Proceedings of the 8th Faculty of Science International Conference (FOSIC 2025), Delta State University, Abraka, Nigeria. 12th – 14th November, 2025. Pp. 127 - 138

Microbial Contaminants of Public Transport Vehicles in Abraka and Environs

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Abstract

Public transport vehicles remain a viable means of transportation for many individuals in Abraka and its environs, however these vehicles tend to harbour microbial contaminantsthat poses significant health risk to humans. The possibility of microbial pathogen transmission through frequent contact with contaminated surfaces makes this an important area of public health concern. This study investigated the prevalence of microbial contaminants on high-contact surfaces of buses and tricycles in Abraka, Obiaruku, and Eku, Delta State, Nigeria.A total of 120 swab samples comprising of 60 Tricycles and 60 Buses, were collected from steering wheels, handrails, floors, and seats, and analysed using standard microbiological procedure for identification of Bacteria and fungi. Bacterial isolates included *Staphylococcus* spp. (38%), *Escherichia coli* (28%), *Enterococcus* spp. (22%), and *Klebsiella* spp. (12%). Eight fungal species were recovered, with *Aspergillus niger* and *A. fumigatus* most prevalent. No significant association was observed between bacterial distribution and vehicle type or location ($p > 0.05$). A significant association was found between fungal species and infection levels ($\chi^2 = 74.925$, $df = 54$, $p < 0.05$). The uniform distribution of microbial contaminants underscored the risk of pathogen transmission via public transport. These findings provide a scientific basis for implementing standardized cleaning protocols and microbial monitoring in shared transportation systems

Keywords: Public Transport, Microbial contaminants, *Staphylococcus* spp, Public Health Concern

Introduction

The presence of microbial contaminants on public transport vehicles is a significant public health concern globally, including in Nigeria, where Abraka, Eku, and Obiaruku are located. Public transport vehicles, such as buses and taxis, are often crowded, poorly ventilated, and inadequately cleaned, creating an environment that fosters the growth and transmission of microorganisms (WHO, 2018). These microorganisms can cause a range of illnesses, from mild respiratory infections to life-threatening diseases, such as tuberculosis and influenza (CDC, 2020).

The risk of microbial contamination on public transport vehicles is heightened by the fact that they are used by large numbers of people, often in close proximity to one another, which facilitates the transmission of microorganisms through direct contact, airborne particles, and contaminated surfaces (Li et al., 2019). Furthermore, public transport vehicles often lack adequate ventilation, which can lead to the recirculation of airborne pathogens,

increasing the risk of transmission (Qian et al., 2018). Several studies have investigated the presence of microbial contaminants on public transport vehicles in different parts of the world. For example, a study conducted in the United States found that public transport vehicles were contaminated with a range of microorganisms, including bacteria, and fungi (Gulled et al., 2018). Similarly, a study in China found that buses and taxis were contaminated with microorganisms, including Escherichia coli and Staphylococcus aureus, (Li et al., 2019).

In Nigeria, there is a significant lack of research on the microbial contaminants of public transport vehicles, despite the fact that the country has a large and densely populated public transport system (Adegoke et al., 2018). However, a few studies have investigated the presence of microorganisms on public transport vehicles in different parts of the country. For example, a study conducted in Lagos found that buses and taxis were contaminated with microorganisms, including bacteria, viruses, and fungi (Ogunleye et al., 2017). Another study conducted in Ibadan found that public transport vehicles were contaminated with microorganisms, including Escherichia coli, Staphylococcus aureus, and Salmonella spp. (Adesiji et al., 2019). Abraka, Eku, and Obiaruku are towns located in the Delta State of Nigeria, where public transport vehicles play a crucial role in the daily lives of residents. However, there is a lack of research on the microbial contaminants of public transport vehicles in these towns, which is a significant public health concern. The aim of this study is to investigate the presence of microbial contaminants on public transport vehicles in Abraka, Eku, and Obiaruku, and to identify the factors that contribute to the transmission of microorganisms on these vehicles. Understanding the types and levels of microbial contaminants on public transport vehicles in Abraka, Eku, and Obiaruku is crucial for developing effective strategies to prevent the transmission of infectious diseases. This study will provide valuable information on the microbial contaminants of public transport vehicles in these towns, and will identify areas for improvement in terms of cleaning, disinfection, and ventilation. Furthermore, this study will contribute to the existing body of knowledge on the microbial contaminants of public transport vehicles in Nigeria, and will provide recommendations for reducing the risk of microbial transmission on these vehicles.

In conclusion, the presence of microbial contaminants on public transport vehicles is a significant public health concern globally,

including in Nigeria, where Abraka, Eku, and Obiaruku are located. The risk of microbial contamination on public transport vehicles is heightened by factors such as overcrowding, poor ventilation, and inadequate cleaning. Several studies have investigated the presence of microbial contaminants on public transport vehicles in different parts of the world, including Nigeria. However, there is a significant lack of research on the microbial contaminants of public transport vehicles in Abraka, Eku, and Obiaruku, which is a significant public health concern. This study aims to investigate the presence of microbial contaminants on public transport vehicles in these towns, and to identify the factors that contribute to the transmission of microorganisms on these vehicles.

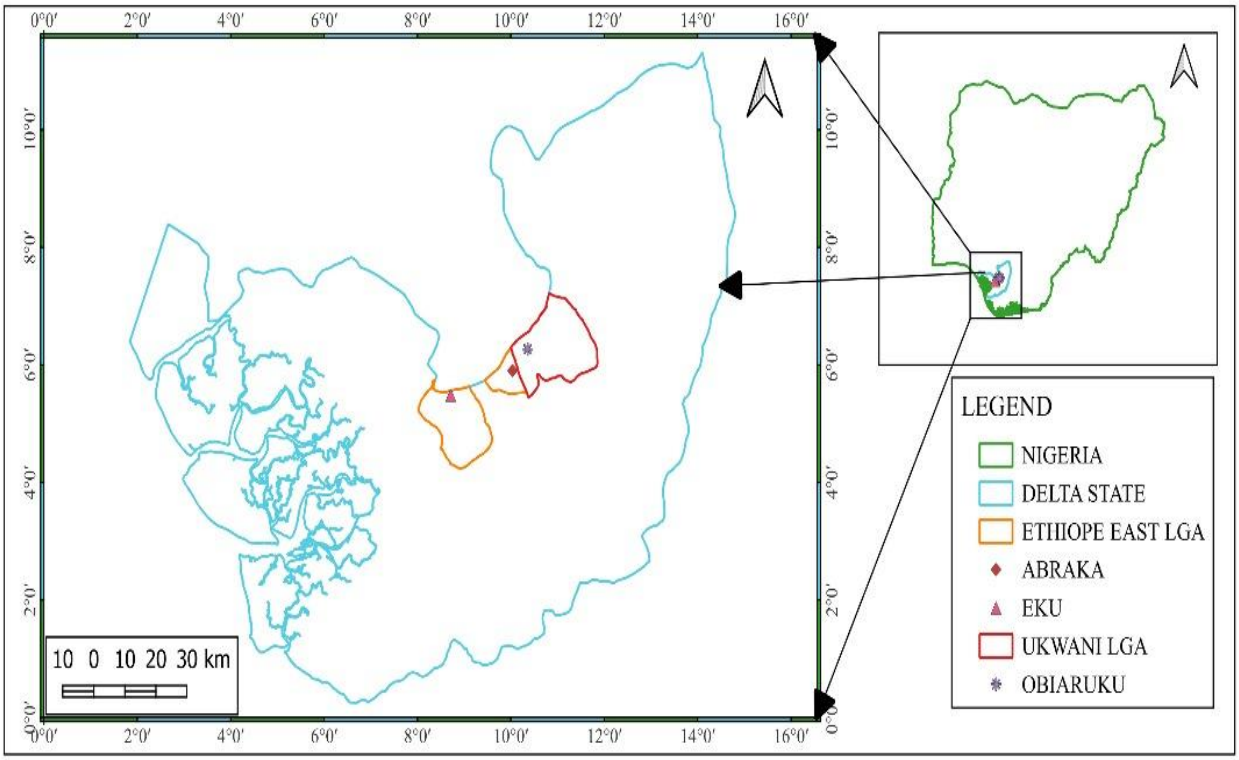
Materials and Methods

Description of Study Area

This study was carried out at Abraka, Eku, and Obiaruku , these communities are located in Delta State, Nigeria. Delta State is situated in the southern part of Nigeria, within the Niger Delta region, and is associated by a humid tropical rainforest climate with distinct wet (April–October) and dry (November–March) seasons. Its receives 1,500–2,500 mm of annual rainfall, with average temperatures ranging from 25–32°C (Nigerian Meteorological Agency [NIMET], 2020). These climatic conditions are favourable for the survival and transmission of microbial contaminants. Abraka (5.7894° N, 6.1023° E) is situated in the present Ethiope East Local Government Area (LGA) and serves as a commercial and academic settlement. It has a land mass of about 11.5 km² with an estimated population of 79,963 by 2015 (~6,977 people/km²). River Ethiope flows through the town, influencing local ecology and sanitation. Tricycles and Minibuses are the major means of public transportation, and are frequently used by students, traders, and civil servants.Obiaruku (5.8387° N, 6.1580° E), with an estimated Coverage around 3.70 km², and a population strength of ~15,438 in 2015 (~4,171 people/km²). It houses the administrative headquarters of Ukwuani LGA, is a semi-urban settlement with a growing population whose major occupations are, farming, trading, and small-scale enterprises. Buses and tricycles

serves as the major forms of public transportation, linking the town with surrounding communities. Eku (5.7361° N, 5.9357° E), also located in Ethiope East LGA with about 0.142 km² in area. With an estimated population of ~1,477 (yielding an extremely high density of ~10,389 people/km²) as of 2015, is a semi-urban town historically known for hosting the Baptist Medical Centre (now Eku Baptist Hospital). The town relies heavily on buses and tricycles as the main means of mobility for residents, farmers, and traders (Ilondu and Nweke 2016).

Map of study area



Study Design

Samples were obtained from Public transport vehicles, specifically tricycles and buses operating within Abraka and neighboring communities (Eku and Obiaruku), high-contact vehicle surfaces, such as seats, steering wheels, handrails, and floors, were sampled with the aid of a Swap stick moistened with nutrient broth. Swab samples were taken to the laboratory where they are cultured for microbial and

fungi growth. At the laboratory swab stick was inoculated on the surface of three different agar plates (Nutrient ager, Potato Dextrose Agar, and Mac conkey Agar) each swab stick thereafter the media was incubated in an incubator for 24hrs at 37°C. After incubation the particular strains of micro-organism that was observed in the media was gram stained to identify whether the organism is gram positive or gram negative, thereafter biochemical test was conducted and the result was stated.

Results and Discussion

Table 4.1: Bacteria Distribution in Abraka, Obiaruku and Eku.

Location		**Bacteria recovered**	**No infected (%)**
Abraka 40	13(26%)	*Staphylococcus*	3(6)
		E.coli	4(8)
		Enterococcus sp	6(12)
		Klebseilla sp	0(0)
Obiaruku 40	18(36%)	*Staphylococcus*	8(16)
		E.coli	6(12)
		Enterococcus	1(2)
		Klebseilla sp	3(6)
Eku 40	19(38%)	*Staphylococcus*	8(16)
		E.coli	4(8)
		Enterococcus	4(8)
		Klebseilla sp	3(6)
Total			50

Among the 50 Bacterial-positive samples recovered from vehicle surfaces *Staphylococcus* (16%) was the most isolated Bactarial, followed by *E.coli and Enterococcus* with (12%) each and *Klebseilla sp* with(6%). The highest contamination was recorded in Eku (38%) followed by Obiaruku (36%), and then Abraka, (26%). Chi-square tests examined associations between bacteria type, location, and number of infection shows that no statistically significant associations were found χ^2 (8) = 3.000, p = 0.934. Suggesting that contamination occurred across all location without significant variation.

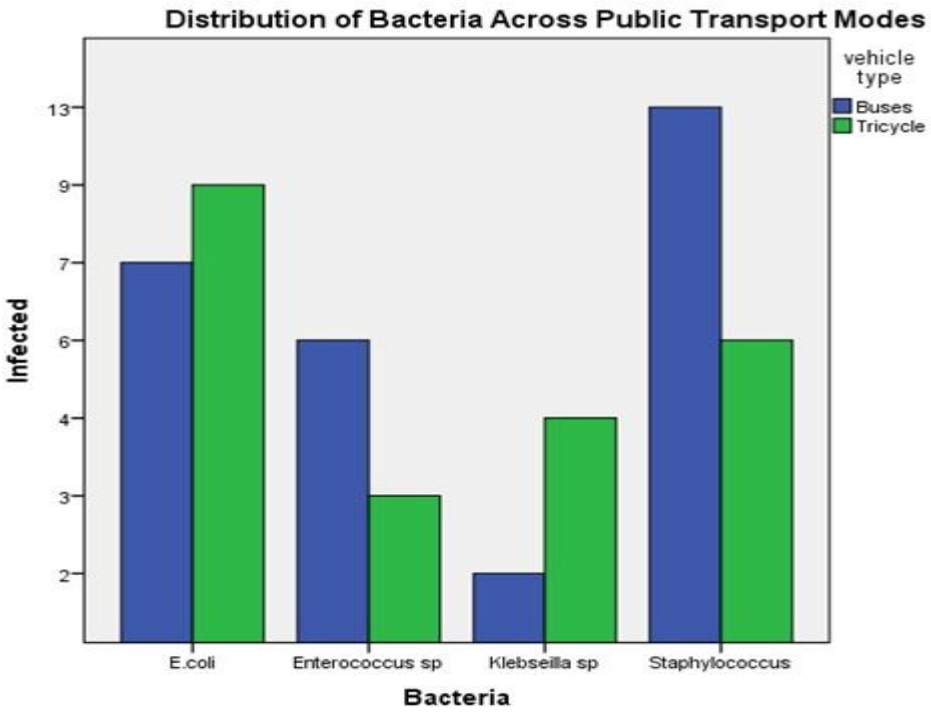
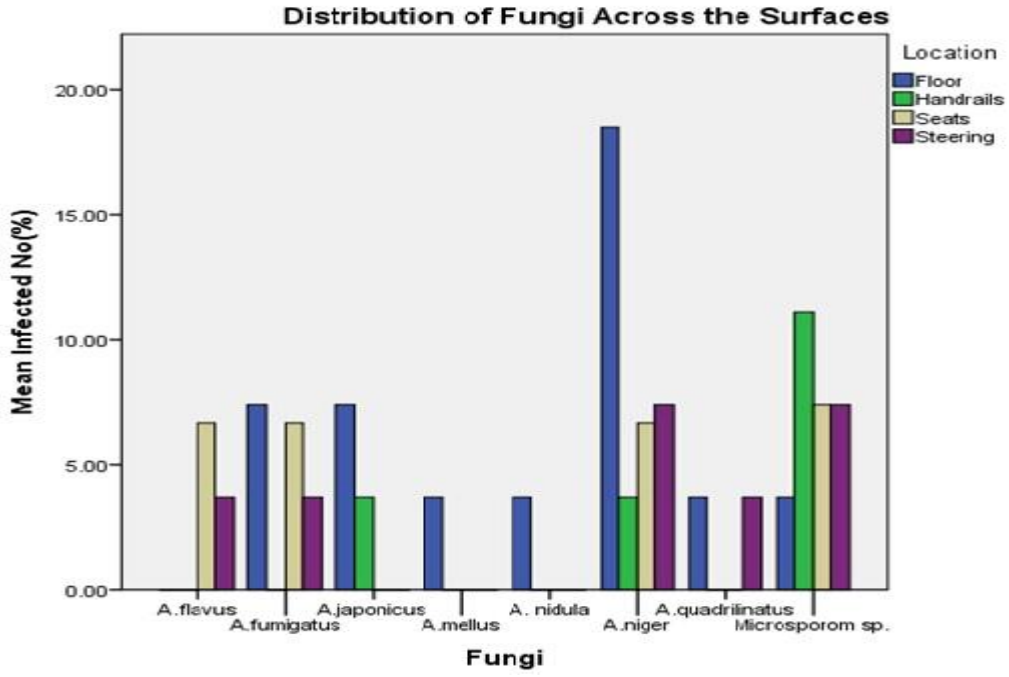


Fig 4.1: Bacterial Distribution and Infection Rates in Public Transport Vehicles

Each bacteria species was found in both buses and tricycles, with an even distribution. Thus, bacterial contamination was uniform across vehicle types. To determine the association between bacteria and vehicle type Chi-square analysis revealed that there was no statistically significant association between the type of bacteria isolated and the vehicle type χ^2 (3) = 0.000, p = 1.000 (p > 0.05). This indicates that both buses and tricycles were equally likely to harbour the bacterial species recovered



A total of 8 fungal species were isolated in the study. *Aspergillus nidula*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus japonicas*, *Aspergillus mellus*, *Aspergillus niger*, *Aspergillus quadrilinatus*, *Microsporom sp.with* a mean infection rate of 4.07% ± 5.59%. Among fungal species identified, *Aspergillus fumigatus* and *A. niger* were detected across broader infection ranges, including higher infection rates up to 18.5%, highlighting them as potentially more virulent or persistent. Species like *Microsporom sp.* and *Trichodema* also appeared across multiple infection categories, suggesting varied resistance or adaptability. Chi-square tests revealed statistically significant associations between fungal species and infection levels $\chi^2 = 74.925$, df = 54, $p = 0.031$, but not between surface location and infection levels $\chi^2 = 94.697$, df = 30, $p = 0.000$.

The study assessed the prevalence of bacteria, and fungi on public transport vehicles in Abraka, Eku and Obiaruku with the aim of accessing public health risks posed by frequently touched surfaces such as Handrail, Steering, Floor and Seats. Our findings reveal high level of contamination of non-pathogenic and pathogenic organisms which is in line with growing global concern regarding hygiene in shared public spaces.

Bacterial Contamination

Bacterial isolated from this study includes *Staphylococcus* spp. (38%), *Escherichia coli* (28%), *Enterococcus* spp. (22%), and *Klebsiella* spp. (12%). These findings is in line with Kelechi *et al*., (2020), in his work, in Imo State, Nigeria, *Staphylococcus* spp. (20.4%) and *E. coli* were among the most prevalent on fomites in airport surfaces and bus terminals in like manner Nwankwo *et al*., (2023), discovered a high level of contamination on public bus door handles in Umuahia, with 73 bacterial isolates including *Staphylococcus aureus* (6.8%), *Staphylococcus epidermidis* (5.5%), *Streptococcus faecalis* (2.7%), *Escherichia coli* (6.8%), *Klebsiella* spp.(5.5%), *Enterobacter spp.* (4.1%), *Pseudomonas aeruginosa* (17.8%), *Proteus* spp. *(23.3%), Micrococcus* spp. (6.8%) *and Bacillus* spp. (20.5%).

Similarly, Peekate (2020), reported a high bacterial load on taxis in university routes in Port Harcourt, identifying organisms such as *Staphylococcus,Bacillus,* and *Proteus*, which are also found in our study.

Like these authors, it was observed that door handles, seats, floor, and steering surfaces commonly harboured microbes, supporting the notion that high-contact vehicle surfaces serve as microbial reservoirs.

The lack of statistically significant difference between bacterial presence in buses and tricycles ($\chi^2 = 0.000$, $p = 1.000$) supports the conclusion of Kim *et al.*'s (2022) which state that microbial community in public transportation facilities is affected more by environmental exposure and human traffic than by specific surface type or vehicle model.

Fungal Contamination

The study identified eight fungal species from surfaces of vehicles, *Aspergillus niger* and *A. fumigatus* as the most prevalent, followed by *Microsporom* sp., *A. japonicus*. Floors and steering wheels, were the most contaminated surfaces, and there was a statistically significant association was found between fungal species and infection levels ($\chi^2 = 74.925$, $p = 0.031$), though not with surface type or location. This finding highlights the environmental plasticity of certain fungi across various surface conditions.

This results are in agreement with Kim *et al*., (2022), who studied microbial communities in public transportation facilities and found *Aspergillus*, *Penicillium*, and *Malassezia* to be dominant fungal taxa.. The reemergence of *Aspergillus* species in both studies is particularly concerning, as these are well-documented agents of respiratory infections and allergies, especially in immune compromised populations.

The work of Kemal Metiner *et al*., (2021) further supports our findings, having reported *Penicillium* spp., *Paecilomyces* spp., and *Aspergillus* spp. as the most common airborne fungi in Istanbul's public transport vehicles. Fungal concentrations were highest in buses, with a significant positive correlation between passenger density and fungal load ($r = 0.68$, $p < 0.05$).

Although this study did not measure airborne fungal counts, the surface contamination by similar genera on public vehicles in Abraka and its environ suggests that passenger volume and ventilation standards are likely contributing factors. This is similar to Metiner's conclusion that public transport systems lacking indoor air quality (IAQ) regulations which may present chronic exposure risks.

Collectively, these findings point to fungal persistence in public transit systems across climates and continents. The presence of *Microsporom* sp. in our study expands the potential health risks beyond respiratory illness to include cutaneous mycoses. The consistent isolation of these fungi on high-contact surfaces underscores the need for periodic fungal load assessments and improved vehicle hygiene protocols.

Conclusion

Public transport vehicles in Abraka, Obiaruku, and Eku are often contaminated with clinically important . The lack of significant vehicle-type or spatial variation for and bacteria suggests that contamination is caused by common behavioral and environmental factors, which includes high passenger turnover and inadequate cleaning regimes. fungal diversity detected, particularly the dominance of *A. niger* and *A. fumigatus*, indicates persistent fungal exposure risks. Without intervention, these vehicles will continue to serve as reservoirs for pathogen transmission

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