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Thesis on epidemiology and management of infectious comorbidities among individuals living with Type 2 diabetes mellitus at general hospitals in Bayelsa State Nigeria: Discussion of mixed-method study

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Abstract

Objective: This study examined the prevalence of infectious comorbidities among individuals living with Type 2 Diabetes Mellitus (T2DM) attending General Hospitals in Bayelsa State, Nigeria. The study was anchored on the Epidemiologic Triad Theory (Agent–Host–Environment Model), which explains disease occurrence through the interaction of susceptible hosts, infectious agents and environmental factors.

Method: A hospital-based cross-sectional descriptive design was adopted. Primary data was collected using structured questionnaires administered to 133 individuals living with T2DM and 85 healthcare management staff. Secondary data were obtained from hospital records of 243 diabetic patients using a checklist. Respondents were selected through multistage sampling involving purposive selection of hospitals, proportionate allocation and simple random sampling. Descriptive frequencies, percentages, prevalence estimates and 95% confidence intervals addressed research questions One to Three, while cross-tabulations, Pearson Chi-square tests examined associations. Mean scores, standard deviations and coefficients of variation were used to evaluate healthcare management practices.

Results: There is significant difference in the prevalence of T2DM between various stratified age groups ($p < 0.05$). There is significant difference in the level of bacteria, fungal, and viral infections between DM patients ($p < 0.001$); and the proportions of various infections between stratified durations of T2DM ($p < 0.001$). Participants are undecided about the influence of these factors; and there is gap between knowledge and management practice.

Conclusion: Infectious comorbidities remain a major public health concern among patients with T2DM. It recommends routine infection screening, improved glycaemic control, strengthened patient education, multidisciplinary diabetes care, enhanced laboratory diagnostic services and continuous capacity building for healthcare professionals.

Keywords: T2DM, infection, comorbidities

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1. Introduction

The first literature review highlighted that:

> "Type 2 diabetes mellitus (T2DM) is commonly associated with infectious disease complications. Primary healthcare services including health promotion is one of the preventive medicine options … Outcome: The Alma Ata concept is a major program in primary healthcare service. However, the low-mid-income countries have yet to equip their facilities for expected quality services. The healthcare providers and users also have their behavioural change wheel factors that need to be addressed. Microbial infections in diabetes are quite varied but there is established model for quality management at the primary healthcare level … Understanding the concepts of primary healthcare services, the Alma Ata declarations, and the current limitations in low-mid-income countries require all stakeholders. Knowledge of the model of care for immunocompromised individuals is imperative. Promotion of behavioural change wheel for both healthcare providers and users is imperative ti achieve quality primary healthcare services to improve the lives affected individuals living with T2DM" (Ogbara et al., Jul 2025).

The second literature review emphasized that:

> "Diabetic foot ulcer (DFU) is a common complication among people living with diabetes mellitus (DM). Infection is a very common comorbidity in diabetes, which constitutes a risk factor for this complication. However, the knowledge of microbial spectrum associated with DM and/or DFU in Bayelsa State, Nigeria is unknown. Objective: To identify empirical epidemiology, health promotion and primary healthcare data on infections and infectious disease management among individuals living with DM … Empirical findings on the three themes i.e. epidemiology, primary healthcare preventive management and milestone achievements of health promotion in diabetes care are discussed. Addition fourth section of discussion is focused on DFU" (Ogbara et al., Aug 2025)

Objectives The study proposal was aimed "to evaluate the prevalence of infection co-morbidities among individuals living with T2DM in General Hospitals in the eight (8) Local Government Areas of Bayelsa State" (Ogbara et al., 2025); with specific objectives outlined to include

1. To determine the prevalence of T2DM in the study population.
2. To identify the common comorbid infections associated with T2DM in Bayelsa State.

3. To determine the prevalence of common comorbid infections among T2DM patients.
4. To identify risk factors for common comorbid infections among T2DM patients.
5. To ascertain the management practices of common comorbid infections among T2DM patients.

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2. Methods

Design: This was mixed methods research. Table 1 presents a snapshot of statistical designs. Other details are as published/registered on repository (Ogbara & Nwose, 2026).

Table 1: Research objectives matching design and data proposal

SN	**Research objectives**: To determine	**Study design**
1	Burden of T2DM in the study population.	Cross-sectional descriptive
2	Infections associated with T2DM in Bayelsa State	Comparative
3	Prevalence of the identified infectious microbes.	Cross-sectional mixed methods
4	Identify risk factors for infection comorbidities	Comparative
5	Management practice of infection comorbidity	Cross-sectional descriptive

Key: SN – serial number for specific research objectives

3. Results

There is a total of 461 participants, which is comprised of 53% patients, 29% medical professionals and 18% medical records staff. Details of the demographic descriptions are registered in the repository (Ogbara et al., 2026).

Table 2 presents the prevalence of T2DM among diabetes cases across selected hospitals in Bayelsa State between July and December 2024. The chi-square analysis ($\chi^2 = 81.162$, $p = 0.000$) indicates a statistically significant difference in T2DM prevalence across the facilities. This suggests that the distribution of T2DM is not uniform and may be influenced by location-specific factors such as healthcare access, lifestyle, or demographic variations.

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Table 2: Descriptive Statistics for prevalence of T2DM for each Hospital.

Facility	Diabetes (%)		
	Total (B1)	T2DM (B2)	Others
Total	427 (100.00)	213 (49.88)	214 (50.12)
Ekeremor	16 (100.00)	9 (56.25)	7 (43.75)
Sagbama	55 (100.00)	37 (67.27)	18 (32.72)
Brass	122 (100.00)	38 (31.15)	84 (68.85)
Kolo	38 (100.00)	28 (73.68)	10 (26.32)
Nembe	75 (100.00)	20 (26.67)	55 (73.33)
Amassoma	31 (100.00)	31 (100.00)	0 (0.00)
Odi	75 (100.00)	42 (56.00)	33 (44.00)
Agudama-Ekpetiama	15 (100.00)	8 (53.33)	7 (46.67)

Key: X^2 = chi-square statistic (81.16), $p < 0.001$

Fig 1 the second part of this null hypothesis is accepted ($p < 0.05$). This means that there is significant difference in the prevalence of T2DM between various stratified age groups of patients that visited these General Hospitals in Bayelsa State.

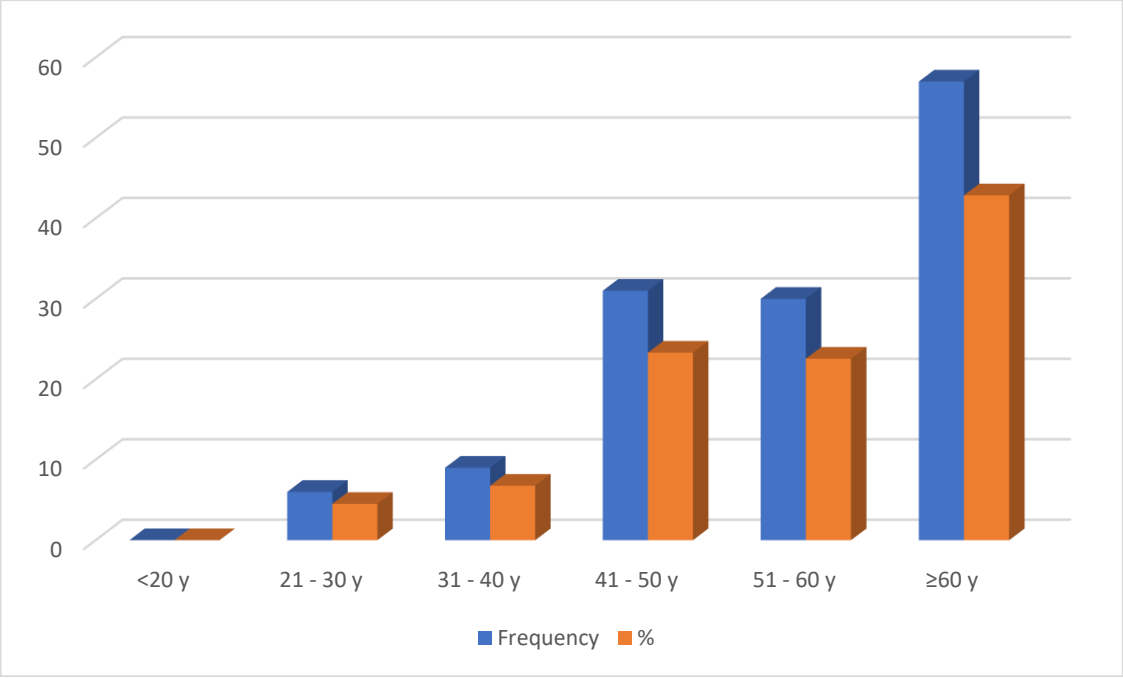


Fig 1: Prevalence of T2DM patients with respect to age groups ($p = 0.000$)

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Table 3 presents the mean and standard deviation scores of medical records responses on common comorbid infections associated with T2DM patients in Bayelsa State (C1.1 – C6.1). Overall, the cluster mean of 1.37 (SD = 0.96) indicates that these infections were generally rarely observed among patients.

Table 3: Levels of comorbid infections according to Medical Records Staff

Item	Specific Types of Infections	*N*	Mean	*SD*	Remark
C1.1	Celllulitus	243	1.93	1.19	Sometimes
C1.2	Foot ulcer	243	2.23	0.92	Sometimes
C1.3	Carbuncles	243	1.60	1.12	Sometimes
C1.4	Inflamed tissue with pus	243	1.70	0.88	Sometimes
C1.5	Staphylococcus infection	243	1.28	1.13	Rarely
C2.1	Malignant Otitus external	243	0.95	0.71	Rarely
C2.2	Rhinocerebral Mucomycosis	243	1.04	0.78	Rarely
C3.1	Cystitis (Infection of the Bladder)	243	2.18	0.87	Sometimes
C3.2	Pyelonephritis (kidney infection)	243	1.92	0.94	Sometimes
C4.1	Community-acquired Pneumonia (CAP)	243	1.44	1.18	Rarely
C4.2	Nosocomial Pneumonia (NAP)	243	1.19	1.08	Rarely
C4.3	Aspiration Pneumonia	243	1.23	1.13	Rarely
C5.1	Pulmonary TB (	243	1.13	0.82	Rarely
C5.2	Extrapulmonary TB	243	0.98	0.73	Rarely
C5.3	Multidrug-resistant TB	243	0.89	0.76	Rarely
C5.4	Extensive drug-resistant TB (XDR-TB)	243	0.85	0.75	Rarely
C6.1	Others	243	0.66	1.39	Rarely
	Cluster Mean		1.37	0.96	Rarely

Key: *N* = total number of respondents, *SD* = Standard deviation

Fig 2 showed that there was significant difference in the level of bacteria, fungal, and viral infections between DM patients ($p < 0.001$). Therefore, the null hypothesis is rejected. Specifically, significant differences were observed between all pairs of comparisons as shown in Table 3.

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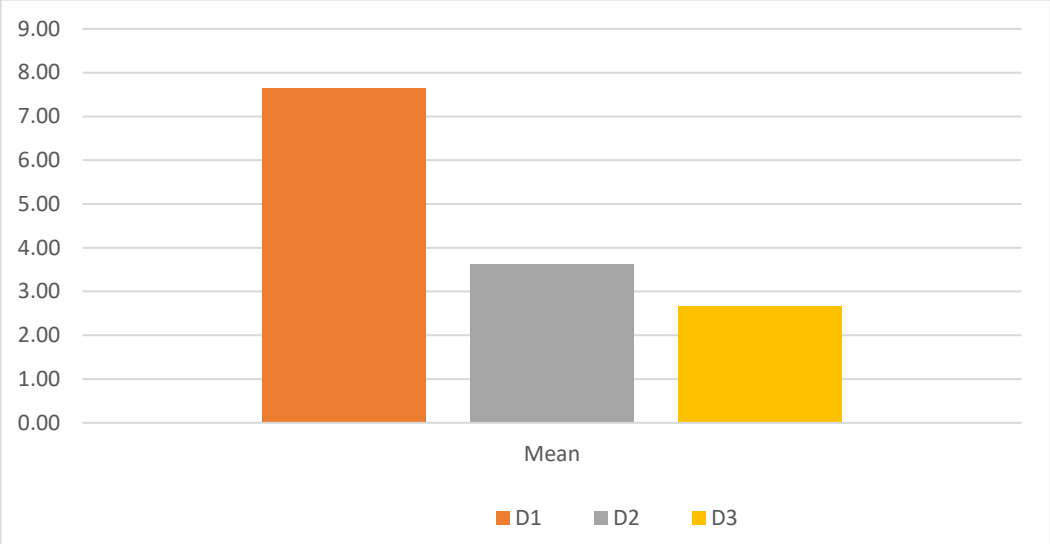


Fig 2: Mean levels of bacteria (D1), fungal (D2), and viral (D3) infections

Table 4: Patient reported infections between stratified durations of T2DM

Infection	Duration of T2DM (yrs)									
	< 1 (N = 9)		1 – 5 (N = 61)		6 – 10 (N = 39)		11 – 15 (N = 10)		16 – 20 (N = 9)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C1.1	2.00	1.50	1.08	1.42	0.69	1.08	0.00	0.00	0.00	0.00
C1.2	2.00	1.50	0.39	0.86	0.15	0.37	0.20	0.41	0.00	0.00
C1.3	1.67	1.32	0.59	1.02	0.31	0.61	0.40	0.83	0.00	0.00
C1.4	1.67	0.50	0.20	0.68	0.15	0.54	0.00	0.00	0.00	0.00
C1.5	1.67	1.80	0.44	0.87	0.00	0.00	0.00	0.00	0.00	0.00
C2.1	2.67	2.00	0.05	0.22	1.00	1.59	1.20	1.52	0.00	0.00
C2.2	1.33	2.00	0.34	0.96	0.15	0.54	0.00	0.00	0.00	0.00
C3.1	0.67	1.00	1.61	1.50	1.77	1.55	2.20	1.21	0.00	0.00
C3.2	1.33	1.00	0.34	0.91	0.00	0.00	0.00	0.00	1.00	1.50
C4.1	1.00	1.50	0.20	0.68	0.15	0.54	0.00	0.00	0.00	0.00
C4.2	0.33	0.50	0.05	0.22	0.00	0.00	1.00	1.31	0.00	0.00
C4.3	0.00	0.00	0.38	0.76	0.46	0.85	0.00	0.00	0.00	0.00
C5.1	1.33	2.00	0.15	0.36	0.00	0.00	0.00	0.00	0.00	0.00
C5.2	1.67	1.80	0.20	0.51	0.00	0.00	0.00	0.00	0.00	0.00
C5.3	1.67	1.80	0.25	0.70	0.00	0.00	0.00	0.00	0.00	0.00
C5.4	1.33	1.32	0.15	0.36	0.00	0.00	0.00	0.00	0.00	0.00
C6.1	0.67	1.00	0.98	1.49	0.46	0.85	0.80	1.01	0.00	0.00

Key: N = total number of respondents, SD = standard deviation, yrs = years

There is no significant difference in proportions of various reported infections between stratified durations of T2DM. Hi_3: There is significant difference in Proportions of various

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reported infections between stratified durations of T2DM. This analysis shows statistically significant differences between stratified durations of T2DM ($p < 0.001$). Therefore, the null hypothesis is rejected, and the alternative hypothesis is accepted Table 4.

On the risk factors for comorbid infections among T2DM, it is observed that the respondents were generally undecided about the influence of these factors (Table 5).

Table 5: Risk factors of comorbid infections among T2DM

Item	Specific Types of Infections	*N*	Mean	*SD*	Remark
E1.1	Living in crowded area	85	2.27	1.63	Undecided
E1.2	Living in unsanitary conditions	85	2.65	1.52	Agree
E1.3	Frequent healthcare visits	85	1.40	1.49	Disagree
E1.4	Hospitalizations	85	1.68	1.51	Undecided
E1.5	Poor hygiene practices	85	2.96	1.35	Agree
E2.1	Air pollution	85	1.81	1.49	Undecided
E2.2	Water pollution	85	2.15	1.48	Undecided
E2.3	Stress	85	2.38	1.53	Undecided
E2.4	Nutritional deficiencies	85	2.81	1.33	Agree
E3.1	Limited access to healthcare	85	2.65	1.49	Agree
E3.2	Climatic change/extreme weather	85	1.52	1.52	Undecided
E3.3	Low income	85	2.65	1.32	Agree
E3.4	Low educational level	85	2.60	1.39	Agree
E3.5	Age	85	2.38	1.46	Undecided
E3.6	Relationship with family members	85	1.40	1.47	Disagree
E4.1	Family history	85	2.78	1.42	Agree
E5.1	Others	85	0.52	1.24	Disagree
E6.1	Gender	85	1.41	1.58	Disagree
	Cluster Mean		2.11	1.46	Undecided

Key: *N* = total number of respondents, *SD* = Standard deviation

On the management practices of comorbid infections among T2DM patients, the respondents were generally undecided regarding the effectiveness of their management practices. The

patients demonstrate strength in dietary control and stress management, there are notable gaps in essential practices such as glucose monitoring and physical activity, which are crucial for effective diabetes and infection management (Table 6).

Table 6: Patients' responses on management practices (N = 133)

Item	Self-Management Practices	Mean	SD	Remark
E1	Frequent checking of blood glucose	1.27	0.58	Less Effective
E2	Managing diet and nutrition	2.75	0.74	Effective
E3	Frequent physical activity or exercise	1.14	0.55	Less Effective
E4	Managing stress and emotions	2.92	1.30	Effective
E5	Management of medication regimen	1.91	0.36	Undecided
	Cluster Mean	2.00	0.70	Undecided

Key: *N* = total number of respondents, *SD* = Standard deviation

4. Discussion

4.1 Demographics – results on repository (Ogbara et al., 2026)

The study comprised 461 respondents, which were predominantly medical records staff (52.71%), followed by patients (28.85%) and medical professionals (18.44%). The demographic data used was obtained from Section A of each of the medical records staff, patients and medical professionals' questionnaires. Among patients, as shown in Table 4.1a (Ogbara et al., 2026), females constituted the majority (60.90%), suggesting higher healthcare utilization or disease burden in this group. The age distribution was skewed toward older individuals, with 42.86% aged ≥60 years and 22.56% between 51–60 years, while younger age groups were underrepresented. This pattern reflects a predominantly ageing patient population, which may have implications for disease prevalence and healthcare needs, particularly in conditions more common among older adults.

As shown in Table 4.1b (Ogbara et al., 2026), the marital profile of patients was predominantly married (56.39%), with a substantial proportion separated (32.33%), while single (6.77%) and divorced (4.51%) respondents were few. Educational attainment showed a moderate distribution, with most having secondary education (42.86%), followed by equal proportions with primary and tertiary education (27.07% each), and minimal representation of those

without formal education (3.01%). Occupationally, civil servants constituted the largest group (36.09%), followed by farmers (21.05%), traders (18.05%), and others (24.81%). Overall, the findings suggest a relatively educated and economically active patient population, with diverse occupational backgrounds that may influence health-seeking behavior and access to care.

Table 4.1c (Ogbara et al., 2026), indicates that the respondents were overwhelmingly Christian (97.74%), with minimal Muslim representation (2.26%) and no affiliation to other religions. Geographically, most resided in Sagbama (25.56%) and Brass (20.30%), while fewer participants came from Ogbia (2.26%) and Kolokuma/Opokuma (6.02%) indicating uneven spatial distribution across LGAs.

Among medical professionals shown on Table 4.1d (Ogbara et al., 2026), females constituted a slight majority (54.12%) compared to males (44.71%), indicating a relatively balanced gender distribution. A substantial proportion had ≤5 years of experience (41.18%), suggesting a predominantly early-career workforce, while more experienced professionals were evenly distributed across higher categories. In terms of residence, respondents were fairly spread across LGAs, with the highest representation from Sagbama (17.65%) and Ogbia (16.47%), and lower proportions from Kolokuma/Opokuma (8.24%). This distribution reflects a moderately diverse and geographically dispersed professional group, which may enhance representativeness in service delivery perspectives across the study area.

The medical records data, from Table 4.1e (Ogbara et al., 2026), indicate a slight female predominance (54.73%) over males (45.27%). Age distribution was skewed toward older individuals, with the highest proportions in ≥60 years (34.16%) and 51–60 years (27.16%), while younger age groups were minimally represented. Educationally, nearly all individuals had tertiary education (96.30%), with a small proportion possessing postgraduate qualifications (3.70%), and none with lower educational levels. This pattern reflects a highly educated and ageing population captured in the records, which may influence the observed disease patterns and healthcare utilization trends within the study population.

Medical records staff on Table 4.1f (Ogbara et al., 2026) were predominantly married (62.96%), with notable proportions separated (18.93%) and divorced (10.70%), while few were single (7.41%). The majority were civil servants (81.89%), reflecting formal employment within the health system, with a smaller proportion in other occupations (18.11%). Religiously,

most identified as Christians (94.65%), with minor representation of traditional beliefs (4.12%) and others (1.23%), and no Muslim respondents. Overall, the group reflects a largely stable, formally employed workforce with limited occupational diversity and a dominant religious affiliation, which may influence workplace dynamics and institutional culture within the health records system.

Medical records staff were distributed across all LGAs as shown in Table 4.1g (Ogbara et al., 2026), with the highest proportions residing in Kolokuma/Opokuma (17.70%), Brass and Ogbia (15.64% each), and Sagbama (14.81%). Lower representation was observed in Ekeremor (6.17%). The findings indicate a relatively broad geographical spread of staff across the study area.

4.2 Objective 1

The findings of this study revealed that 213 out of 427 diabetes patients (49.88%) were diagnosed with T2DM, indicating that approximately one-half of all diabetes cases recorded in the selected hospitals in Bayelsa State were T2DM. This finding confirms the substantial burden of T2DM within the study area and aligns with global evidence that T2DM constitutes the predominant form of diabetes worldwide. Although the proportion observed in this study is lower than the global estimate that over 95% of diabetes cases are T2DM, it nevertheless demonstrates that T2DM remains a major public health concern requiring sustained preventive and management interventions (World Health Organization, 2024)

The observed prevalence is consistent with reports that diabetes prevalence is increasing rapidly in low- and middle-income countries, including Nigeria, due to urbanization, population ageing, unhealthy dietary practices, obesity, and physical inactivity (Olamoyegun et al., 2024; World Health Organization, 2024). Studies have identified overweight, obesity, advancing age, family history of diabetes, and sedentary lifestyles as major determinants of T2DM occurrence (CDC, 2024).

A notable finding was the significant variation in T2DM prevalence across healthcare facilities. Amassoma recorded the highest prevalence (100.00%), followed by Kolo (73.68%) and Sagbama (67.27%), whereas Brass (31.15%) and Nembe (26.67%) reported considerably lower prevalence rates. The statistically significant chi-square result ($\chi^2 = 81.162$, $p < 0.001$) confirms

that T2DM distribution differed significantly among facilities. Such geographical variations have been reported in previous studies and may reflect differences in demographic composition, socioeconomic status, lifestyle patterns, healthcare accessibility, and diagnostic practices across communities (Olamoyegun et al., 2024).

The high prevalence observed in some facilities may also be associated with increased exposure to modifiable risk factors such as obesity, poor nutrition, reduced physical activity, and inadequate preventive healthcare utilization (CDC, 2024). Furthermore, evidence suggests that ageing populations and genetic predisposition contribute significantly to the development of T2DM, particularly in African populations undergoing epidemiological transition (Olamoyegun et al., 2024; World Health Organization, 2024).

4.3 Objective 2

The findings shown in Table 4.3a indicate that comorbid infections among patients with T2DM in Bayelsa State were generally infrequent, as reflected by the low cluster mean score of 1.37 (SD = 0.96). Nevertheless, certain infections, particularly diabetic foot ulcers, cellulitis, cystitis, and pyelonephritis, were reported with moderate frequency. These findings are consistent with existing evidence that individuals with diabetes are more susceptible to infections because chronic hyperglycaemia impairs neutrophil function, cellular immunity, and tissue perfusion, thereby increasing vulnerability to bacterial and fungal pathogens (Carey et al., 2023; Casqueiro et al., 2012)

Among the infections identified, foot ulcers had the highest mean score (2.23), followed by cystitis (2.18) and cellulitis (1.93). This pattern agrees with previous studies that have identified diabetic foot infections as among the most common and serious complications of diabetes mellitus. According to the International Working Group on the Diabetic Foot, peripheral neuropathy and peripheral arterial disease predispose diabetic patients to foot ulceration and secondary infection, which often result in prolonged hospitalization and amputation if inadequately managed (van Netten et al., 2024).

The moderate occurrence of urinary tract infections (UTIs), particularly cystitis and pyelonephritis, is also supported by previous research. Geerlings (2018) reported that diabetic patients experience higher rates of UTIs than non-diabetic individuals due to impaired immune

responses, glycosuria, and bladder dysfunction. The increased availability of glucose in urine creates a favorable environment for bacterial growth, particularly by uropathogenic organisms such as *Escherichia coli* (Geerlings, 2008)

Conversely, respiratory infections, including community-acquired pneumonia, nosocomial pneumonia, and aspiration pneumonia, were rarely observed in this study. Tuberculosis-related conditions and opportunistic fungal infections such as *rhinocerebral mucormycosis* were also uncommon. These findings differ somewhat from studies conducted in regions with high tuberculosis burdens, where diabetes has been shown to significantly increase susceptibility to active tuberculosis (Workneh et al., 2017). The low occurrence observed in Bayelsa State may reflect effective infection control measures, lower exposure rates, or improved diabetes management among patients attending the selected facilities.

4.4 Objective 3

The findings of this study as shown in Figure 4.4 revealed substantial variation in the prevalence of comorbid infections among patients with T2DM in Bayelsa State. Foot ulcer infection recorded the highest prevalence (90.89%) and was statistically significant ($p < .001$), while the lowest prevalence was observed for infection C6.1 (11.76%). The predominance of foot ulcer infections among T2DM patients is consistent with existing literature identifying diabetic foot complications as one of the most frequent and debilitating consequences of diabetes mellitus worldwide (Armstrong et al., 2023; Schaper et al., 2020).

The exceptionally high prevalence of foot ulcer infection observed in this study may be attributed to chronic hyperglycaemia, peripheral neuropathy, peripheral arterial disease, and impaired wound healing, which are common among individuals with poorly controlled diabetes (Armstrong et al., 2023). Peripheral neuropathy reduces pain sensation, causing patients to overlook minor injuries that subsequently become infected. Furthermore, impaired blood circulation delays healing and increases susceptibility to bacterial colonization and tissue destruction (Schaper et al., 2020). Similar findings have been reported in sub-Saharan Africa, where diabetic foot complications constitute a major cause of hospitalization and lower-limb amputation among diabetic patients (Mutyambizi et al., 2018).

The high prevalence of skin and soft tissue infections is also consistent with the biological effects of diabetes on immune function. Hyperglycaemia impairs neutrophil chemotaxis, phagocytosis, and intracellular killing of pathogens, thereby increasing vulnerability to infections (Casqueiro et al., 2012). Consequently, diabetic patients are more likely to experience recurrent skin infections, cellulitis, and infected ulcers than the general population (Carey et al., 2023).

The relatively lower prevalence of other infections, particularly those represented by C6.1, suggests that not all infectious conditions occur with equal frequency among T2DM patients. Previous studies have shown that while diabetes increases susceptibility to a broad range of infections, the burden is disproportionately concentrated in foot infections, urinary tract infections, and certain skin conditions (Geerlings, 2008). This may explain why some infections were rarely encountered during the study period.

The statistically significant differences in prevalence among infection types indicate that infection occurrence is not random but reflects differences in pathophysiological mechanisms and exposure risks. It has been known that diabetic complications are influenced by glycaemic control, duration of disease, age, and access to healthcare services (Pearson-Stuttard et al., 2016).

4.5 Objective 4

The results from Table 4.6 indicate that medical professionals identified poor hygiene practices, unsanitary living conditions, nutritional deficiencies, limited access to healthcare, low income, low educational attainment, and family history as the most important risk factors for comorbid infections among patients with T2DM. Although the overall cluster mean (2.11 ± 1.46) suggests some uncertainty among respondents regarding the influence of all listed factors, there was considerable agreement on the role of socioeconomic, environmental, and lifestyle determinants in increasing infection risk.

Poor hygiene practices emerged as the most important risk factor. This finding is consistent with evidence that inadequate personal and environmental hygiene increases exposure to pathogenic microorganisms, particularly among individuals with diabetes whose immune defenses are already compromised by chronic hyperglycaemia (Casqueiro et al., 2012).

Diabetes impairs neutrophil function, phagocytosis, and cellular immunity, thereby increasing susceptibility to bacterial, fungal, and opportunistic infections (Pearson-Stuttard et al., 2016). Consequently, poor hygiene may exacerbate the risk of skin infections, diabetic foot infections, and urinary tract infections commonly observed in diabetic populations.

Respondents also agreed that living in unsanitary conditions and nutritional deficiencies contribute significantly to infection occurrence. This finding aligns with reports that poor living environments facilitate exposure to infectious agents, while malnutrition impairs immune competence and delays wound healing. Nutritional deficiencies, particularly deficiencies in protein, zinc, and vitamins A, C, and D, have been associated with increased infection susceptibility and poor clinical outcomes among diabetic patients (Calder et al., 2020).

Socioeconomic factors, including low income, low educational level, and limited access to healthcare, were also identified as important determinants. Similar observations have been reported in previous studies, which found that socioeconomic disadvantage reduces access to preventive healthcare services, diabetes education, medications, and early treatment of infections (Hill-Briggs et al., 2020). Individuals with lower educational attainment may have limited knowledge of diabetes self-management practices, thereby increasing their vulnerability to infection-related complications.

Family history was another recognized risk factor. Although family history is primarily associated with genetic susceptibility to T2DM, studies have shown that inherited factors may influence immune responses, glycaemic control, and the development of diabetes-related complications (Almgren et al., 2011). In contrast, respondents disagreed that gender, interpersonal relationships, and frequent healthcare visits significantly contributed to infection risk. This finding is supported by evidence suggesting that these factors exert indirect rather than primary influences on infection occurrence (Carey et al., 2023).

4.6 Objective 5

The findings of this study revealed mixed levels of self-management practices among patients with T2DM in Bayelsa State. The overall cluster mean score of 2.00 (SD = 0.70) suggests uncertainty regarding the effectiveness of self-management practices used to prevent or manage common comorbid infections. While respondents demonstrated relatively effective

practices in dietary management and stress control, important deficiencies were observed in blood glucose monitoring, physical activity, and medication management. These findings indicate that although patients recognize some aspects of diabetes self-care, adherence to comprehensive diabetes management remains suboptimal.

Diet and nutrition management was rated as effective (mean = 2.75), suggesting that many patients actively engage in dietary modifications. This finding is consistent with recommendations of the American Diabetes Association (American Diabetes Association Professional Practice Committee for Diabetes, 2026), which emphasizes medical nutrition therapy as a cornerstone of diabetes management (Muro et al., 2026). Appropriate dietary practices help maintain glycaemic control, reduce inflammation, and lower the risk of infection-related complications (Evert et al., 2019). Previous studies have similarly reported that dietary adherence contributes significantly to improved metabolic outcomes and reduced diabetes-related morbidity (Johnson et al., 2020; Nwose et al., 2019).

Stress and emotional management recorded the highest effectiveness score (mean = 2.92). This finding may reflect growing awareness of the relationship between psychological well-being and diabetes outcomes. Psychological stress has been associated with poor glycaemic control through increased cortisol secretion and adverse health behaviors. Effective stress management can therefore improve self-care behaviors, treatment adherence, and overall quality of life among diabetic patients (Ogbolu et al., 2025).

In contrast, frequent blood glucose monitoring was rated as less effective (mean = 1.27). Regular glucose monitoring is essential for detecting hyperglycaemia and preventing complications, including infections that arise from poor glycaemic control. The low score may reflect barriers such as the cost of glucometers and test strips, inadequate patient education, or limited access to healthcare resources. Similar challenges have been reported among diabetic populations in low- and middle-income countries (American Diabetes Association Professional Practice Committee for Diabetes, 2026).

Physical activity also recorded a low mean score (1.14), indicating poor engagement in exercise. This finding is concerning because regular physical activity improves insulin sensitivity, enhances immune function, and reduces cardiovascular and metabolic risks associated with diabetes. Studies have shown that sedentary lifestyles are associated with

poorer glycaemic control and increased susceptibility to diabetes complications (Colberg et al., 2016; Nwose & Bwititi, 2016).

Medication management yielded an undecided response (mean = 1.91), suggesting inconsistent adherence. Medication adherence is critical for maintaining optimal glycaemic control and preventing infections and other complications (Beck et al., 2017). Poor adherence may result from financial constraints, complex treatment regimens, or inadequate understanding of prescribed therapies (Polonsky & Henry, 2016).

5 Conclusion and recommendations

5.1: Conclusion

This study highlights a substantial burden of T2DM in selected hospitals in Bayelsa State, with approximately half of all recorded diabetes cases attributed to T2DM. The distribution of T2DM varied significantly across health facilities, indicating possible influences of geographic, demographic, and healthcare-related factors. Although severe opportunistic infections were generally uncommon, diabetic foot complications and urinary tract infections emerged as persistent and clinically significant concerns. The markedly high burden of foot ulcer infections underscores the need for intensified preventive care and early intervention strategies in diabetic management.

Furthermore, the study demonstrates significant differences in the prevalence of infection types among T2DM patients, reflecting the complex and multifactorial nature of infection risk in this population. Overall, infection occurrence appears to be shaped by a combination of clinical, environmental, and behavioral determinants, with diabetic foot disease being the most prominent complication.

In terms of self-management practices, patients showed relative strength in dietary control and psychological coping strategies. However, critical gaps exist in essential management behaviours, particularly in blood glucose monitoring, physical activity, and medication adherence. These deficiencies may contribute to poor glycaemic control and increased vulnerability to complications.

5.2 Recommendations

This study has established a substantial burden of T2DM in Bayelsa State. A markedly high burden of foot ulcer infections among diabetic patients in Bayelsa State. Further, poor behaviour in terms of blood glucose monitoring, physical activity, and medication adherence among T2DM patients in Bayelsa State. Thus, the following recommendations are proposed.

1. Given the substantial burden T2DM in Bayelsa State, health authorities should intensify community-based prevention strategies targeting modifiable risk factors such as unhealthy diets, physical inactivity, and obesity.
2. Since T2DM distribution varies significantly across health facilities, tailored interventions should be implemented based on facility burden, with high-prevalence centres receiving additional resources and clinical support.
3. Due to the high burden of foot ulcer infections, routine foot screening, early detection of neuropathy, patient education on foot hygiene, and access to podiatric care should be integrated into standard diabetes management protocols.
4. Healthcare providers should adopt routine screening for urinary tract infections in T2DM patients and ensure prompt diagnosis and treatment to prevent complications.
5. Health facilities should reinforce infection prevention practices, particularly for patients with diabetes, to reduce variability in infection prevalence across infection types.
6. Given the multifactorial nature of infection risk, integrated care involving physicians, nurses, dietitians, and health educators should be implemented to address both medical and lifestyle determinants.
7. Targeted education should focus on improving blood glucose monitoring, physical activity, and medication adherence, which were identified as weak areas in patient self-care practices.
8. Government and healthcare institutions should subsidize glucometers, medications, and test strips to encourage consistent self-monitoring and adherence.
9. Structured follow-up systems should be strengthened to ensure continuous assessment of glycaemic control and early detection of complications.
10. Community sensitization programmes should be implemented to improve awareness of T2DM risks, complications, and preventive lifestyle practices.

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