

ORIGINAL ARTICLE**Household Sanitation and Crowding Status in Addis Health and Demographic Surveillance System (Addis-HDSS) in Addis Ababa, Ethiopia****Walelegn W. Yallew^{1*}, Nebiyou Fasil¹, Semira Abdelmenan², Hanna Y. Berhane³, Sitota Tsegaye³, Dongqing Wang⁴, Wafaie Fawzi⁵, Meaza Demissie¹, Alemayehu Worku², Yemane Birhane²****OPEN ACCESS**

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ABSTRACT

BACKGROUND: Access to sanitation and healthy housing conditions are essential for public health, reducing the spread of diseases and improving overall well-being. However, millions of people, particularly in low-income countries, still lack access to basic sanitation and housing facilities. This study assessed household sanitation and crowding status in a rapidly developing urban area of Addis Ababa.

METHODS: Data were extracted from the household census conducted from December 2022 to January 2023 at the Addis-HDSS site. Availability of basic sanitation facilities was defined as the presence of privately owned sanitation facilities within the household. Household crowding was measured by the number of occupants per bedroom. Multivariable logistic regression was used to identify factors associated with access to sanitation facilities (STATA/SE 14.2). A *p*-value of <0.05 was considered statistically significant.

RESULTS: The study included 30,533 households. Overall, 76.37% (95% CI: 74.86–77.2) lacked access to basic sanitation facilities. Most households (67.42%) lived in overcrowded housing. Educational status of the household head and household size were significantly associated with sanitation access. Households with college-educated heads were more likely to have access to basic sanitation (AOR 2.52, 95% CI: 2.27–2.79), while overcrowded households were less likely to have such access (AOR 0.06, 95% CI: 0.040–0.063).

CONCLUSIONS: A large proportion of households lacked basic sanitation facilities and lived in overcrowded housing, which increases the risk of infectious disease transmission. Improving sanitation and housing conditions is crucial for reducing health risks and improving public health outcomes.

KEYWORDS: Sanitation, Household crowding index, Ethiopia

INTRODUCTION

Despite global efforts, a significant portion of the population still lacks access to basic sanitation facilities(1). According to the World Health Organization, in 2022, only 2.4 billion people worldwide had access to safe sanitation (1, 2). Ethiopia has one of the lowest access rates, with only 20% of households using improved toilet facilities (3). In urban areas, overcrowding is also a major public health concern, as it exacerbates the spread of infectious diseases, including diarrheal diseases, tuberculosis, and respiratory infections (4-6). Sanitation interventions have been shown to increase both the availability and use of latrines (7). Understanding the factors influencing sanitation access and household overcrowding is critical for developing effective public health policies. Previous studies have identified factors associated with access to sanitation, including household

wealth, education status, and crowding (8–12). However, few large-scale studies have been conducted in Addis Ababa.

This study aims to investigate the proportion of households with access to basic sanitation and the prevalence of overcrowding. It also assesses to identify the socioeconomic factors associated with sanitation access.

METHODS

Study setting: The Addis Health and Demographic Surveillance System (Addis-HDSS) is located in Yeka sub-city, Addis Ababa, the capital city of Ethiopia. Addis Ababa has a population of approximately 4 million people, with a population density of 5,165 individuals per square kilometer (13). The city is growing rapidly, with an annual growth rate of 4.4%, making it one of the fastest-growing cities in the world(*Figure 1*).

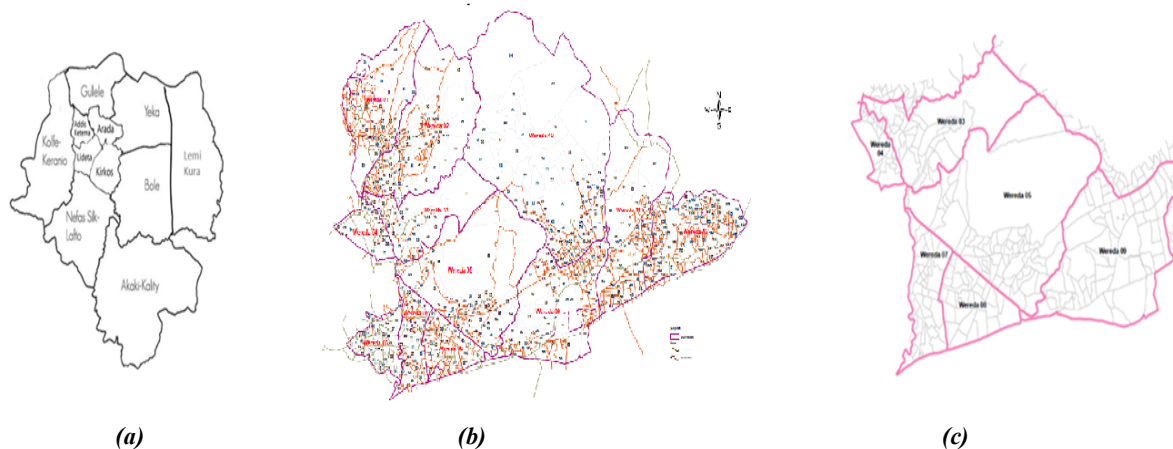


Figure 1: Map of the sub-cities of Addis Ababa (a), Woredas of Yeka sub-city (b), and Addis-HDSS site(c)

Study design and population: Data were obtained from the Addis-HDSS census conducted from December 2022 to January 2023. All households in the Addis-HDSS were eligible for the study, with heads of households or any adult household members serving as respondents.

Data collection: A structured questionnaire, adapted from a similar system used in Ethiopia, was used to collect data on housing and household member characteristics(14). Data were collected electronically using tablets. Fieldworkers were trained on data collection methods, and quality

checks were performed during the fieldwork to ensure accuracy.

Measurement

Sanitation availability: Defined as the presence of privately owned sanitation facilities (e.g., flush toilets, pit latrines, VIP latrines)(15).

Crowding status: Assessed using a crowding score, which was calculated by dividing the number of household members by the number of bedrooms. Households were categorized as "Not Crowded" (score ≤ 1), "Crowded" (score > 1), or "Overcrowded" (score ≥ 3) (16).

Data management and analysis: Data were managed using STATA/SE 14.2. Descriptive statistics were used to assess sanitation and crowding status, and logistic regression was used to identify factors associated with sanitation access. Results are presented as odds ratios (OR) with 95% confidence intervals (CI).

Ethical considerations: Ethical approval was obtained from the Addis Continental Institute of Public Health and the Addis Ababa Health Bureau. Written informed consent was obtained from all participants.

RESULTS

The study included 30,533 households. The median household size was 3, with an interquartile range of 3. A total of 29.04% of households owned their homes, and the majority of household heads were married (56.4%), completed secondary education (29.4%), and were employed (26.4%).

Sanitation access: Only 23.26% (95% CI: 22.8–23.7) of households had access to basic sanitation facilities (Table 2, Figure 2).

Crowding status: 12.08% of households were not overcrowded, while 67.42% were crowded, and 20.50% were considered overcrowded (Table 2 & Figure 3).

Table 1: Socio-demographic characteristics of household and household head in Addis HDSS, Addis Ababa, 2022

Characteristics	Frequency	Percent
Household ownership		
Own	8867	29.04
Rented from the government	6345	20.78
Rented from Individuals	12180	39.89
Cohabited (no payment)	2464	8.07
Other (Military housing, Church)	677	2.22
Household Size		
Mean(+SD)	3.51(1.75)	
Median (IQR)	3(3)	
Household head marital status		
Single (never married)	4827	16.11
Married (monogamous)	16882	56.35
Divorced	2049	6.84
Widow/Widower	5090	16.99
Separated	1112	3.71
Household head educational status		
No formal education/Preschool	3875	12.93
Primary (1-8)	7656	25.55
Secondary (9-12)	8792	29.35
Vocational/Technical	1624	5.42
College/University	8013	26.75
Household head occupational status		
Student	160	0.53
Not employed	5334	17.80
Occasionally employed	1246	4.16
Seasonal employment	685	2.29
Temporary employed	4529	15.12
Permanently employed	7894	26.35
Self-employed	7034	23.48
Retired	3081	10.28

Table 2: Households access to basic sanitation facility and household crowding in Addis HDSS, Addis Ababa, Ethiopia

Variable		Frequency	Percent	95% CI
Households' sanitation status	Had no basic sanitation	23431	76.3	74.86, 77.2
	Had basic Sanitation	7102	23.26	22.8, 23.7
Household crowding	Not crowded	3689	12.08	11.7- 12.5
	Crowded	20584	67.42	66.9, 67.9
	Overcrowded	6260	20.50	20.01,21.0

Logistic regression: After controlling for potential confounders, households with college-educated heads were more likely to have access to sanitation (AOR 2.52, 95% CI: 2.27–2.79). In contrast,

overcrowded household facilities had significantly lower odds of accessing sanitation facilities (AOR 0.06, 95% CI: 0.040–0.063)(Table 3).

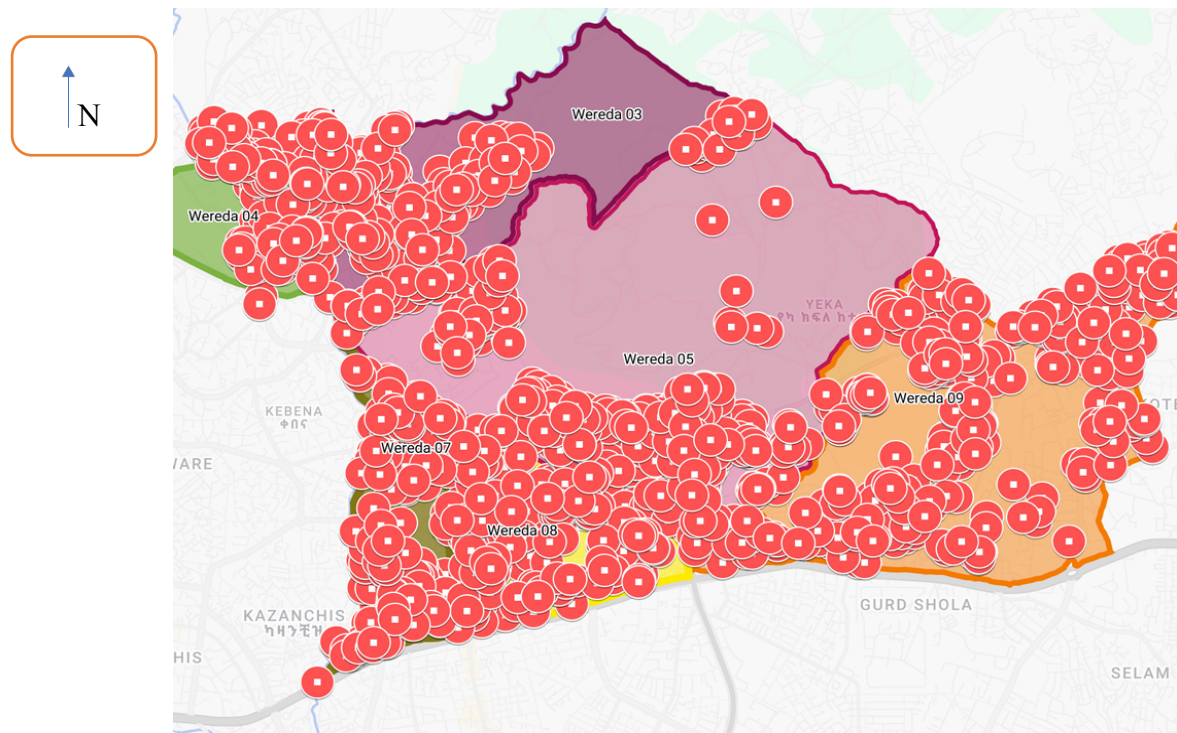


Figure 2: Map of the sub-cities of sanitation status in Addis -HDSS sites in 2022

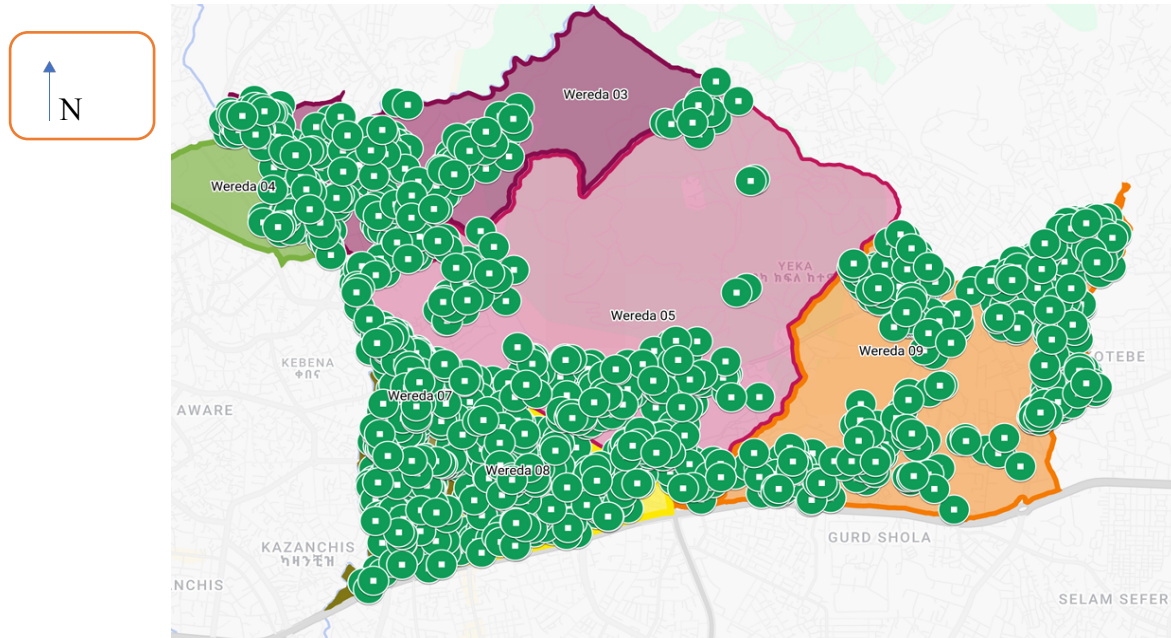


Figure 3: Map of the sub-cities of Household crowded status in Addis-HDSS sites in 2022

Table 3: Factors associated with access to sanitation facilities of households in Addis HDSS, Addis Ababa, 2022

Characteristics	Access to basic Sanitation facilities		Crude OR	Adjusted OR
	Yes	No		
Household Size				
Mean (\pm SD)	3.98(1.89)	3.37(1.67)	1.21(1.19,1.23)***	1.59(1.566,1.63)***
Median (IQR)	4(2)	3(2)		
Education status of Head of the Household				
No formal education/Preschool	628	3247	1	1
Primary(1-8)	1058	6598	0.83(0.75,0.92)***	0.80(0.72,0.90)**
Secondary(9-12)	1791	7001	1.32(1.19,1.46)***	1.21(1.09,1.35)**
Vocational/Technical	418	1206	1.79(1.56,2.06)***	1.53(1.34,1.78)
College/University	3053	4960	3.18(2.89,3.51)***	2.52(2.27,2.79)***
Household crowding status				
Not crowded	1768	1921	1	1
Crowded	4223	16361	0.28(0.26,0.30)***	0.17(0.16,0.183)***
Overcrowded	1111	5149	0.23(0.21,0.26)***	0.06(0.040,0.063)***

NB: p-value - * p-value (0.01, 05), ** p-value (0.001, 0.01), *** p-value (<0.001)

DISCUSSION

Only about 25% of households had access to basic sanitation, and just 1 in 10 lived in non-crowded housing. Household size, educational status of the

head of the household, and crowding were significantly associated with sanitation access.

Low access to sanitation increases the risk of infectious diseases such as diarrhea and cholera (17–21). Studies in Ethiopia have also shown low levels of sanitation access, contributing to

contamination of water sources and poor health outcomes (22-24).

Crowding is a significant public health concern, as it promotes the spread of respiratory infections and other diseases due to inadequate ventilation and close contact (25, 26). Overcrowded households face challenges in maintaining sanitation, as space limitations hinder the construction of adequate facilities (12, 16). Large families are particularly at risk, as they require more space and resources to meet their needs (11).

The findings highlight the need for urgent interventions to improve sanitation access and reduce overcrowding. Addressing these issues will help mitigate the spread of infectious diseases, including emerging threats like COVID-19.

This study relied on self-reported data and did not assess the functional status of sanitation facilities. Additionally, the exact size of housing units was not measured. Future studies should include more objective measurements of these factors.

In conclusion, three-quarters of households in the study area lacked access to basic sanitation, and nearly 90% lived in overcrowded housing. Poor sanitation and overcrowding were more prevalent in households with uneducated heads and larger family sizes. Improving sanitation and housing conditions is essential to prevent the spread of infectious diseases in rapidly growing urban areas.

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