British Journal of Earth Sciences Research, 14(3),1-26, 2026
Print ISSN: 2055-0111 (Print)
Online ISSN: 2055-012X (Online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

Assessment of Toilet Adequacy and Determinants of Utilisation in Public Secondary Schools in Bauchi Metropolis

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doi: https://doi.org/10.37745/bjesr.2013/vol14n3126 Published April 17, 2026

Citation: Caleb T., Oladosu R. O., and Idris O. D. (2026) Assessment of Toilet Adequacy and Determinants of Utilisation in Public Secondary Schools in Bauchi Metropolis, *British Journal of Earth Sciences Research,* 14(3),1-26

Abstract: *This study investigates the toilet adequacy and determinants of their utilisation in public secondary schools within Bauchi Metropolis. Highlighting a fundamental global challenge, particularly in low-income regions such as Northern Nigeria, the study examines toilet facility deficiencies exacerbated by inadequate provision, water supply, poor maintenance, and limited gender sensitivity. A survey research design was adopted, while primary and secondary data were obtained from field surveys, direct physical observations, journal articles, and records of public secondary schools, among other sources. Through an empirical analysis of ten (10) purposively sampled schools, involving 365 respondents selected through simple random sampling, and the application of a binary logistic regression model, the study reveals that most schools significantly exceed international and local standards for student-to-toilet ratios, resulting in low utilisation rates and the persistence of open defecation practices. Key determinants of toilet utilisation, including cleanliness, accessibility, and water availability, were identified as critical factors in reducing open defecation. Despite some improvements in toilet accessibility, challenges related to gender sensitivity and hygiene persist, posing public health risks and undermining educational outcomes. The findings underscore the urgent need for policy interventions that emphasise adequate provision, regular maintenance, stakeholder engagement, and behavioural education to improve toilet facilities, align with international and local standards, and promote a safe and dignified learning environment.*
Keywords: toilet, adequacy, determinants, utilisation, schools

INTRODUCTION

The provision of adequate toilet facilities in schools is a critical component of a healthy learning environment and falls within the broader framework of Water, Sanitation and Hygiene (World

Health Organization [WHO], 2022). Water, Sanitation and Hygiene (WASH) are facilities providing safe water, sanitation, and hygiene to protect human health such as, toilets, handwashing stations and others. Toilets are sanitary facilities designed for the safe disposal of human excreta in a hygienic manner, thereby preventing disease transmission and promoting environmental cleanliness (Haruna *et al*., 2025). Toilet adequacy in public schools refers to the availability of sufficient, functional, accessible, clean, and gender-segregated facilities that meet the needs of the students (Lewkowitz & Gilliland, 2025). It also includes supporting elements such as water supply, handwashing facilities, privacy, and maintenance.

Globally, access to adequate sanitation in schools remains a significant challenge. According to the United Nations Children's Fund (UNICEF), about 427 million children worldwide lack basic sanitation facilities such as toilets in their schools, while over 646 million lack basic hygiene services (UNICEF, 2020). Furthermore, approximately 3.5 billion people globally still lack safely managed sanitation, indicating widespread infrastructural deficits (UNICEF, 2020). In many parts of Asia and Africa, studies such as Akundo *et al*. (2025), Yamada and Vu (2025), and Byansi *et al*. (2025) reveal that less than half of school toilets are functional, and a large proportion are either not gender-segregated or lack water supply. Even in developed regions such as the United States, disparities still exist, particularly in underserved communities, where aging infrastructure and poor maintenance continue to affect toilet adequacy (Leela, 2025).

Adequate toilet facilities in public schools are essential for students' and teachers' health, dignity, and academic performance. However, the mere provision of toilets does not guarantee their effective use, as several factors influence utilization patterns (Garn *et al*., 2014). These determinants include the cleanliness and maintenance of facilities, availability of water, privacy, safety, cultural norms, and gender sensitivity (Shao *et al*., 2021). In many developing urban areas such as Bauchi metropolis, poor infrastructure and weak management systems further discourage usage, leading to open defecation or avoidance behaviours. Understanding the determinants of toilet usage is therefore crucial for improving sanitation outcomes, promoting hygiene practices, and ensuring a conducive learning environment in public schools.

In Africa, the situation is more critical. Nigeria has one of the highest rates of open defecation globally, with about 46 million people affected, and only about 10 percent of schools having basic sanitation facilities such as toilets (UNICEF, 2020). National data also indicate that only about 7 percent of schools have access to basic WASH services, highlighting severe inadequacies (Haruna *et al.*, 2025). These deficiencies disproportionately affect girls, especially during menstruation, leading to absenteeism, reduced academic performance, and increased vulnerability to health risks and gender-based violence (Ugbede, 2025).

Public secondary schools are institutions established by government to cater for post-primary education in any settlement, town or city. In Bauchi Metropolis, similar challenges persist, particularly in public secondary schools where rapid population growth and inadequate funding have strained existing toilet facilities (Adamu *et al*., 2022). Common issues include insufficient

number of toilets relative to student population, poor maintenance, lack of water supply, and absence of gender-sensitive facilities (Oleabhiele *et al*., 2022). These problems not only compromise students' health and dignity but also hinder effective teaching and learning. Therefore, assessing the adequacy of toilet facilities and the determinants of their utilisation in public secondary schools in Bauchi Metropolis is essential for informing policy interventions and improving educational and sanitation outcomes.

Conceptual and Literature Review

Social equity in urban planning is strongly associated with John Rawls and later advanced in planning by David Harvey (Guy & McCandless, 2012). It emphasizes fairness in the distribution of resources, opportunities, and services within society. The concept claims that all individuals, regardless of socio-economic status, gender, or location, should have equal access to basic urban services (Guy & McCandless, 2020). It assumes that equitable provision leads to social justice and improved well-being, but it is limited by difficulties in implementation, resource constraints, and political influence (Wooldridge & Gooden, 2009). In relation to the study, social equity helps assess whether toilet facilities are fairly distributed and adequate across public secondary schools in Bauchi Metropolis. It highlights disparities in access, especially for vulnerable groups like female students, and supports the need for inclusive and equitable sanitation planning in schools.

Seventeen (17) Sustainable Development Goals (SDGs) were adopted by the United Nations in 2015 as part of the 2030 Agenda for global development (Rajendrakumar *et al.*, 2025). They aim to promote inclusive growth, environmental protection, and social well-being. One of the goals of the SDGs relevant to this study is Goal 6 (Clean Water and Sanitation), which targets universal access to adequate sanitation (Addie, 2025). The SDGs claims that coordinated global and local actions can achieve sustainable outcomes, but it is limited by funding gaps, weak governance, and uneven implementation across regions (Kedzior, 2024). In relation to the study, the SDGs provide a framework for evaluating the adequacy of toilet facilities in public secondary schools in Bauchi Metropolis. It helps assess whether schools meet acceptable sanitation standards and highlights the need for improved infrastructure to ensure healthy learning environments and sustainable urban development.

Adequate toilet facilities in schools are a fundamental component of Water, Sanitation and Hygiene (WASH) services, essential for students' health, dignity, and educational participation. Globally, inadequate sanitation in schools remains a major challenge, particularly in low and middle-income countries such as Nigeria, India and Cambodia, where a significant proportion of schools lack basic sanitation infrastructure (UNICEF, 2020). Evidence shows that inadequate toilet facilities contribute to disease transmission, absenteeism, and poor academic performance among students (UNICEF, 2020). Studies across Sub-Saharan Africa reveal persistent deficiencies in school toilets. For instance, only about 45% of schools in low-income countries have adequate toilet facilities, leading to overcrowding, open defecation, and unsafe hygiene practices among students (WHO, 2022).

According to the World Health Organization (WHO) and UNICEF guidelines under the Water, Sanitation and Hygiene (WASH) framework, the recommended standard for schools is approximately one toilet per 25 girls and one toilet per 30–50 boys, with additional provisions such as urinals for boys. In addition, this international standard recommends that there should be a minimum of one toilet within the required provision that is accessible to students with disabilities, as well as separate toilets for teaching and other staff in public schools. In Nigeria, for example, the Federal Ministry of Education stipulates a student-to-toilet ratio of one toilet per 30 students. Nevertheless, research in Nigeria indicates that many public schools suffer from insufficient toilets relative to the student population, poor maintenance, and a lack of water supply, which collectively reduce the usability and effectiveness of sanitation facilities (Wada *et al*., 2020).

In Nigeria, WASH deprivation among school-aged children is widespread. National data suggest that a large proportion of children lack access to safe sanitation, with public schools being the most affected. Studies such as Norling *et al*. (2016) show that poor toilet conditions in schools often force students to resort to open defecation, nearby bushes, or returning home during school hours. This practice not only undermines hygiene but also exposes students to preventable diseases such as cholera, diarrhoea, and helminth infections (Ekpo *et al*., 2008). In addition, gender disparities are evident, as inadequate toilet privacy and lack of menstrual hygiene facilities disproportionately affect female students, often leading to school absenteeism or dropout (Kaka *et al*., 2022).

Within Northern Nigeria, including Bauchi State, the situation is particularly concerning. Some secondary schools indicate that toilet facilities are often dilapidated, insufficient, or non-functional, resulting in students avoiding their use entirely. In some cases, schools with large student populations operate with only a few functional toilets, creating long queues and unhealthy sanitation practices (Haruna *et al.*, 2025). These conditions have been associated with health risks and occasional outbreaks of sanitation-related diseases in school communities.

The utilisation of toilet facilities in schools is influenced by several determinants. Key factors include the availability and accessibility of facilities, cleanliness, water supply, privacy, safety, and maintenance. Studies such as Bodinga *et al.* (2025) and Uwadia *et al.* (2022) show that when toilets are clean, functional, and gender-segregated, students are more likely to use them consistently. Conversely, poor maintenance, unpleasant odour, broken doors, lack of water, and absence of soap, discourage utilisation even when facilities are available. Overcrowding and high student-to-toilet ratios further worsen utilisation patterns, as students may avoid using facilities due to long queues and poor hygiene conditions (Enitan *et al*., 2021). Behavioural and socio-cultural factors also play a role in toilet utilisation. Peer influence, hygiene awareness, and cultural beliefs about purity and cleanliness can either encourage or discourage toilet use (Routray *et al*., 2015). Inadequate sanitation education and lack of enforcement of hygiene practices can also contribute to poor utilisation habits among students.

Empirical studies conducted in Nigeria and other developing countries such as Ghana, reveal a consistent pattern of poor condition of toilets in public schools. A study by Mynepalli *et al.* (2014)

on school facilities in Lagos State found that over 60% of public schools lacked functional toilet facilities, with many students resorting to open defecation. Similarly, a study in Ghana by Tiswin *et al.* (2019) showed that inadequate sanitation facilities were a major factor in high dropout rates among adolescent girls. In northern Nigeria, Lawal *et al.* (2025) conducted an assessment of sanitation in government secondary schools and found that while some schools had toilets, they were either broken, lacked water, or were not gender-segregated, making them unsuitable for effective use. However, these studies were conducted in locations other than Bauchi metropolis. In addition, the determinants of toilet usage were not properly documented in these studies.

The Study Area

Bauchi Metropolis lies between latitude 10°15′00″N and 10°20′00″N, and longitude 09°45′00″E and 09°55′00″E in northeastern Nigeria (Figures 1-4). The city has a rich administrative history dating to the early nineteenth century, and Bauchi State was created in 1976. Administratively, Bauchi has evolved from an emirate capital to a provincial headquarters under British colonial rule, and subsequently to a state capital, reflecting its enduring political and administrative significance.

The Metropolis experiences two distinct climatic seasons: wet and dry. The wet season spans May to October and is characterized by slightly lower temperatures and high relative humidity, reaching about 94% in August, with peak rainfall averaging 372–430 mm. The dry season extends from November to February and includes the Harmattan period, marked by dusty winds, reduced visibility, and low temperatures (Ibrahim *et al*., 2025).

The area is well drained by surface water and underlain by low-lying rocks interspersed with prominent inselbergs such as Warinji, Zaranda, Miri, and Dumi hills. It is situated on upland terrain composed of ancient crystalline basement complex rocks. Vegetation is predominantly mixed leguminous wooded savanna, largely classified as plateau grass savanna (Enwerem, 2006). The population is largely composed of civil servants employed in government agencies, although part-time farming remains a common supplementary livelihood (Ibrahim *et al*., 2025).

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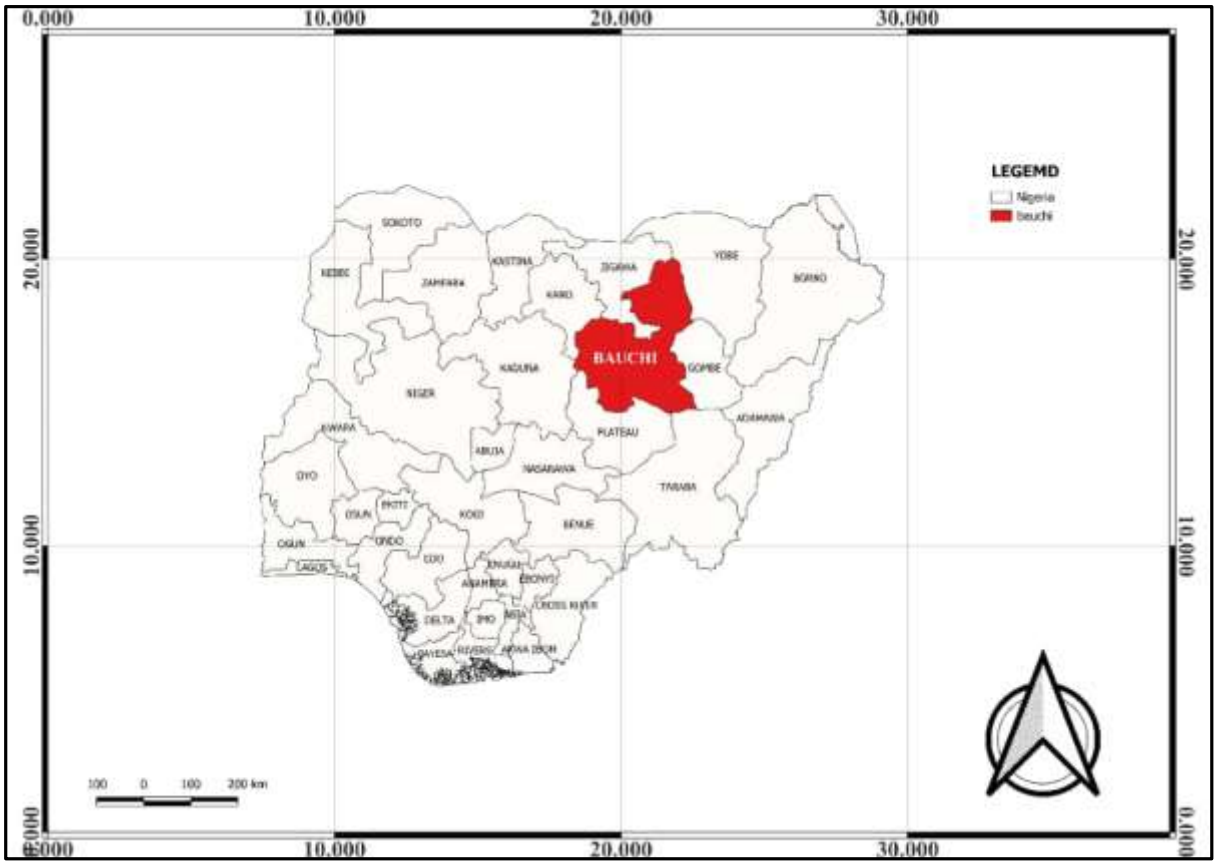

Figure 1: Bauchi State in Nigeria
Source: Bauchi State Ministry of Land and Survey (2024)

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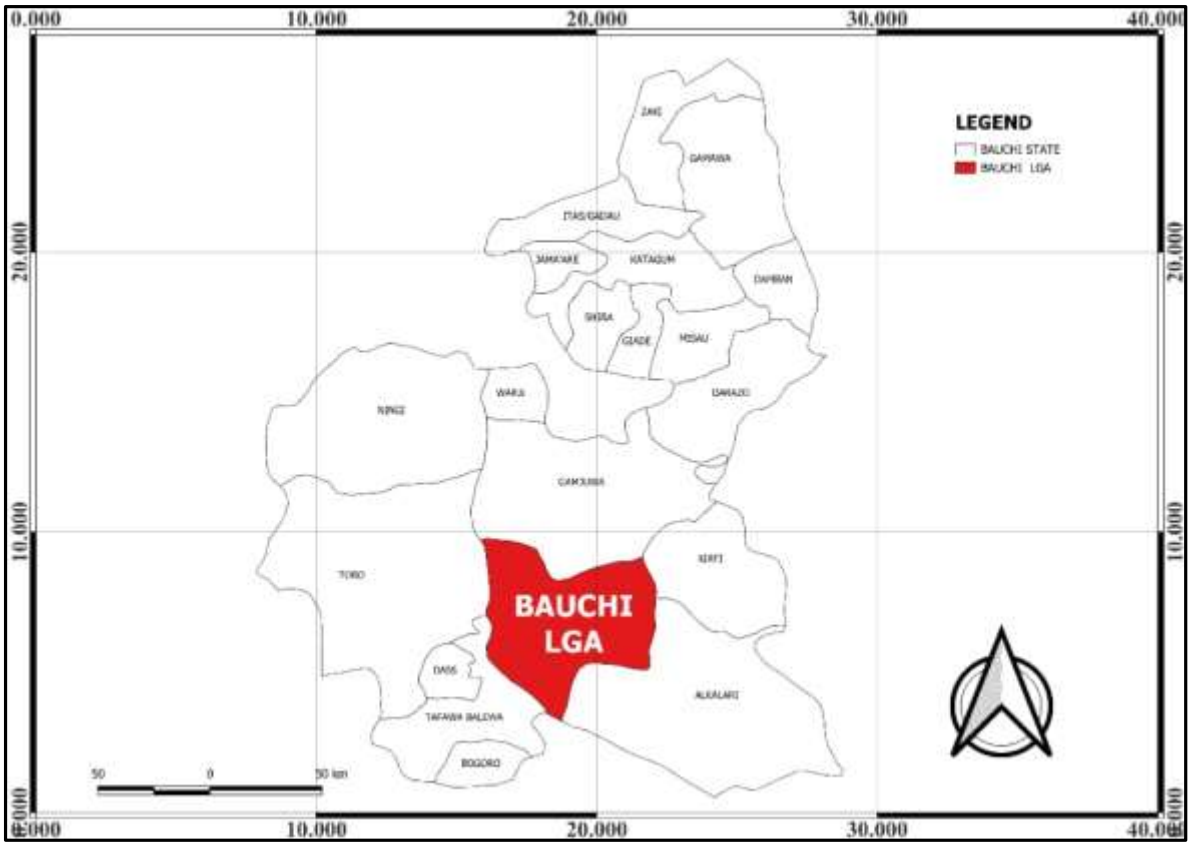

Figure 2: Bauchi Local Government Area in Bauchi State
Source: Bauchi State Ministry of Land and Survey (2024)

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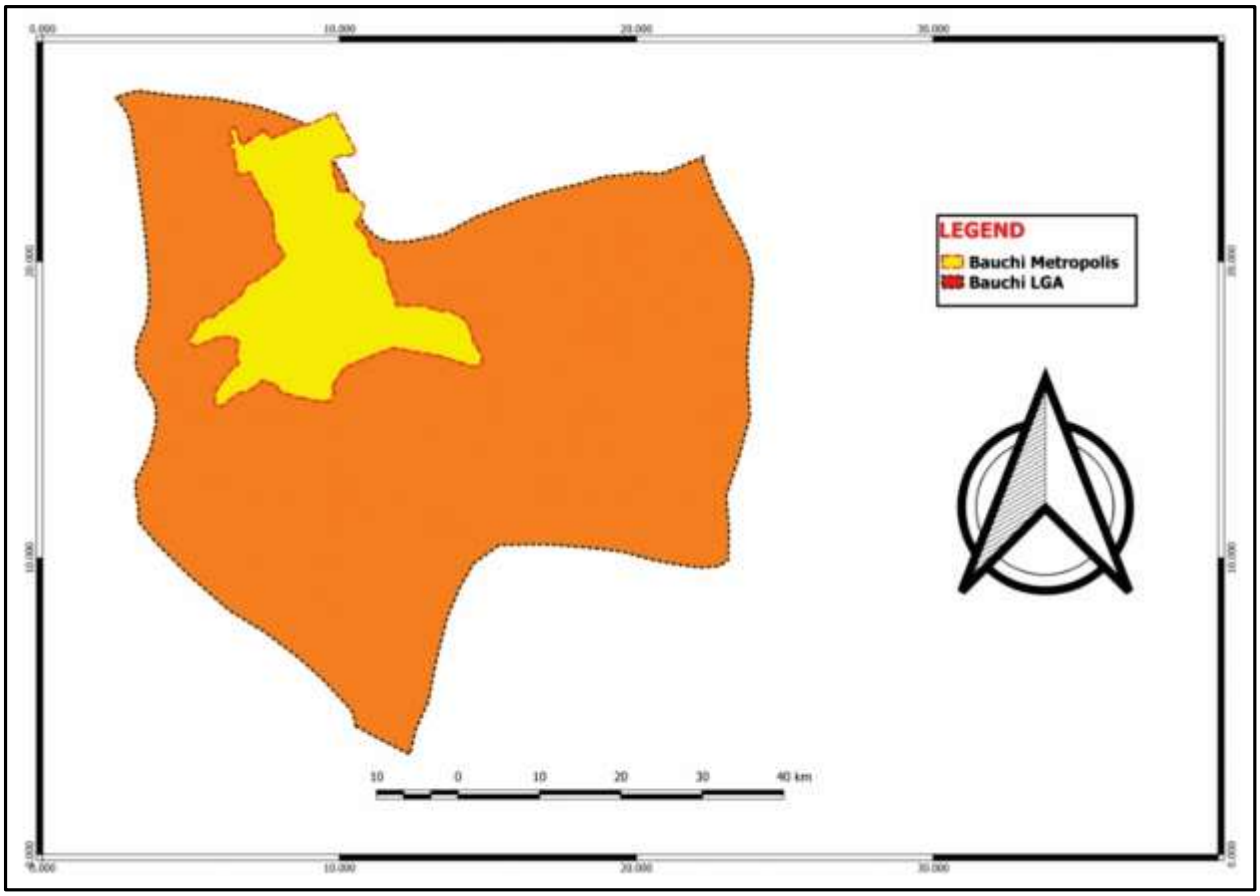

Figure 3: Bauchi Metropolis in Bauchi Local Government Area
Source: Bauchi State Ministry of Land and Survey (2024)

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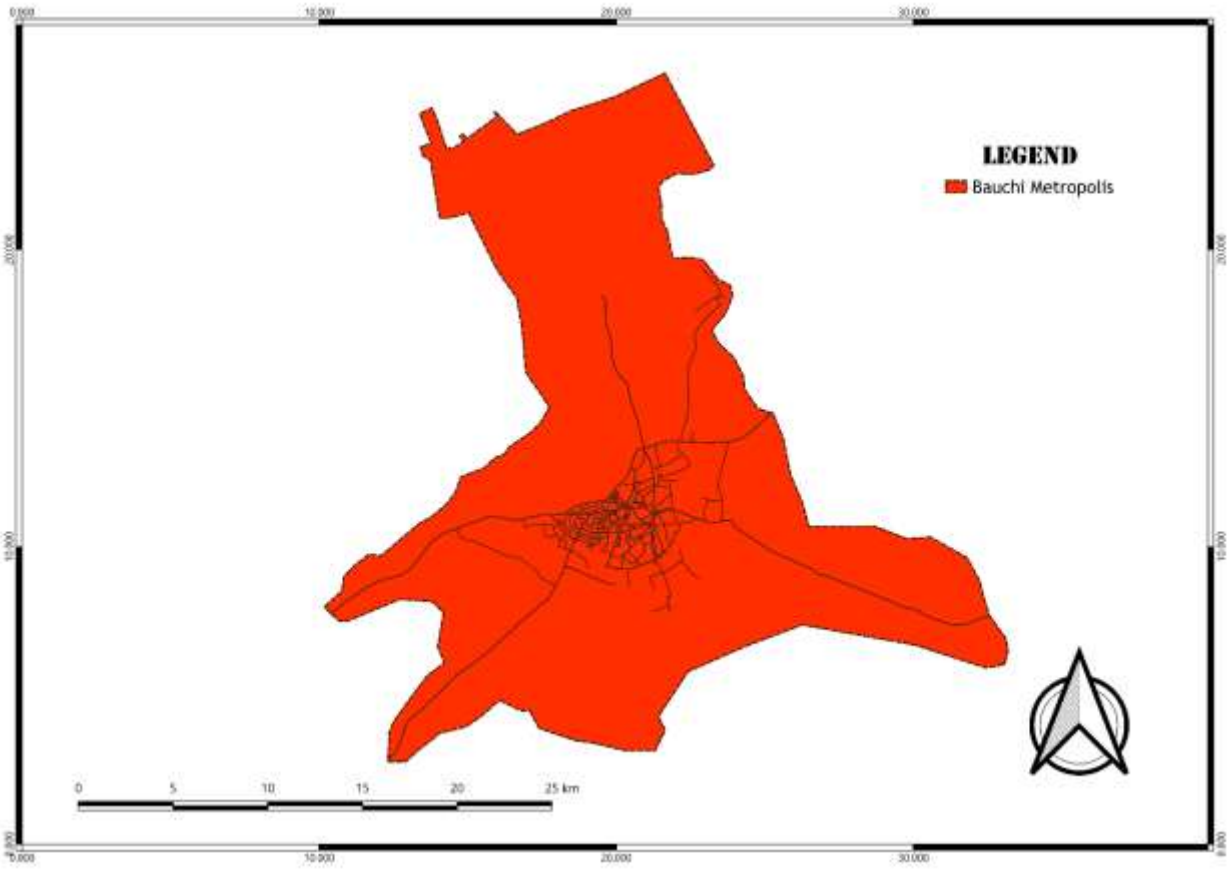

Figure 4: Bauchi Metropolis
Source: Bauchi State Ministry of Land and Survey (2024)

METHODOLOGY

The study is non-experimental in nature and employs a range of techniques, including field surveys and observations; hence, a survey research design was adopted. The study population comprises all students and staff in the sampled secondary schools, including the principals of these schools. Primary data were collected through field surveys and direct physical observations, while secondary data were obtained from journal articles, textbooks, and records from public secondary schools. The data required for the study include information on the adequacy of toilet facilities and the determinants of their utilisation.

There are seventy-four (74) public secondary schools in Bauchi Metropolis (Appendices I–II). However, ten (10) schools were sampled for the study. These schools were purposively sampled to reflect relevant characteristics, including large and underdeveloped schools, as well as both boarding and day schools. Specifically, the sample comprised three boarding schools, four large schools, one technical school, and two underdeveloped schools (Table 1).

The sampling frame for the quantitative data consists of 7,452 staff and students from the ten sampled public secondary schools. For the qualitative component, the sampling frame comprises the principals of the sampled schools. The sample size for staff and students was 365, determined using the Krejcie and Morgan Sample Size Determination Table. Similarly, the qualitative sample size consisted of the ten (10) principals of the sampled schools.

A proportional quota sampling technique was used to determine the number of questionnaires to be distributed in each school (Table 2). Simple random sampling was employed to administer the 365 copies of the structured questionnaires to staff and students, while purposive sampling was used to select the principals. Data collection instruments included two sets of structured questionnaires for students and staff, as well as for the principals; geospatial tools (GIS version 10.5 and GPS) for mapping the sampled schools; a camera; and the Statistical Package for the Social Sciences (SPSS) for data analysis.

The questionnaire designed for the assessment of toilet adequacy and determinants of utilisation was subjected to validity and reliability testing prior to the field survey. Content and face validity were ensured through expert review by researchers in urban sanitation and urban planning. To establish reliability, the test–retest method was employed by administering the questionnaire to respondents in a similar school setting in Bauchi Metropolis on two different occasions. The results from both administrations were examined. Since there was a similarity in the responses and scores, that is, in the first and second questionnaire administration, then the research instruments and the measured variables were considered to be reliable.

The geographic coordinates of each sampled school were obtained using a Global Positioning System (GPS) and integrated into a map of Bauchi metropolis using ArcGIS software (Figure 5)

to determine the spatial distribution of the sampled schools within the study area. Pictures of the conditions and usage of toilets were taken with the use of a camera. The researchers, assisted by ten (10) field assistants, visited each sampled school during break periods (between 10:00 a.m. and 10:30 a.m.) and (12:30 p.m. and 12:45 p.m.) to administer the questionnaires using simple random sampling. English was used for the questionnaire administration, as it is the official language of instruction in the sampled schools. The data collection exercise lasted for twenty (20) school days. The data was analysed using SPSS. The relationship of open defecation practices and determinants of toilet utilization was analysed using the binary logistic regression model.

Table 1: Sampled Schools

Name of School	Category
General Hassan Usman Katsina Unity College (GHUKUC) Bauchi	Boarding
Government Comprehensive Day Secondary School (GCDSS) Bauchi	Large school
Government Day Secondary School (GDSS)Bayara	Underdeveloped
Government Day Secondary School (GDSS) Kofar Wambai	Large school
Government Girls' College (GGC) Bauchi	Boarding
Federal Government Girls' College (FGGC) Bauchi	Boarding
Government Day Secondary School Bakari Dukku (GDSS)	Large school
Government Day Technical College (GDTC) Bauchi	Technical college
Government Day Secondary School (GDSS) Army Barracks	Large school
Government Day Secondary School (GDSS) Federal Lowcost	Underdeveloped

Source: Researchers' (2024)

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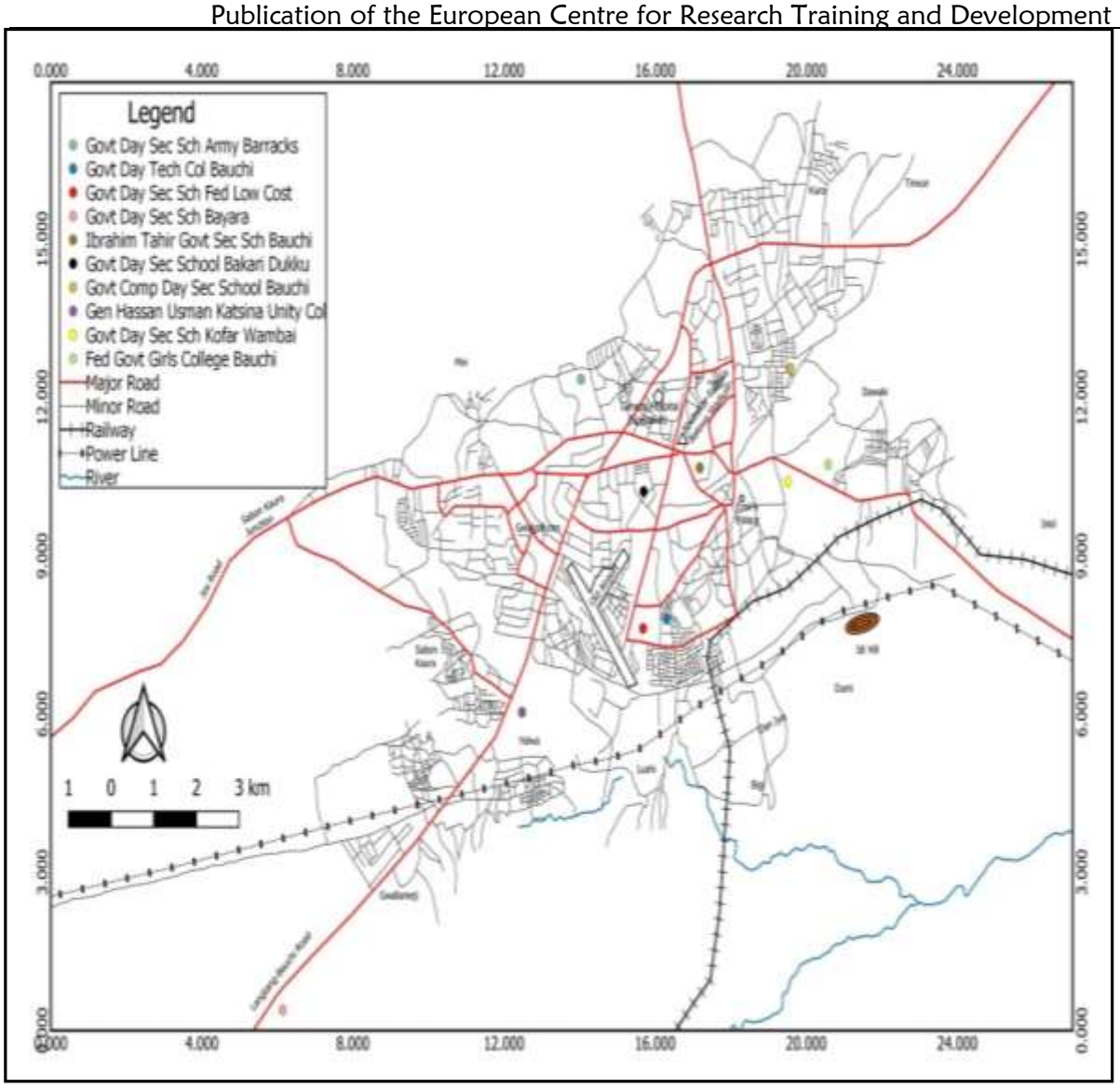

Figure 5: Spatial Distribution of the Sampled Public Secondary Schools
Source: Researchers' (2024)

Table 2: Population in Sampled Schools and Questionnaire Distribution

S/N	Name of School	Population		Total	Number of Questionnaire
		Students	Staff		
1	General Hassan Usman Katsina Unity College (GHUKUC) Bauchi	980	41	1,021	51
2	Government Comprehensive Day Secondary School (GCDSS) Bauchi	1,055	43	1,098	54
3	Government Day Secondary School (GDSS) Bayara	820	33	853	40
4	Government Day Secondary School (GDSS) Kofar Wambai	820	31	851	40
5	Government Girls' College (GGC) Bauchi	780	49	829	40
6	Federal Government Girls' College (FGGC) Bauchi	649	42	691	33
7	Government Day Secondary School Bakari Dukku (GDSS)	560	25	585	33
8	Government Day Technical College (GDTC) Bauchi	530	27	557	26
9	Government Day Secondary School (GDSS) Army Barracks	501	25	526	26
10	Government Day Secondary School (GDSS) Federal Lowcost	423	21	441	22
				7,452	**365**

Source: Researchers' (2024)

Adequacy of Toilet Facilities

The adequacy of existing toilet facilities across secondary schools in the study area was assessed based on their availability and physical condition. It was determined using the population of the sampled schools, number of available toilets, and the student-to-toilet ratio. For example, in order to determine the student-to-toilet ratio for FGGC Bauchi the total number of students (649) was divided by the number of existing toilets in the school which is 16. The result of the division was approximately 41. This indicates that the student-to-toilet ratio in FGGC Bauchi is 1:41. Table 3 presents the ratio of students to available toilet facilities in the selected schools. The results show that FGGC Bauchi has one toilet per 41 students; GGC Bauchi, one toilet per 37 students; GHUKUC, one toilet per 75 students; GCDSS, one toilet per 264 students; GDTC, one toilet per 31 students; and GDSS Bakari Dukku, one toilet per 112 students. Similarly, GDSS Army Barracks has one toilet per 167 students; GDGSS, one toilet per 205 students; GDSS Federal Low-Cost, one toilet per 106 students; and GDSS Bayara, one toilet per 205 students.

In order to determine the required number of toilets based on the Federal Ministry of Education of Nigeria's standard of one toilet per 30 students, the total number of students in a given sampled school was divided by 30 students. For example, in the case of FGGC Bauchi, the total number of students was 649 and it was divided by 30 students. The result of this division is twenty-two (22) toilets. Therefore, in order for the toilets to be adequate in this school, there is need to provide additional six (6) toilets since the existing toilets in FGGC Bauchi is 16. The findings of this study reveal that most schools have ratios that far exceed this benchmark, with some schools recording ratios as high as one toilet per 264 students. Only a few schools, such as GDTC (1:31) and GGC Bauchi (1:37), fall within a relatively manageable range, although they still do not meet the recommended standard. The majority of schools, however, operate under severely overstretched conditions, reflecting substantial toilet facility deficits.

Furthermore, the findings suggest that inadequate toilet provision may contribute to low utilization rates, as students may avoid using facilities that are unhygienic or insufficient. Maity (2026) reiterates that lower student-to-toilet ratios indicate greater adequacy, while higher ratios reflect insufficient, overburdened, and inadequate toilet facilities.

Table 3: Student-to-Toilet Ratio in Sampled Public Secondary Schools

Sampled Schools	Students' Population	Existing Toilets	Ratio	Required Number of Toilets	Short Fall	Remark
FGGC, Bauchi	649	16	1:41	22	6	Inadequate
GGC, Bauchi	780	21	1:37	26	5	Inadequate
GHUKUC, Bauchi	980	13	1:75	33	20	Inadequate
GCDSS, Bauchi	1,055	4	1:264	35	31	Inadequate
GDTC, Bauchi	530	17	1:31	18	1	Inadequate
GDSS Bakari Dukku	560	5	1:112	19	14	Inadequate
GDSS Army Barracks	501	3	1:167	18	15	Inadequate
GDGSS Kofar Wambai	820	4	1:205	27	23	Inadequate
GDSS Federal Low-cost	423	4	1:106	14	10	Inadequate
GDSS Bayara	820	4	1:205	27	23	Inadequate

Source: Researchers' (2024)

Toilet Utilization and Open Defecation Practices

The frequency of toilet usage by the respondents is presented in Table 4. The results show that 20.3% use the toilet facilities frequently. About 26% use the toilet facility sometimes while 'not frequently' and 'no usage' has a response of 36.4% and 17.3% respectively. Higher toilet adequacy increases usage frequency, while inadequate facilities reduce usage and encourage avoidance behaviours among students. Hermano (2026), also claims that frequency of toilet utilization is directly proportional to their functionality and adequacy.

Concerning the practice of open defecation, 17.3% of respondents reported practicing it daily, while 7.9% indicated that they do not frequently engage in the practice. Approximately 9.3% rarely defecate openly, whereas 65.5% do not practice open defecation at all. This suggests that the surrounding environments of some public secondary schools in Bauchi Metropolis are characterized by the presence of human fecal waste, which may lead to environmental pollution within the school premises. In some instances, open defecation occurs within the toilet facilities themselves, where students dispose of fecal wastes and urine around the surroundings of toilet pits rather than directly into them (Figure 3). Li *et al.* (2026) argue that inadequate toilet facilities contribute to open defecation practices among students due to poor access, congestion, and unhygienic conditions.

Concerning the negative impact on the school environment and the surrounding neighbourhood, the results shows that 55.9% strongly agreed that open defecation has negative impacts on the school environment and the surrounding neighbourhood, while 20% also agreed. However, 8.2% do not agree, 6% were undecided and 9.9% strongly disagreed to the negative impacts of open defecation.

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Table 4: Frequency of Toilet Utilisation and Open Defecation Practices

Category	Items	Students and Staff	Per cent
Frequency of toilet usage	Frequently	74	20.3
	Sometimes	95	26.0
	Not frequently	133	36.4
	No Usage	63	17.3
		365	**100.0**
Practices of open defecation	Frequently (daily)	63	17.3
	Not frequently	29	7.9
	Rarely	34	9.3
	No open defecation	239	65.5
		365	**100.0**
Open defecation has negative impact on the school environment and neighbourhood.	Strongly agreed	204	55.9
	Agreed	73	20.0
	Disagreed	30	8.2
	Undecided	22	6.0
	Strongly disagreed	36	9.9
		365	**100.0**

Source: Researchers' (2024).

Figure 3: Practice of Open Defecation within a Pit Toilet in GDSS Bakari Dukku
Source: Researchers' (2024)

Determinants of Toilet Utilisation

The determinants of toilet usage, with particular emphasis on accessibility, cleanliness, ventilation, water supply, gender sensitivity, safety, and hygiene practices is presented in Table 5. The survey data, organised using a Likert scale, revealed diverse perceptions among respondents, providing valuable insights into user experiences. Analysis of central tendency, particularly the mean scores, indicates that accessibility was rated most favourably, with a mean score of 4.33, suggesting that respondents generally considered the facilities to be easily accessible. Cleanliness also received a positive evaluation, with a mean score of 4.07, reflecting favourable perceptions of sanitary conditions. Ventilation and safety, with mean scores of 4.19 and 3.90, respectively, also indicate general satisfaction, although slightly lower than those of accessibility and cleanliness.

Nevertheless, several issues of concern were identified, particularly in the area of water supply, gender sensitivity, and hygiene practices, all of which recorded scores below the neutral threshold of 3. The mean score for water supply was 3.55, indicating potential challenges in consistency or adequacy. Meanwhile, gender sensitivity, with a mean of 3.14, and hygiene practices, with a mean of 3.21, reflected noticeable dissatisfaction or disagreement, suggesting that these areas require prompt attention. Although the overall mean score of 3.77 indicates a generally positive perception of the facilities, variations in the individual scores highlight the need for improvement.

The analysis of data dispersion, as indicated by the standard deviations, provides further insights into the variability of respondents' opinions. Gender sensitivity and hygiene practices exhibited the highest standard deviations, at 1.55 and 1.58, respectively, indicating a wide range of views and potential contention in these areas. This suggests that perceptions of these factors were not uniform, and that interventions would need to address diverse concerns. In contrast, accessibility had the lowest standard deviation of 1.15, implying greater consistency in respondents' views. Cleanliness, ventilation, water supply, and safety exhibited moderate variability, suggesting that although there was general agreement, differing perspectives still existed. These variations underscore the importance of considering the nuanced perceptions of users when addressing the determinants of toilet facility utilisation.

The practical implications of these findings are significant. The high mean scores for accessibility, cleanliness, ventilation, and safety suggested that maintaining these standards would be crucial for continued user satisfaction. However, the lower mean scores for water supply, gender sensitivity, and hygiene practices indicated that targeted interventions were necessary. In order to improve water supply, ensuring a consistent and adequate supply would be paramount. This could involve infrastructure improvements and regular maintenance. Regarding the issue of gender sensitivity, providing separate facilities and addressing cultural or social norms would be essential. In the case of hygiene practices, implementing effective waste disposal systems and promoting better hygiene practices through education would be necessary. The high standard deviations for gender sensitivity and hygiene practices highlighted the need for interventions that could address diverse concerns and opinions.

Table 5: Determinants of Toilet Utilisation

Variables	SA (5)	A (4)	UD (3)	D (2)	SD (1)	Total	Mean	SD
Accessibility	38.36% (140)	31.51% (115)	5.48% (20)	13.70% (50)	10.96% (40)	365	4.33	1.15
Cleanliness	54.79% (200)	19.18% (70)	6.85% (25)	13.70% (50)	5.48% (20)	365	4.07	1.34
Ventilation	40.55% (148)	25.48% (93)	13.15% (48)	16.71% (61)	4.11% (15)	365	4.19	1.25
Water Supply	26.03% (95)	26.85% (98)	6.85% (25)	28.77% (105)	11.51% (42)	365	3.55	1.45
Gender Sensitivity	28.77% (105)	26.03% (95)	4.11% (15)	19.73% (72)	21.37% (78)	365	3.14	1.55
Safety	43.84% (160)	27.40% (100)	2.74% (10)	13.42% (49)	12.60% (46)	365	3.90	1.39
Hygiene practices	28.77% (105)	26.85% (98)	5.48% (20)	19.73% (72)	19.18% (70)	365	3.21	1.58
Grand Mean							**3.77**	

SA (Strongly Agreed); A (Agreed); UD (Undecided); D (Disagreed), SD (Strongly Disagreed)
Source: Researchers' (2024)

Table 6 presents the results of a binary logistic regression analysis predicting the practice of open defecation from various determinants of toilet utilisation. The model examined the predictive influence of toilet accessibility, cleanliness, ventilation, water supply, gender sensitivity, safety, and hygiene practices. The analysis revealed that all predictors were significantly associated with the likelihood of practicing open defecation, with varying degrees of influence.

The coefficients (B) in the table represents the change in the log-odds of practicing open defecation for a one-unit increase in the predictor variable, holding all other variables constant. Notably, all predictor variables exhibited negative coefficients, indicating an inverse relationship with the practice of open defecation. For instance, toilet cleanliness had a coefficient of -1.20 ($p < .001$), suggesting that better cleanliness significantly reduces the likelihood of open defecation. Similarly, toilet accessibility ($B = -0.85$, $p < .001$), water supply ($B = -0.90$, $p < .001$), and hygiene practices

(B = -1.10, p < .001) also demonstrated strong negative associations, indicating that improvements in these areas substantially decrease the odds of open defecation. Ventilation (B = -0.50, p = .005), gender sensitivity (B = -0.60, p = .004), and safety (B = -0.40, p = .035) also showed significant negative relationships, albeit with slightly weaker effects compared to the other variables.

The standard errors (SE) for each coefficient reflect the precision of the estimates. Smaller SE values indicate greater precision. The p-values associated with each predictor were all statistically significant, ranging from p < .001 to p = .035. This significance is further emphasized by the asterisks denoting the level of significance: *** for p < .001, ** for p < .01, and * for p < .05. The constant term, representing the log-odds of open defecation when all predictors are zero, was also statistically significant (B = 2.50, p < .001).

The overall goodness-of-fit of the model was assessed using several metrics. The Nagelkerke R^2 value of 0.42 indicates that the model explained 42% of the variance in the practice of open defecation, suggesting a moderately strong predictive capacity. The Hosmer-Lemeshow test, with $\chi^2(8) = 10.50$ and p = .23, indicated a good fit between the model and the data, as a non-significant p-value suggests that the model's predictions do not significantly deviate from the observed data. The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were 450.20 and 485.50, respectively. These values provide a measure of model fit while penalizing for complexity, and can be used to compare different models.

The findings of this logistic regression analysis highlight the critical role of toilet facility determinants in predicting the practice of open defecation. The significant negative coefficients across all predictors underscore the importance of improving toilet facilities to reduce open defecation. Interventions aimed at enhancing cleanliness, accessibility, water supply, and hygiene practices are likely to yield the most substantial reductions in open defecation. Additionally, addressing ventilation, gender sensitivity, and safety concerns can further contribute to positive behavioural changes. The model's significant goodness-of-fit measures suggest that it provides a reliable framework for understanding and predicting open defecation practices in the given population.

Table 6: Binary Logistic Regression Predicting Open Defecation Practice from the Determinants of Toilet Utilisation

Predictors	Coefficient (B)	SE	p-value	Significance
Toilet Accessibility	-0.85	0.20	<.001	***
Toilet Cleanliness	-1.20	0.25	<.001	***
Ventilation	-0.50	0.18	.005	**
Water Supply	-0.90	0.22	<.001	***
Gender Sensitivity	-0.60	0.21	.004	**
Safety	-0.40	0.19	.035	*
Hygiene Practices	-1.10	0.24	<.001	***
Constant	2.50	0.30	<.001	***

Goodness of fit AIC: 450.20, BIC: 485.50, Nagelkerke R^2: 0.42, Hosmer-Lemeshow Test: $\chi^2(8) = 10.50$, $p = .23$, * $p < .05$, ** $p < .01$, *** $p < .001$, SE (Standard error)

Conclusion and Recommendations

The study assessed the adequacy of toilet facilities and determinants of utilisation in public secondary schools in Bauchi Metropolis. Findings revealed severe inadequacy of toilets with most schools exceeding international standards of student-to-toilet ratios. Although some facilities were accessible and relatively clean, issues of water supply, gender sensitivity, and hygiene practices remained weak. Toilet utilisation was generally low, while open defecation persisted among students. The analysis further confirmed that toilet cleanliness, accessibility, water availability, and hygiene practices significantly influence usage patterns and reduce open defecation behaviour. Overall, inadequate sanitation infrastructure undermines health, dignity, and effective learning in schools. Government and school administrators should prioritize the provision of adequate, gender-segregated toilet facilities in line international standards. Regular maintenance, consistent water supply, and improved hygiene education should be ensured to enhance utilisation. Schools should strengthen monitoring systems and involve stakeholders in sanitation management. Additionally, targeted interventions focusing on cleanliness, safety, and behavioural change campaigns are necessary to discourage open defecation and promote healthy sanitation practices among students in Bauchi Metropolis schools.

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Appendix I: List of Senior Secondary Schools in Bauchi

S/N	Name of School
1	Government Day Secondary School Army Barracks
2	Government Comprehensive Day Secondary School Bakari Dukku
3	Government Day Secondary School Bakari Dukku
4	Government Comprehensive Day Secondary School Bauchi
5	Government Girls College Bauchi
6	Government Day Technical College Bauchi
7	General Hassan Usman Katsina Unity College Bauchi
8	Married Women Secondary School Bauchi
9	SEC Bauchi
10	WEC Bauchi
11	Women Education Centre Bauchi
12	Government Day Secondary School Bayera
13	Government Girls Day Secondary School Birshin Fulani
14	BSADP Model School(Special School)
15	GCSS Dr.Ibrahim Tahir
16	Government Day Secondary School Federal Lowcost
17	Government Girls Day Secondary School Games Village
18	Government Day Secondary School Gwallameji
19	Jibril Aminu Model Girls Day Secondary (Special School)
20	Government Girls Day Secondary School Kofar Idi
21	Government Girls Day Secondary School Kofar Wambai
22	Government Girls Comprehensive Day Secondary School Saadu Zungur
23	Government Day Secondary School Tudun Salmanu
24	Tambari Model School(Special School)
25	Government Day Secondary School Miri

Appendix II: List of Junior Secondary Schools

S/N	Name of School
26	Dr Ibrahim Tahir Junior Secondary School Bauchi
27	Government Comprehensive Junior Secondary School Bakari Dukku
28	Government day Junior Secondary School Bakari Dukku
29	Government Girls Junior Secondary School Bauchi
30	Government Junior Secondary Babasidi
31	Government Junior Secondary School Birshin Fulani
32	Government Junior Secondary School Federal Lowcost
33	Government Junior Secondary School Hospital Quarters
34	Government Junior Secondary School Inkil
35	Government Junior Secondary School Jahun 1
36	Government Junior Secondary School Jahun Waya Makafi
37	Government Junior Secondary School Lushi
38	Government Junior Secondary School Miri
39	Government Junior Secondary School Saleh Manga
40	Government Junior Secondary School Adamu Jumba
41	Government Junior Secondary School Babban Mutum
42	Government Junior Secondary School Army Barracks
43	Government Junior Secondary School Bayara
44	Government Junior Secondary School Birshin Gandu
45	Government Junior Secondary School Dan Gikka
46	Government Junior Secondary School kofar Dumi
47	Government Junior Secondary School Fadamar Mada
48	Government Junior Secondary School Games Village
49	Government Junior Secondary School Garba Mohammed Noma
50	Government Junior Secondary School GHUKUC
51	Government Junior Secondary School Gwallagan Mayaka

52	Government Junior Secondary School Gwallameji
53	Government Junior Secondary School Ibrahim Bako
54	Government Junior Secondary School Kandahar
55	Government Junior Secondary School Kobi
56	Government Junior Secondary School
57	Government Junior Secondary School Kofar Nassarawa
48	Government Junior Secondary School Kofar Wase
59	Government Junior Secondary School Married Women Bauchi
60	Jibril Aminu Model Junior Secondary School
61	Government Junior Secondary School Rimin Jahun
62	Government Junior Secondary School Saadu Zungur
63	Government Junior Secondary School Special Education Centre Yelwa
64	Government Junior Secondary School Tudun Gambo
65	Government Junior Day School Tudun Salmanu
66	Government Junior Day School Wuntin Dada
67	Government Junior Day School Zannuwa
68	Government Junior Day School Unguwar Borno
69	Government Junior Day School Sabon Kaura ATBU
70	Government Junior Technical College Bauchi
71	Government Junior Secondary School Yelwan Makaranta
72	Federal Government Girls College Bauchi
73	Government Junior Secondary School Ibrahim Bako
74	Government Junior Secondary School Tirwun