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Status of Human Waste Management in Informal Settlements within the Urban Areas in Developing Countries: Case Study in Eldoret Municipality, Kenya

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Abstract: ***In developing countries, most people live in the informal areas where municipal services are rarely availed. How this affects human waste management is not clearly understood. Consequently, a study was undertaken to determine the status of human waste and their management in the informal settlements of Eldoret Municipality in Kenya. This was a case study involving interviews with a total of 257 households in the informal settlements and interviews with key informants in the realm of waste management of the town. Majority of the residents lived in rented houses. There was poor excreta disposal in the settlements areas. Significantly (P < 0.05) higher quantity of wastes was generated in the informal settlements than the formal settlements within the same environment. The ranges of human wastes generated ranged between 0.001 to 0.026 kg/person/day. The study revealed that the main facility used by residents for human waste disposal in the settlements was pit latrines which were poorly constructed, not properly maintained. Some of the facilities were full and thus discharged their affluent into the environment. The study recommended that with the help of Municipal Council of Eldoret, households to be encouraged to connect to existing sewer wherever possible. Furthermore there is need to exploit the production of biogas. It was also recommended that properly designed and constructed pit latrines, in accordance to health and environmental standards, be used in the informal settlements.***

Keywords: Human waste, human waste management, Eldoret Municipality, Informal settlement, developing countries

1. Introduction

Urbanization is currently a major world issue. The world's urban population currently stands at around 4.5 billion and will almost double to more than 8 billion by 2050 [1]. The problem in the urban areas is exacerbated by an increased rural-urban migration by much young population in search of better living conditions [2-4]. As a result these areas cannot be adequately planned for leading to proliferation and emergence of informal settlements with very poor living conditions. Sub Saharan Africa (SSA), which currently has the highest percentage of the world poor has an "estimated 72% of the urban population living in informal settlement [5]. In Kenya, more than 34% of the total population lives in urban areas and 71% is confined in informal settlements [6]. There is very little planning in the informal settlement and there is a potential to produce a large amount of human waste. According to the recent survey conducted by Open Data (https://opendata.go.ke/Counties/Households-by-main-mode-of-human-waste-disposal/5fav-vwxi), Eldoret is one of the fastest growing towns in the SSA and has large portion of the town being converted into informal settlement at fast rate. It is therefore important to understand how they are coping with problem of human wastes. Due to systematic lack of such information, the aim of this study was to determine the status of human waste management in informal settlements within the urban areas in developing countries using Eldoret Municipality, in Kenya as a case in point.

2. Methodology

The study was conducted in Eldoret Town, situated about 320 km north-west of the Kenyan capital, Nairobi. It lies at an altitude of about 1200 m above sea level with approximately latitude 0°31' North and Longitude 35°16' East. It has urban and rural setting with cosmopolitan populace. The design chosen in this study was qualitative research design. From the approach, this study was conducted through survey method. Survey design presented focus oriented methodology. The sample size was 257 households determined according to [7]. A total of 12 Key informants from sectors that directly deal with human waste management were also included in the study to supplement and compliment the information gathered from the households. hey included Honey sucker/Exhauster operators, private human wastes collectors and government officials in public health, physical planning and environment departments. To identify the participants in the study, a sampling frame was obtained from the Kenya Demographic and Health Survey based on 2008-09 population census (http://www.nacc.or.ke/index.php?option=com_booklibrary&task=view&id=6&catid=124&Itemid=122). This information was provided by the District Statistics Office in the then Uasin Gishu District. Owing to the heterogeneous composition of the study population and the various categories of participants targeted for the study, a combination of sampling methods was employed to draw the required sample for the study, systematic

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random sampling was used in the study. Sampling was done in proportion to the area, population density and actual number of households in the respective settlements. The actual sample was further determined through proportional sampling technique.

Questionnaires, interview schedules and document analysis were used as the main tools for data collection. Questionnaires were used to sample; local community members in the informal settlements. In-depth semi-structured interviews with CBO managers and leaders, representatives of support organisations and government officials were used to derive rich qualitative data. At the end of data collection, all completed questionnaires were thoroughly examined by the researcher, coded and organized for computer analysis. The data was analysed using Statistical Package for the Social Sciences (SPSS version 21).

3. Results and Discussion

In order to prepare a well-planned human waste management system, it is essential to know the quantity of waste generated as well as different categories of the waste. The quantity of waste generated in kg/day and kg/person/day (inset) at four randomly sampled informal settlements (IF1, IF2, IF3 and IF4) and two formal settlements (F1 and F3) we sampled in Eldoret is provided in Figure 4.1. Based on the figure, significantly ($P < 0.05$) higher quantity of human wastes was generated in the informal settlements than the formal settlements within the same environment. The differences in quantity of human waste generated were attributed to difference in population generating waste, but could also differ because of poor management within the part of the informal settlement. However, these values appear much lower if compared to the per capita waste generation varies in a range from 0.1 to 0.3 kg/person/day reported in Asian countries [8] compared to the current values ranging between 0.001 to 0.026 kg/person/day (Fig 1. inset).

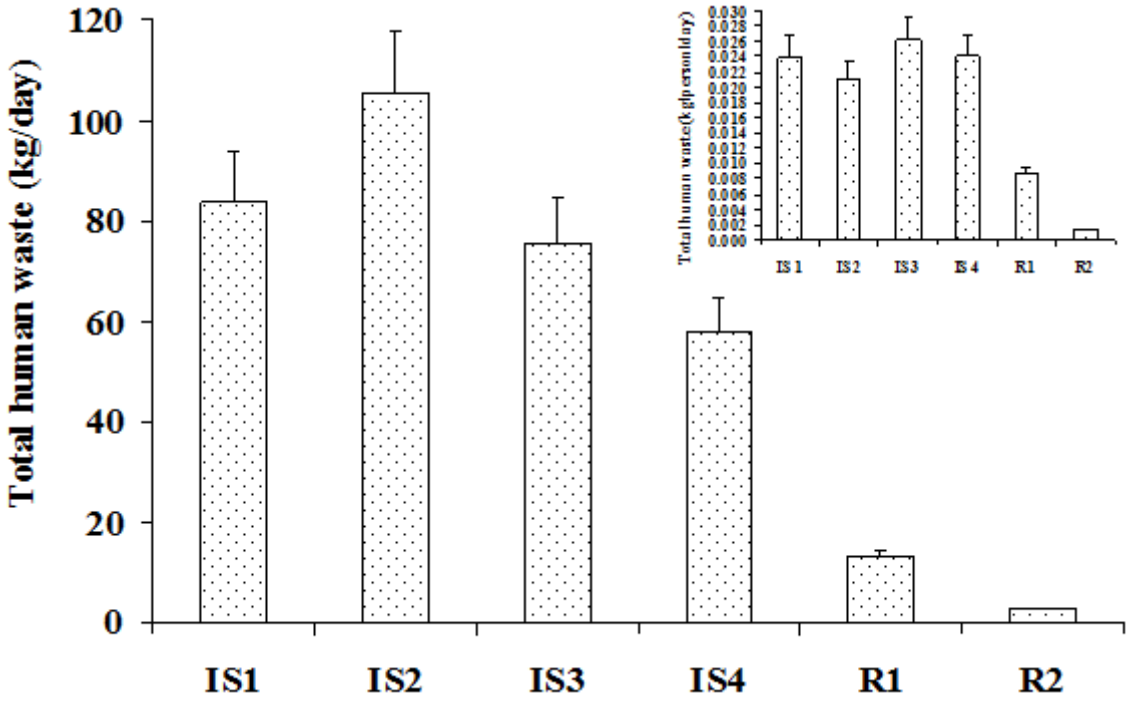


Figure 1: Quantity of human waste generated in four randomly sampled informal settlements compared to two formal settlements in Eldoret Municipality for a period of 1 month

Some of the informal settlements in developing countries of Africa are challenged by population increase and consequent rise in human waste. Although the quantity of human wastes generated appeared low, they need to be managed in order to reduce their possible environmental and health impacts. Based on a survey of 19 informal settlements in Eldoret Municipality, it was observed that initiatives for collection of human waste from house-to-house and human waste segregation have been undertaken in only two of the 19 informal settlements. Upto 90% of the households reported that they occasionally defecate in bushes and family gardens (Fig. 2a) with another 60% indicating that they throw the feaces into dry to river beds (Fig. 2b). In most of the informal centres in Africa, open defecation is the most preferred method for the final human wastes. Even though, government and municipalities are already working to develop the sanitary toilets in the urban areas, open defecations still remains the cheapest and most effective solution for most households without proper toilet facilities. The cost of toilet facilities in town is still far too much for most of the residents who prefer open defecation. In some of the informal settlements, children were seen defecating behind residential building (Fig 2c) while some others were seen urinating outside dilapidated toilet facilities

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(Fig. 2d). Perhaps all these resulted from poor quality of toilet facilities in the study area (Fig 2e and f).



Figure 2: Photographs showing the status of human waste and challenges in human waste management in Eldoret Municipality

The presence, type and ownership of human waste disposal facilities in the households of the study are is provided in Table1. Only 32.3% had human waste disposal facilities. Most of the residents owned pit latrines, which were of very poor status (see Fig 2f). In terms of ownership of the human waste disposal facilities, it was determined that most of the settlers in the urban areas relied on the landlords to built them these facilities. However, given that most landlords stayed in better facilities and did not want to commit more poor due to low rents (personal communication), it was established that they rarely provided those facilities.

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Table 1: Presence, types and ownership of the facilities for human waste disposal in Eldoret Municipality

Parameter	Response	Frequency (n = 257)	Percent
Have human waste disposal facilities	Yes	83	32.3
Type of human waste disposal facilities	Pit latrine	122	77.7
	Raised pit latrine	27	10.5
	VIP	23	8.9
	Multiple seat VIP	2	0.8
	Pour flash toilet	19	7.4
	Septic tanks	44	17.1
	Ablution block	5	1.9
Ownership of the facility	Individual/Privately owned	45	19.5
	Landlord (shared facility)	183	79.2
	Public Facility	3	1.3%

4. Conclusions

Based on the information collected, it was clearly evident that the facilities which the residents of the informal settlements of Eldoret relied upon for human waste management included: pit latrines, owned by most of the residents. However, there were no elaborate plans to collect human wastes from the residents. These facilities were also poorly constructed and maintained making most of the residents to prefer own defecation. Based on ownership of or the responsibility for the facilities used in human waste management, it was found that the majority of the facilities were owned by landlords/ ladies. This implies that these facilities are shared and/or communal and this fact had a bearing on the maintenance, care and cleaning of the facilities.

5. Future Prospect

The study recommended that with the help of Municipal Council of Eldoret, households to be encouraged to connect to existing sewer wherever possible. Furthermore there is need to exploit the production of biogas. It was also recommended that properly designed and constructed pit latrines, in accordance to health and environmental standards, be used.

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Author Profile



Dr. George Kwedho an engineer with over 30 years experience in water and sanitation sectors in Kenya, United Kingdom and Japan. He is an expertise in designing, construction operation and maintenance of Water/Sewerage systems. He has held senior management positions at Eldoret Water and sanitation Company, Western Water Services Company and Lake Victoria North Water Services Board. Additionally, he has PhD in Environmental Planning and Management from Moi University.



Prof. Pancras G. Opata holds a Bachelor of Arts Degree in Economics (Hons) and Master of Arts Degree in Urban and Regional Planning from the University of Nairobi and a PhD in Development Studies from Jawarhal Nehru University, New Delhi India. He has 22 years teaching, research and managerial experience at Moi University. His major field of specialization is Environmental

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Dr. Elijah Oyoo-Okoth graduated with A PhD in aquatic Ecology and Ecotoxicology from the University of Amsterdam in 2012, and MSc in Fisheries and Aquaculture Sciences from Moi University. He is an international scholar with several publications in the field of metal pollution. He is currently a lecturer and researcher at Karatina University. He has diverse interested in Environmental Biology, Environmental Health, and Environmental Epidemiology.

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