlikely to utilize them. The study revealed a positive association between the location of pit latrine, functionality, and utilization ( $R= .235$ ,  $P=.00$ , and  $R=0.215$ ,  $P=.00$ , respectively). Households with

functional latrines were more likely to utilize them as compared to the households whose latrines were non-functional. Table 1 shows more details. The findings of this study agreed with those of Budhathoki et al. [17], who added that the utilization of latrines depended on their functionality and need of maintenance. Non-functional latrine gives various problems such as leakage, privacy issues, and lack of comfort that may hinder its use. Similarly, presence of a door and height of latrine above 1.5 m was positively associated with latrine utilization. The study by Chanie et al., [7] whose results were found consistent with this study found that a number of factors are associated with latrine utilization. They included unclean latrine facility, poorly constructed latrine, having children, traditional hut latrine facility and age of families. This study showed that, households with clean latrine facilities were 4 times more likely to use it compared to those with unclean ones. The reason could be attributed to the fact that participant's behavior will be motivated through attractive environment [7].

### 3.3 Social Demographic Factors

#### 3.3.1 Gender and marital status

From the findings, most respondents were males (approximately 63% of the total respondents), while 37% of the total respondents were females. The odds ratios in this study revealed that females were 2.8 times likely to utilize the pit latrines compared to the males (F=17.21, P=.00),

(AOR=2.803). This disparity could be explained by the high need for privacy and safety during defecation in females compared to males in this area. Most of the respondents (83%) were married, with 7% single and 8% widowed. This agrees with a research done by Leshargie [15]. She explained that it is important for people, especially women, to avoid being seen exposing body parts. Improved privacy is a key reason for latrine construction for around 45 percent of latrine owners in Bihar, Kenya, and Cambodia; 56 percent in Rajasthan; and up to 90 percent in Meghalaya [15]. Further, it is illustrated by the following quote from a latrine owner from East Java who said "My wife never goes to the river; she is not used to it. She feels embarrassed and uncomfortable. So I thought I'd better build my own toilet" [15].

#### 3.3.2 Household size

An assessment of household size (family size) revealed that overall; some households had only one member, whereas others had twelve as the maximum or the highest number of members. The results further indicated that latrine utilization was highly dependent on household size ( $X^2=13.573$ ,  $P=.00$ ). The cohort of households with 1-6 members was 2.35 times likely to utilize the pit latrine compared to those cohorts with a household size of 7-12 members. Presence of so many people utilizing a facility could have been the cause of uncleanliness and therefore others in the family were uncomfortable to utilize the latrine thus practicing open defecation. This

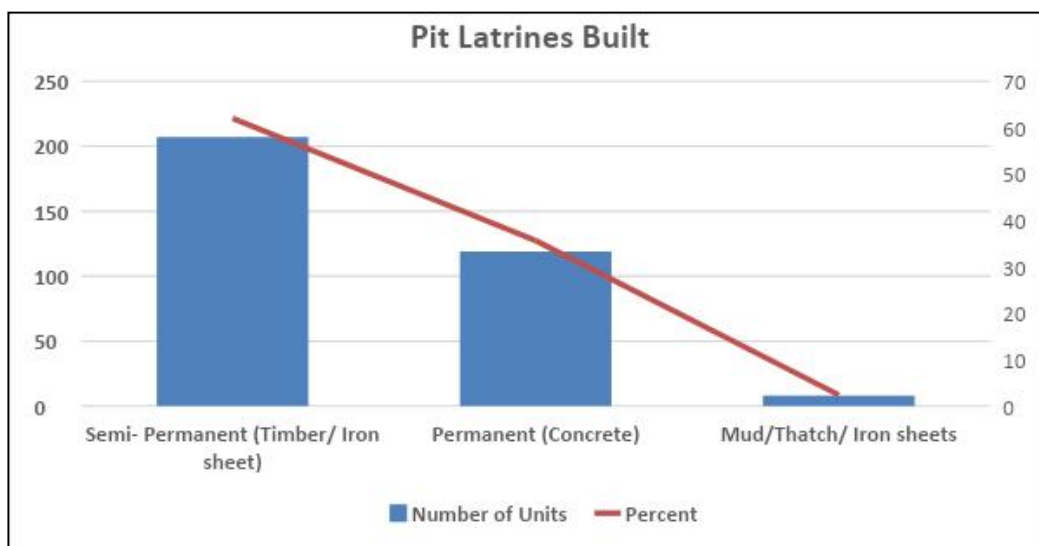


Fig. 1. Type of latrine

**Table 1. Physical factors**

|                            |                        | <b>Physical factors</b>           |               | <b>Chi-square</b>              | <b>Odds ratios (95% CI)</b> |
|----------------------------|------------------------|-----------------------------------|---------------|--------------------------------|-----------------------------|
| <b>Variables</b>           | <b>Categories</b>      | <b>Utilization of pit latrine</b> |               |                                |                             |
|                            |                        | <b>Yes (%)</b>                    | <b>No (%)</b> |                                |                             |
| Ownership of pit latrine   | Yes                    | 121(46.2)                         | 141(53.8)     | (x <sup>2</sup> =7.06, p=.06)  | OR=2.12                     |
|                            | No                     | 23(28.8)                          | 57(71.3)      |                                |                             |
| Pit latrine functionality  | Yes                    | 108(45.8)                         | 128(54.2)     | (x <sup>2</sup> =4.17, P=.04)  | OR=4.36                     |
|                            | No                     | 36(34)                            | 70(66)        |                                |                             |
| Location of pit latrine    | 250m-500m              | 118(44.4)                         | 148(56.6)     | (x <sup>2</sup> =2.49, P=.15)  | OR=1.53                     |
|                            | less than 250m         | 26(34.2)                          | 50(65.8)      |                                |                             |
| Materials used in building | Timber/iron sheets     | 119(47.4)                         | 132(52.6)     | (x <sup>2</sup> =12.5, P=.002) | *                           |
|                            | Concrete               | 13(22.4)                          | 45(77.6)      |                                |                             |
|                            | Mud                    | 12(36.4)                          | 21(63.6)      |                                |                             |
| Constraints in building    | High costs             | 133(44.9)                         | 163(55.1)     | (x <sup>2</sup> =7.28, P=.002) | *                           |
|                            | No one to build        | 8(22.9)                           | 27(77.1)      |                                |                             |
|                            | Savings /credit Issues | 3(27.3)                           | 8(72.7)       |                                |                             |

**Table 2. Social demographic factors**

| Variables              | Categories               | Social demographic factors |           | Chi-square                     | Odds Ratios 95% CI |
|------------------------|--------------------------|----------------------------|-----------|--------------------------------|--------------------|
|                        |                          | Utilization                |           |                                |                    |
|                        |                          | Yes                        | No        |                                |                    |
| Age of the respondents | 17-35                    | 70(53.4)                   | 61(46.6)  | (x <sup>2</sup> =12.68, p=.05) | *                  |
|                        | 36 - 55                  | 56(33.7)                   | 110(66.3) |                                |                    |
|                        | 56 - 75                  | 8(33.3)                    | 16(66.7)  |                                |                    |
|                        | 76 - 85                  | 10(47.6)                   | 11(52.4)  |                                |                    |
| Gender                 | male                     | 115(49.8)                  | 116(50.2) | (x <sup>2</sup> =17.2, p=.00)  | OR=2.83            |
|                        | female                   | 29(26.1)                   | 82(73.9)  |                                |                    |
| Marital status         | single                   | 46(65.7)                   | 24(34.3)  | (x <sup>2</sup> =20.46, p=.00) | *                  |
|                        | married                  | 90(36.4)                   | 157(63.6) |                                |                    |
|                        | divorced                 | 4(28.6)                    | 10(71.4)  |                                |                    |
|                        | widowed                  | 4(36.4)                    | 7(63.6)   |                                |                    |
| Household size         | 1-6 members              | 104(50)                    | 104(50)   | (x <sup>2</sup> =13.5, p=.00)  | OR=2.35            |
|                        | 7-12 members             | 40(29.9)                   | 94(70.1)  |                                |                    |
| Education level        | no education             | 4(22.2)                    | 14(44.8)  | (x <sup>2</sup> =11.6, p=.009) |                    |
|                        | primary                  | 125(46.5)                  | 144(53.5) |                                |                    |
|                        | secondary                | 15(30)                     | 35(70)    |                                |                    |
|                        | higher education         | 5(100)                     | 0         |                                |                    |
| Monthly income         | Less than 5,000 Kshs     | 122(47.7)                  | 134(52.3) | (x <sup>2</sup> =15.9, p=.003) |                    |
|                        | 5,000-9,999 Kshs         | 8(17.4)                    | 38(82.6)  |                                |                    |
|                        | 10,000-14,999 Kshs       | 9(39.1)                    | 14(60.9)  |                                |                    |
|                        | 15,000-19,999 Kshs       | 3(30)                      | 7(70)     |                                |                    |
|                        | Greater than 20,000 Kshs | 2(21.6)                    | 5(71.4)   |                                |                    |

results disagreed with that of Chanie et al., [7] who found out that households having children were 2.5-fold higher to utilize latrine as compared to those without children.

### 3.3.3 Employment

Approximately 85% of the respondents were not employed, with only about 15% in employment. Interestingly, the study revealed that respondents with gainful employment were 6 times likely to utilize pit latrines compared to those unemployed (AOR=6.127, P=.013). The study, therefore, established a positive linear association between employment and pit latrine utilization. This implies that employed respondents could most likely afford to construct a decent pit latrine, which further encouraged its utilization ( $X^2=5.972$ , P=.00). This results were found to be consistent with those of Busienei et al., [11], who discovered that poorest populations are more likely to practice open defecation as compared with the wealthiest populations. This means that poverty is a major contributor to open defecation. Further, the study by Thys et al., [14], indicated that poverty is a major cause of non-utilization though other factors really explain non utilization. Moreover the study by Dagneu [12], noted a significant relationship between level of income and latrine use. The study found out that latrine use was higher among the high income earners compared to the low income earners [11].

The results concluded the existence of a positive relationship between some social demographic factors and the utilization of pit latrines (R=0.502, P=.00). About 50.2% of changes in pit latrine utilization are explained by the social demographic factors. These correlation and coefficients imply that the respondent's education and income levels significantly explain the utilization of pit latrines (F=18.77, P=.00). Similarly the results of this study concurred with those of Debesay et al., [9] who noted that Households with husbands educational status of primary and above were 3.71 times [AOR=3.71, 95%CI: 1.52-9.09] more likely to utilize latrine than households with illiterate husbands.

## 4. DISCUSSION

Over 8 million Kenyans still defecate in the open which results in the high prevalence of diseases such as diarrhoea, amoeba, typhoid, and cholera [8]. Although open defecation is among the known causes of diarrhea-related illnesses; pit

latrine ownership neither means that a country will be a 100% open-defecation free (ODF) nor guarantees maximum latrine utilization. This study revealed that despite most study respondents owning a pit latrine; a significant majority of them never utilized them and were still practicing open defecation. This could indicate the need for maintenance of the pit latrines to ensure maximum utilization. However, households that owned pit latrines were 2 times likely to utilize them compared to those who never owned them. There is an indication that owning a pit latrine is not enough but ensuring that the pit latrine is regularly maintained and clean would encourage utilization (Odds ratio 2.127), ( $X^2=7.641$ , P=.00). The results of this study were consistent with those of Debesay et al., [9] which noted that the presence of school-age children, husband's educational status (primary level and above), family's monthly income, duration of owning latrine by the household, latrine construction materials, and type of latrine were the major factors affecting utilization of latrines. Therefore, it is essential to note that owning a pit latrine did not prevent open defecation because functionality of the latrine is essential.

Households with functional pit latrines were 1.6 times likely to utilize the pit latrines compared to those without pit latrines ( $X^2=4.178$ , P=.00). Therefore, households with aged and dilapidated latrines most probably preferred to engage in open defecation than utilizing these latrines, hence increasing the risk of diarrhea diseases. These findings agreed with those of Budhathoki et al., [17] which established that the utilization of latrines depended on their functionality and need for maintenance. Non-functional latrines lead to various problems such as leakages, privacy issues, accidents, and lack of comfort that may hinder their use. Similarly, the presence of a door and a latrine height above 1.5 m was positively associated with latrine utilization [18].

According to Chanie et al., [7] several factors are associated with latrine utilization. These factors include unclean latrine facility, poorly constructed latrine, having children, traditional latrine facility, and age of families. This study also showed that households with clean latrine facilities were 4 times more likely to use them compared to those with unclean ones. The reason for this could be attributable to the fact that a participant's behavior will be motivated through an attractive environment [7].



The study established that the respondents' age, gender, and marital status were found to be positively associated with pit latrine utilization. This means that children were more predisposed to open defecation due to their vulnerability than adults. Additionally, females were more likely to utilize these latrines than males probably due to the need for high privacy by females and their homely chores that would have them spend more time at home than in the field or shamba, unlike males. Moreover, heat from the pit latrine, odor, and fear of falling into the pit may act as barriers to utilization amongst young children [19]. This indicates the need to construct user-friendly pit latrines since this is a rural area with limited water supply.

Family planning may encourage good maintenance and utilization of pit latrines. This study found out that latrine utilization was dependent on household size ( $F=13.573$ ,  $P=.00$ ). The cohort of households with less than 6 members was 2.35 times likely to utilize the pit latrine compared to the cohorts with a household size of 7-12 members. The presence of many household members utilizing one facility could have been the cause of uncleanliness, odor, and the feeling of discomfort, which are most likely predictors of open defecation. These results disagreed with those of Chanie et al. [7] which found that households comprising children were 2.5-fold higher to utilize latrine as compared to those without children. This discrepancy could probably be due to the fact that families with young children are more cautious about diseases that children are highly vulnerable to, such as diarrhea [4].

Employment is positively related to pit latrine utilization. Those respondents who had gainful employment were 6 times likely to utilize the pit latrine than those that are unemployed. This means that the high cost of building a pit latrine would not deter them from having one as they can afford. There is a positive linear association between employment and latrine utilization implying that those employed probably could afford an income to construct a decent pit latrine hence encouraging utilization ( $X^2=5.972$ ,  $P=.00$ ). These results agreed with those of Busienei et al. [11] that established that the poorest populations are more likely to practice open defecation compared to the wealthiest. Therefore, there is an indication that poverty is a major contributor to open defecation. Further, the study by Thys [15] indicated that poverty is a major cause of non-utilization despite other factors still explain non-

utilization. Moreover, the study by Dagnev [12] noted a significant relationship between the level of household income and pit latrine use. The study found that latrine use was higher among the high-income earners compared to the low-income earners [12].

## 5. CONCLUSION

Interventions should target households with more than 7 members. A call for partnerships between government and donors to improve household income, provision of clean water, and sanitation practices in Tigania East Sub-County are necessary. The study also calls for funding projects related to pour-flush pit latrines and wet technologies in Tigania East Sub-County since the pit latrine functionality significantly enhances utilization and improves health outcomes.

## CONSENT AND ETHICAL APPROVAL

The survey was carried out after a thorough examination done by the Meru University of Science and Technology (MUST) Institutional Research Ethics Review Committee (MIRERC) to ensure compliance with the ethical standards. As per international standard or university standard guideline participant consent has been collected and preserved by the authors.

## ACKNOWLEDGEMENTS

Sincere gratitude to The Meru University of Science and Technology and all the respondents in the households where data was collected for their great contribution towards the success of this study. Special thanks to Eric M. Muchiri, Patrick Kubai and Jane Rutto for mentorship and support towards the conceptualization and completion of the study.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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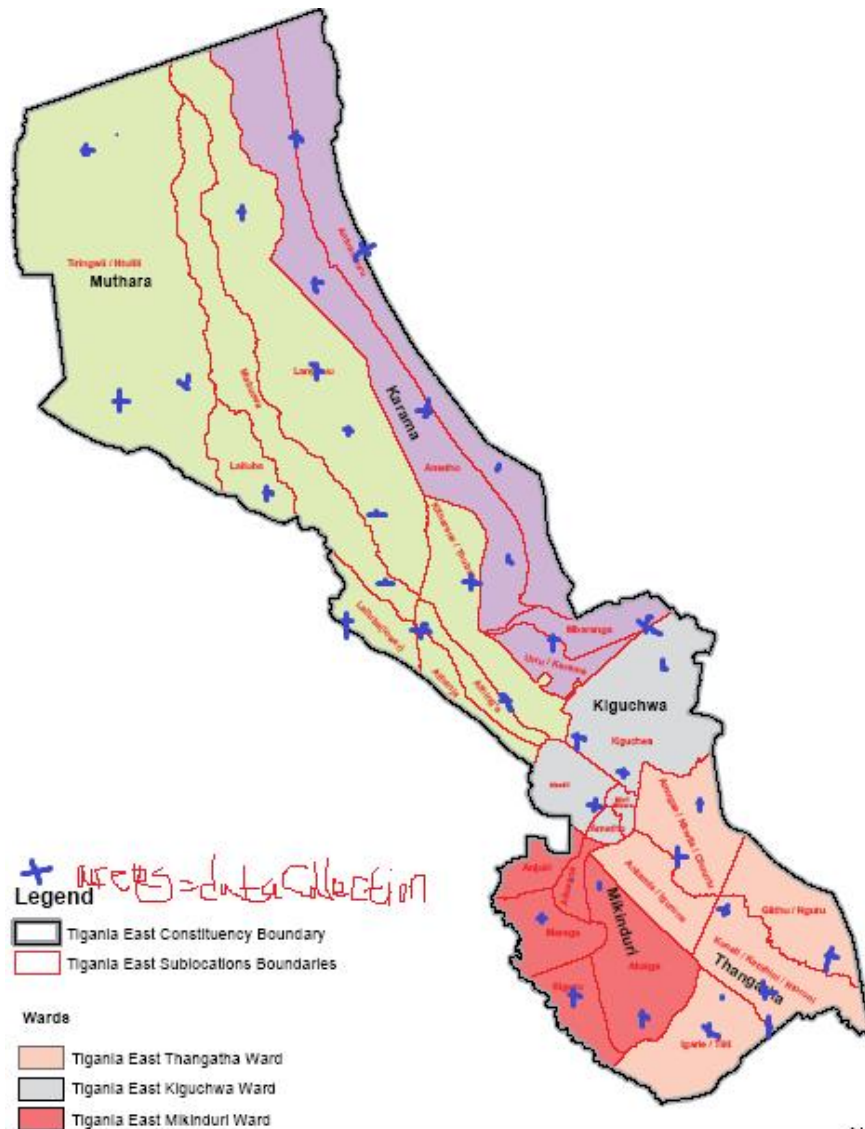
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## APPENDIX



**Fig. 2. WHO figures in which shared facilities stand at 51% for Urban and 18% for Rural in Kenya**



**Fig. 3. Tigania east map**

Source: (Google maps, 2020)

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