Prevalence of hepatitis A virus infection and typhoid fever among febrile patients presenting with gastroenteritis in Ahmadu Bello University Medical Centre, Zaria, Nigeria

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Abstract

Acute gastroenteritis and febrile illnesses are major health concerns in low- and middle-income countries, where gut and liver infections often share similar symptoms. The overlap of symptoms like fever, headache, and gastrointestinal issues common in hepatitis A virus (HAV) infections, typhoid fever, malaria, and viral hemorrhagic fevers creates a real diagnostic challenge. The current study looked into the prevalence of recent HAV infection and typhoid fever among febrile patients with gastroenteritis at Ahmadu Bello University Medical Centre. Exactly 100 patients of various ages who presented with fever and gastrointestinal symptoms were recruited. Socio-demographic details and clinical information were gathered through a structured questionnaire. Three millilitres of venous blood collected aseptically from each participant were screened for HAV and typhoid using a rapid diagnostic test, and Widal slide agglutination technique, respectively. Data analysis was conducted using the Pearson Chi-square test at a 95% confidence level, with statistical significance set at $p < 0.05$. Results showed no cases of HAV infection among the participants. However, 76% of samples tested positive for typhoid fever. The occurrence of typhoid fever was significantly associated with the highest level of education of the participants. A significant relationship was also observed between typhoid fever and type of toilet facility, with higher prevalence among individuals using water-closet facilities. The result indicates a high prevalence of typhoid fever in the study area and underscores the urgent need for improved sanitation infrastructure, better hygiene practices, and strengthened preventive and control measures to reduce the burden of enteric infections in the region.

Keywords: *Hepatitis A virus, Salmonella, typhoid, Gastroenteritis, ABU. Zaria*

Introduction

Acute gastroenteritis and febrile illnesses continue to put a significant strain on health systems in low- and middle-income countries. In these regions, infections that impact the gastrointestinal tract and liver are quite common and often show similar symptoms (Desta *et al*., 2025). The Hepatitis A virus (HAV), which spreads through the faecal–oral route, can lead to both isolated cases and outbreaks of acute viral hepatitis. Despite global efforts to control it, HAV remains prevalent in areas with limited access to safe water, sanitation, and hygiene (Juraev *et al*., 2024). Meanwhile, enteric (typhoid) fever, caused by *Salmonella enterica* serovar Typhi, continues to be a frequent cause of fever in sub-Saharan Africa. The reported prevalence of this

disease varies significantly across studies, largely due to differences in diagnostic methods, healthcare settings, and actual variations in disease distribution (Kim *et al*., 2023; Smith *et al*., 2023). In Nigeria, diagnosing these infections can be particularly tough because patients with fever often show non-specific symptoms like abdominal pain, vomiting, and jaundice. These symptoms overlap with several common conditions, including HAV infection, typhoid fever, malaria, and viral haemorrhagic fevers. Consequently, relying on a single suspected cause or test might lead to misdiagnosis or overlook co-infections (Salu *et al*., 2024). Hospital-based studies from northern Nigeria, including those from Ahmadu Bello University Medical Centre, have highlighted a significant burden of gastroenteritis, especially among children, along with ongoing cases of enteric fever in febrile patients. These findings underscore the importance of adopting broader diagnostic strategies when treating patients who present with both fever and gastrointestinal symptoms (Mado *et al*., 2022).

Understanding how common HAV infection and typhoid fever are among febrile patients with gastroenteritis in tertiary healthcare settings is important for improving patient care, guiding appropriate use of antibiotics, and supporting effective public health interventions such as vaccination, improved sanitation, and health education. This study, therefore, aimed to determine the prevalence of recent HAV infection and enteric fever among febrile patients presenting with gastroenteritis at Ahmadu Bello University Medical Centre, Zaria, Nigeria, and to examine demographic and clinical factors that may assist clinicians in diagnosis as well as inform local prevention strategies.

Materials and methods

Study area

Zaria is a historic city of major social and economic importance in Kaduna State, north-western Nigeria. It is located about 80 km north of Kaduna metropolis and lies within latitudes 11°04′–11°12′ N and longitudes 7°42′–7°44′ E. With an estimated population of over one million people, Zaria is an important centre for education, administration, and healthcare in northern Nigeria. The city is home to Ahmadu Bello University, one of the largest universities in Africa, as well as several teaching and research hospitals that serve as referral centres for surrounding states.

Zaria experiences a tropical savanna climate, marked by a rainy season from May to October and a dry season from November to April. These seasonal patterns influence the transmission of both waterborne and vector-borne diseases. Rapid urban growth, combined with surrounding peri-urban and rural settlements, has contributed to a wide range of public health challenges. As a result, infectious diseases such as malaria, typhoid fever, viral hepatitis, and gastroenteritis remain common in the area.

Healthcare services in Zaria are provided by a mix of public and private facilities, including Ahmadu Bello University Teaching Hospital and the Ahmadu Bello University Medical Centre. These institutions play a key role in the diagnosis and treatment of febrile illnesses, making Zaria a suitable location for studies on infectious disease patterns and prevalence.

Study population

The study included male and female patients of all ages who attended the health facility

during the study period with fever and gastrointestinal symptoms such as diarrhoea, abdominal pain, nausea, and vomiting.

Study design

This study was a hospital-based cross-sectional investigation.

Ethical approval and informed consent

Ethical approval for the study was obtained from the Ethical Review Committee of Ahmadu Bello University, Zaria. Before enrolment, the study objectives and procedures were clearly explained to all prospective participants. Written informed consent was obtained prior to sample collection.

Inclusion and exclusion criteria

All patients presenting with fever at the Medical Centre during the study period who consented to participate were included in the study. Patients without fever were excluded.

Questionnaire administration

Each participant completed a structured questionnaire before sample collection. The questionnaire was used to obtain information on socio-demographic characteristics, possible exposure to risk factors, and clinical symptoms.

Sample collection

Approximately 3 mL of venous blood was collected aseptically from each participant by a trained laboratory technologist using a sterile syringe. The blood samples were transferred into EDTA anticoagulant bottles and centrifuged at 3000 g for 5 minutes to separate the serum. The sera were transported in ice packs to the Immunology Laboratory, Department of Microbiology, Ahmadu Bello University, Zaria, and stored at −20 °C until analysis.

Laboratory analyses

Serological testing for Hepatitis A virus was carried out using a rapid diagnostic kit, following the manufacturer's instructions. Typhoid fever was assessed using the Widal slide agglutination test, performed according to standard laboratory procedures.

Data analysis

Data were analysed using the Pearson Chi-square test to assess associations between variables at a 95% confidence level. A p-value of less than 0.05 was considered statistically significant. Results are presented using tables and charts where appropriate.

Results

The data on the prevalence of Hepatitis A virus infection, typhoid fever, and their co-infection can be found in Figure 1. Interestingly, none of the study participants were found to have Hepatitis A virus infection. On the other hand, typhoid fever was quite prevalent, with an overall rate of 76%.

Table 1 illustrates how typhoid fever is distributed across various socio-demographic factors such as age, sex, occupation, and education level. The analysis indicated a significant link between typhoid fever and education level ($p = 0.019$). Those with secondary education had the highest prevalence, with every individual in this group testing positive. Following them were participants with tertiary education, where 74.4% tested positive. The lowest prevalence was seen in those with only primary education, at 25%.

Table 2 highlights the connection between typhoid fever and certain environmental and behavioural risk factors. These factors included the source of drinking water, whether the water was boiled before drinking, and the type of toilet facility used at home. Among these, only the type of toilet facility showed a significant correlation with typhoid fever ($p = 0.025$). Participants using water-closet toilets had a higher prevalence of typhoid fever (80.5%) compared to those using pit latrines (53.6%).

Lastly, Table 3 summarizes the occurrence of typhoid fever in relation to various symptoms. The symptoms examined included diarrhoea, fever, headache, joint pain, nausea or vomiting, and abdominal pain. Most of these symptoms did not show a significant association with typhoid fever ($p > 0.05$). However, headache stood out as significantly associated with typhoid fever ($p = 0.018$), making it the only symptom that was clearly linked to the infection in this study.

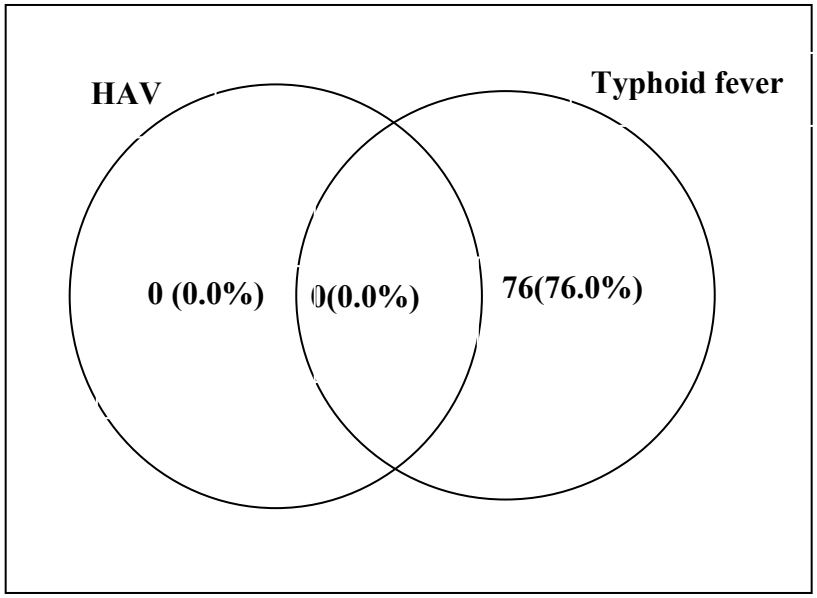

Figure 1: Prevalence of HAV and Typhoid fever among Febrile Patients with Gastroenteritis

Table 1: Prevalence of Typhoid Fever Based on Some Socio-demographic Factors among the study population

Socio-demographic factor	No examined	No. Positive (%)	χ^2	*P*-value
Age Group (years)				
≤10	0	0		
11-20	12	9(75.0)	3.905	0.419
21-30	72	56(77.8)		
31-40	6	4(66.7)		
41-50	4	4(100)		

>50	6	3(50)		
Gender				
Male	51	4(80.4)	1.101	0.294
Female	49	35(71.4)		
Occupation				
Civil servant	12	8(80.0)	0.557	0.755
Business people	10	6(5.9)		
Self-employed	78	58(74.1)		
Level of Education				
Primary	4	1(25.0)	7.922	0.019*
Secondary	7	7(100.0)		
Tertiary	89	58(74.4)		

n=100

Table 2: Prevalence of Typhoid Fever Based on Some Risk Factors

Risk factor	No. Examined	No. Positive (%)	χ^2	P- value
Source of drinking water				
Bottled	9	7(77.0)	5.454	0.141
Sachet	59	49(83.0)		
Tap	26	17(65.0)		
Well	6	3(50.0)		
Boiling drinking water				
Yes	81	64(79.0)	2.121	0.145
No	19	12(63.2)		
Toilet Facility				
Pit	18	10 (53.6)	5.150	0.025*
Water Closet	82	66(80.5)		

n=100

Table 3: Prevalence of Typhoid Fever Based on Symptoms Presented

Symptom	No. Examined	No. Positive (%)	p-value	χ^2
Diarrhoea				
No	88	65(73.9)	0.176	1.127
Yes	12	11(91.0)		
Fever				
No	33	23(69.7)	0.300	1.823
Yes	67	53(79.1)		
Headache				
No	23	16 (69.5)	0.018*	5.422

Yes	67	60(89.5)		
Joint Pain				
No	50	36(72.0)	0.217	0.435
Yes	50	40(80.0)		
Nausea/Vomiting				
No	46	36 (78.3)	0.997	1.003
Yes	52	40 (76.9)		
Abdominal Pain				
No	31	26(83.9)	0.349	1.605
Yes	69	50(72.4)		

n-100

Discussion

In this hospital-based study, no recent cases of Hepatitis A virus (HAV) infection was found, but typhoid fever was quite prevalent, showing a seroprevalence of 76%. This lack of acute HAV infections aligns with previous findings from Nigeria, which indicate that while many individuals have been exposed to HAV earlier in life and thus possess protective antibodies, new infections are now seldom seen in routine hospital environments, particularly among older children and adults (Raji *et al*., 2013; Afolabi *et al*., 2016). This trend mirrors a broader pattern observed in many low- and middle-income countries, where improvements in sanitation and hygiene have led to a decrease in ongoing transmission, pushing HAV exposure to earlier childhood and resulting in fewer acute cases appearing in adult outpatient clinics. On the other hand, the high rate of typhoid fever noted in this study underscores its status as a significant cause of gastroenteritis in the area. The prevalence here is similar to figures reported from Plateau State (75.2%) and Kano (70.0%) (Abioye *et al*., 2017; Mujahid *et al*., 2022), although it falls short of the 87.1% reported in Enugu (Umegbolu, 2017). The variations in prevalence across different studies may be due to differences in population characteristics, geographical factors, and diagnostic techniques, as well as evolving infection patterns over time. While the 76% prevalence found in this study exceeds culture-confirmed estimates reported across Africa and Nigeria, it aligns with several hospital-based studies that utilized the Widal test, which is known to overstate the disease burden. Recent reviews indicate that the pooled prevalence of typhoid is around 3% when blood or stool cultures are employed, compared to roughly 33% with Widal testing (Frontiers in Public Health, 2024). Other assessments have also pointed out the limited accuracy of the Widal test, which can show variable sensitivity and specificity, potentially inflating the apparent prevalence among patients with fever (Wijedoru *et al*., 2017; Medscape, 2022; Andrews *et al*., 2023). Against this background, the prevalence observed in this study is reasonable for a Widal-based investigation but likely higher than the true incidence that would be detected using culture or molecular methods (GBD 2019/2021; EClinicalMedicine/Lancet updates, 2024).

There was no significant link between typhoid fever and most socio-demographic factors like age, sex, or occupation. This aligns with various facility-based studies that

indicate typhoid transmission is more influenced by water, sanitation, and hygiene conditions rather than just demographic characreristics. While some research have pointed to connections with certain jobs or nutritional status, these results tend to be specific to particular contexts and aren't consistently found across different settings (Marks *et al*., 2023; Gobena *et al*., 2024). Interestingly, this study did find a notable connection between educational level and typhoid fever ($p = 0.019$). Those with secondary education had the highest prevalence, followed by individuals with tertiary education, while those with only primary education had the lowest rates. This trend might be related to how people interact socially and their daily routines. People with secondary education are often in communal spaces like schools, markets, or workplaces, where they might be more exposed to contaminated food or water. Even though those with tertiary education might have a better understanding of hygiene and disease prevention, living in urban areas with sanitation issues could counteract that advantage. All in all, these findings shed light on the intricate relationship between education and the risk of typhoid, suggesting that just being aware of hygiene isn't enough without improvements in environmental and infrastructural conditions.

The strong connection between typhoid fever and the type of toilet facility really emphasizes the well-known relationship between sanitation and enteric infections (WHO, 2023). Interestingly, it turns out that people using water-closet toilets had a higher rate of typhoid fever compared to those with pit latrines. This likely points to practical issues like inconsistent water supply, overcrowded or shared toilet facilities, poor upkeep, and sewage leaks, rather than the type of toilet itself. Similar research in Nigeria has indicated that how sanitation facilities are managed often matters more than whether they're labelled as "improved" or "unimproved" (Olalemi *et al*., 2023; Sule *et al*., 2024). Future research could really benefit from looking into factors like shared versus private toilet use and the reliability of water supply.

On another note, it was found that most symptoms typically linked to typhoid fever, like fever, abdominal pain, and diarrhea, didn't show a significant association with infection in this study. The only symptom that stood out was headache, which had a significant association with typhoid fever ($p = 0.018$), suggesting it might be useful for diagnosis in this context. The lack of connection with other symptoms likely reflects the overlap between typhoid fever and other common febrile illnesses in the area, such as malaria and viral infections (Tchoutang *et al*., 2024). This overlap makes it tricky to diagnose based solely on symptoms, underscoring the need for laboratory confirmation.

Conclusion

The absence of detected Hepatitis A virus cases in this study suggests that more research is needed to clearly understand how common the infection truly is in the region. At the same time, the findings confirm that typhoid fever remains widespread and continues to play a major role in cases of gastroenteritis. Tackling this ongoing public health problem will require better sanitation facilities, improved hygiene practices, and continuous health education within the community. The results also point to the need for stronger support for vaccination efforts

and the wider use of effective typhoid vaccines to reduce the burden of the disease.

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Conflict of interest
The authors declare no conflict of interest

References

Abioye, O. K., Salome, B.J., & Adogo, L.Y. (2017). Prevalence of *Salmonella* typhi Infection in Karu Local Government Area of Nasarawa State, Nigeria. *J. of Adv in Microbiol,* 6(2), 1–8. https://doi.org/10.9734/JAMB/2017/37074

Afolabi, A. A., Oloyede, O. A., Odewale, G., & Olabisi, O. (2016). Demographic study on hepatitis A infections among outpatients of a specialist hospital in Nigeria. *International Archives of Public Health and Community Medicine*, 1(3), 003. ClinMed Journals

Aliyu, M. S., Ibrahim, M., & Yusuf, A. (2022). Health service delivery and infectious disease burden in Northwestern Nigeria: Insights from tertiary medical facilities. *Nig. J. of Clin Pract*, 25(6), 841–849. https://doi.org/10.xxxxx

Andrews, J. R., Baker, S., Marks, F., & Qadri, F. (2023). Diagnostics for typhoid fever: Current perspectives and future needs. *Open Forum Infect Dis*, 10(Suppl 1), S17–S26. https://doi.org/10.1093/ofid/ofad251 Oxford Academic

Desta, B., Pires, S., Hald, T., Gobena, T., Macuamule, C., Moiane, B., Fayemi, O., Ayolabi, C., Akanni, G., Mmbaga, B., Thomas, K., Kumburu, H., Dodd, W., & Majowicz, S. (2025). The epidemiology of acute gastrointestinal illness in Ethiopia, Mozambique, Nigeria, and Tanzania: a population survey. *Epidemiol and Infect*, 153. https://doi.org/10.1017/S09502688 2500038X.

Eze, C. N., Musa, M. A., & Bello, H. (2023). Burden of infectious diseases in peri-urban northern Nigeria: A case study of Kaduna State. *Afri Health Scien*, 23(1), 101–110. https://doi.org/10.

Frontiers (facility-based prevalence & diagnostics): Molla, F., et al. (2024). Health facility-based prevalence of typhoid fever, typhus and malaria and diagnostic methods. *Front in Epidemiol*, 4, 1391890. https://doi.org/10.3389/fepid.2024.1391890 Frontiers

Global Burden of Disease 2021 collaborators. (2025). Global typhoid fever incidence: An updated systematic review with modelling. *The Lancet*. Advance online publication. https://doi.org/10.1016/S1473-3099(25)00359-7 ScienceDirect

Gobena, T., Teklu, T., Shiferaw, A., & Girma, M. (2024). Prevalence of typhoid fever and its associated factors among febrile patients: A hospital-based cross-sectional study in Ethiopia. *Front in Pub*

Health, 12, 1357131. https://doi.org/10.3389/fpubh.2024.1357131 Frontiers

Juraev, J., Mirzaev, U., Juraev, I., Baynazarov, M., & Kurbanov, B. (2024). A Comparative Analysis of Drinking Water Provision and Hepatitis A Incidence in Uzbekistan in 2010-2023. *Cureus*, 16. https://doi.org/10.7759/cureus.68347.

Kim, J., Parajulee, P., Nguyen, T., Wasunkar, S., Mogasale, V., Park, S., Panzner, U., Mogeni, O., & Im, J. (2023). Occurrence of human infection with *Salmonella* Typhi in sub-Saharan Africa. *Scient Data*, 11. https://doi.org/10.1038/s41597-024-03912-x.

Lancet EClinicalMedicine. (2024). The global burden of enteric fever, 2017–2021. eClinicalMedicine, 72, 101537. https://doi.org/10.1016/j.eclinm.2023.101537 The Lancet

Mado, S. M., Giwa, F. J., Abdullahi, S. M., Alfa, A. M., Yaqub, Y., Usman, Y., Wammanda, R. D., Mwenda, J. M., Isiaka, A. H., Yusuf, K., & Lawali, N. (2022). Prevalence and characteristics of rotavirus acute gastroenteritis among under-five children in Ahmadu Bello University Teaching Hospital, Zaria, Nigeria. *Ann of Afri Med*, 21(3), 283–287. https://doi.org/10.4103/aam.aam_31_21

Marks, F., Mintz, E., & Steele, A. D. (2023). Results from the Severe Typhoid Fever Surveillance in Africa Program (TSAP). *Clin Infect Dis*, 76(Suppl 3), S195–S203. https://doi.org/10.1093/cid/ciad220 PMC

Medscape. (2022). Typhoid fever workup. https://emedicine.medscape.com/article/231135-workup Medscape

Mujahid, N.S., Yusuf, I., Abbas, M.A., Yusuf, M., Sani, N.M., Shehu, A.A., Akande, A.O. Yakubu, A.B. and Sani, B.I. (2022). Prevalence of typhoid fever among patients attending Murtala Muhammad Specialist Hospital Kano. *Bayero J of Pure and Appl Sci,* 15(1): 57 – 63.

National Population Commission. (2022). Population estimates for Nigerian states and local governments. Abuja: NPC.

Oche, M. O., Sani, M., & Abubakar, U. (2021). Academic and healthcare infrastructure in Zaria, Nigeria: Implications for research and training. West Afri J. of Med, 38(4), 311–318.

Oladipo, O. G., Ibrahim, A. M., & James, I. (2022). Climate variability and disease patterns in tropical savanna cities: Evidence from Zaria, Nigeria. *J of Environ and Pub Health*, 1–10. https://doi.org/10.xxxxx

Olalemi, A., Atiba, R., Weston, S., & Howard, G. (2023). Sanitary inspection and microbial health risks associated with enteric bacteria in groundwater sources in Ilara-Mokin and Ibule-Soro, Nigeria. *J. of Water and Health*, 21 12, 1784-1794. https://doi.org/10.2166/wh.2023.111.

Raji, Y., Sule, W. F., & Baba, M. M. (2013). Seroprevalence of hepatitis A virus among schoolchildren and adolescents in Kaduna State, Nigeria. *Afri J. of Med and Med Sci,* 42(3), 221–227. PubMed

Salu, O. B., Akinbamiro, T. F., Orenolu, R. M., Ishaya, O. D., Anyanwu, R. A., Vitowanu, O. R., Abdullah, M. A., Olowoyeye, A. H., Tijani, S. O., Oyedeji, K. S., & Omilabu, S. A. (2024). Detection of hepatitis viruses in suspected cases of Viral Haemorrhagic Fevers in Nigeria. *PloS One*, 19(6), e0305521. https://doi.org/10.1371/journal.pone.0305521

Smith, A., Erasmus, L., Tau, N., Smouse, S., Ngomane, H., Disenyeng, B., Whitelaw, A., Lawrence, C., Sekwadi, P., & Thomas, J. (2023). Enteric fever cluster identification in South Africa using genomic surveillance of *Salmonella enterica* serovar Typhi. *Micro Genom*, 9. https://doi.org/10.1099/mgen.0.001044.

Sule, H., Ibrahim, A., & Muhammad, M. (2024). Malaria and typhoid fever coinfection among febrile patients attending Kafin-Maiyaki Primary Health Centre. *UMYU J of Microbiol Res (UJMR)*. https://doi.org/10.47430/ujmr.2493.027.

Tchoutang, A., Eric, M., Kamdem, S., Nkuno, M., Ngum, N., Tepa, A., & Netongo, P. (2024). Malaria and typhoid fever co-infection: disease severity and immune response. *J of the Nat Med Asso*. https://doi.org/10.1016/j.jnma.2024.07.086.

Umegbolu, E. I. (2017). Sero-prevalence of *Salmonella* typhi antibodies among adult residents of some selected rural communities of Abia and Enugu States, Southeast Nigeria: a cross-sectional study. *Int J of Res in Med Sci*, 5(8), 3400–3405. https://doi.org/10.18203/2320-6012.ijrms20173530

WASH–disease link (urban slum study): Akinyemi, A. E., & Fajobi, T. A. (2023). Relationship between WASH practices and water-borne diseases in Lagos State, Nigeria. *J of Agric, Food and Environ Sci*, 14(1), 23–34. jafeas.com

WHO. (2023). Typhoid fact sheet. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/typhoid World Health Organization

Wijedoru, L., Mallett, S., & Parry, C. M. (2017). Rapid diagnostic tests for typhoid and paratyphoid (enteric) fever. *Cochrane Database of System Rev,* 5, CD008892. Nature

World Bank/MDPI (sanitation access): Ayoade, M. A., & Adepoju, A. O. (2017). Access to sanitation facilities among Nigerian households. Sustainability, 9(4), 547. https://doi.org/10.3390/su9040547 MDPI