WINSOME PUBLISHING

Maternity and Reproductive Health Sciences **ISSN:3064-7096**

Research Article **Open Access**

Prevalence of bacterial enteric fever diseases among pregnant women in the rural and urban parts of Rivers State

Ukwu Chikaebere A., Nwoke B. E. B., Ozims S. J., Eberendu IF

Department of Public Health, Imo State University, Owerri, Nigeria

***Corresponding Author:** Ukwu Chikaebere A., Department of Public Health, Imo State University, Owerri, Nigeria

Received date: **October 14 ,2024:** **Accepted date:** **October 18, 2024:** **Published date:** **November 10, 2024**

Citation: Ukwu Chikaebere A (2024), Prevalence of bacterial enteric fever diseases among pregnant women in the rural and urban parts of Rivers State, **Maternity and Reproductive Health Sciences (MRHS) 1(2), DOI: 10.1875/ed.2024/001.**

Abstract:

The avoidable illness known as "Bacterial Enteric Fever" is prevalent in West Africa and other low-income areas of the world, and it is primarily caused by Salmonella Typhi (S. Typhi) and Salmonella paratyphi A& B.among this study, the prevalence of enteric fever among pregnant women in Rivers State, Nigeria's rural and urban areas was investigated.It is crucial to prevent and treat enteric fever, particularly in susceptible populations like expectant mothers.In light of this, a study was conducted to ascertain the prevalence and methods of control employed by expectant mothers in River State's rural and urban areas. A cluster sample strategy was used to choose 460 pregnant women (230 from urban and 230 from rural areas) from 24 comprehensive primary health care centers in Rivers State, Nigeria, for a cross-sectional study. Data was gathered using a researcher-designed, structured questionnaire. At a significance threshold of 5%, prescriptive and chi square statistics were employed for the date analysis. According to study results, 48.3% of pregnant women in urban areas and 59.4% of those in rural areas had bacterial enteric fever. between the urban and rural areas. Along with feces in rivers (36.5% vs 0%, p= p=<0.1), hand washing before eating (28.7% vs 30..0%, p = 0…030) was subpar. In conclusion, compared to urban areas, the prevalence of bacterial enteric fever among pregnant women living in rural areas was higher.

Key Words: Enteric fever, pregnant, women, health, blood, Nigeria

Introduction

In middle-class and lower-class nations around the world, bacterial intestinal illnesses have become a serious public health concern [1].Typhoid and paratyphoid fevers are included in the category of bacterial enteric fever.Salmonella Typhi (S Typhi) infection is the cause of typhoid fever, while Salmonella Paratyphi A and B are the cause of paratyphoid fever.As to statistics, 76% of all enteric fevers worldwide are caused by S. Typhi[2].The regions most impacted by enteric fever are South America, Asia, and Africa [3].Eating or drinking anything tainted with human excrement can frequently lead to infection with bacteria like Salmonella Typhi and Paratyphi, which can induce enteric fever [4]. In the tropics and subtropics of Africa, Asia, and South America, it is now an endemic illness [5]. An estimated 540 people per 100,000 are affected by it [6]. This translates to around 33.3 million people worldwide who suffer from the illness each

year, and roughly 260,000 fatalities in areas where the illness is prevalent [7]. Although blood culture is the gold standard for enteric fever diagnosis, clinical microbiology services are sometimes unavailable in some endemic locations, which causes a delay in diagnosis [8]. In these kinds of places, the antibody titre in the serum is frequently determined using the less accurate Widal test because of this abnormality [9]. When additional logistical impediments like transportation challenges, hospital wait times, and healthcare provider diagnoses are added, vulnerable populations—including expectant mothers—are further disadvantaged.

Age, illness status, poor hygiene, unsanitary settings, and a lack of clean water are some of the demographic and environmental factors that affect the incidence (yearly new cases) of bacterial enteric fever [10]. Several writers have also mentioned that, particularly in hotspot regions of Africa, the incidence of bacterial enteric fever among pregnant women in

endemic areas has been reported to be greater than acceptable values.

Bacterial enteric fever is a disease that primarily affects people in Africa and causes fever, anorexia, gastrointestinal pain, nausea, and vomiting. It is primarily spread by contaminated food and drink [11]. The similarity in the infection process and clinical symptoms between Salmonella typhi and paratyphi poses the main diagnostic problems. The fecal–oral route is how Salmonella spp. spread after consuming contaminated food and drink. Eight to fourteen days are needed for enteric fever to incubate. In most endemic countries, typhoid fever is more common than paratyphoid fever; yet, the intensity of symptoms might be similar [12]. A clinical presentation-based diagnosis is made more difficult by this. Typhoid and paratyphoid fevers are therefore clinically identical, which is why a great deal of reliance is placed on laboratory testing.

Bacterial enteric fever continues to be a major health concern in Nigeria. More than 80% of the Salmonella typhi strains that were recovered were shown to be resistant to many antimicrobial medications [13]. This would suggest that Nigeria's antibiotic security is being threatened by typhoid fever. In addition, the World Health Organization advises vaccination in addition to addressing inadequate environmental conditions, ensuring access to portable, clean water, ensuring food safety, and maintaining proper sanitation and hygiene. However, widespread adoption of bacterial enteric fever immunizations in Nigeria has not been successful. Many pregnant women are still at high risk of contracting enteric fever due to low immunization rates, particularly in rural areas. Salmonella species.Pregnancy-related infections can result in fatalities like meningitis, septic miscarriage, and fallopian tube inflammation.As a result, Nigeria has documented pregnancy-related mortality from enteric fever[14].The physiological changes that occur during pregnancy put additional strain on a woman's immune and general health.Because pregnant women's bodies naturally release more inflammatory hormones into their blood, it is frequently believed that pregnancy causes a modest reduction in immunological function compared to a non-pregnant female body[15].Eventually, because to potential side effects that could affect the fetus, pregnant women cannot get the majority of medications used to treat enteric typhoid fever.According to the aforementioned assumption, there are significant problems with the clinical management of typhoid fever in pregnancy. [16]. Moreover, if the expectant mother is not treated, difficulties and even death may arise; if she is, there is a chance that the fetus may suffer injury. This reinforces the necessity of changing the focus of prenatal care from curative to preventative, necessitating an assessment of the pregnant women's present enteric fever prevention and control practices.

In pregnant women, bacterial enteric fever is still common in Nigeria. According to recent data, bacterial enteric fever affects roughly 67.8% and 66.8% of pregnant women in the northern and central regions of Nigeria, respectively [17]. The frequency of bacterial enteric fever in pregnant women in rural and urban areas of Rivers State, southern Nigeria, is unknown due to a lack of published research. Additionally, during the course of the researcher's several years of clinical practice in a tertiary hospital, she has anecdotally witnessed the admission and re-admission of pregnant women for sero-positive typhoid and paratyphoid fever sickness.The majority of the admissions and re-admissions that were observed were from the community's primary and secondary healthcare facilities.More importantly, the clinical personnel confronted a difficult and draining ethical conundrum in trying to minimize harm to the fetus and cure the pregnant lady.Through casual conversations with two of the most severely affected pregnant women, it became apparent that little was known about the basic preventive and control measures for enteric fever that could be done at home.A short qualitative contact provided the researcher the motivation to investigate the occurrence and management of enteric fever in pregnant women.

Materials and method

This manuscript dwelt on proposed research methods to be used in the course of this study

Area for the study

The area of study involved the urban and rural settlements in Rivers States. Rivers State is located within the Niger Delta region of southern Nigeria. It has 24 local government areas namely Abua-Odual, Ahoada East, Ahoada West, Akuku-Toru, Andoni, Asari-Toru, Degema, Bonny, Eleme, Emuohua, Etche, Gokana, Ikwerre, Khana, Obio-Akpor, and Ogba-Egbema-Ndoni. Others include Ogu-Bolo, Okirika, Opobo-Nkoro, Oyigbo, Port Harcourt, Omumma, and Tai. The urban areas in Rivers State include Port Harcourt, Obio-Akpor, Ahoada East, Ahoada West, and Oyigbo. The rural areas include Abua-Odual, Akuku Toru, Andoni, Asari-Toru, Degema, Bonny, Eleme, Emuohua, Etche, Gokana, Ikwerre, Khana, Ogba-Egbema-Ndoni, Ogu-Bolo, Okirika, Opobo-Nkoro, and Tai. Each of the mentioned settlements has at least one Comprehensive Primary Health Centre (CPHC) which offered maternal and child health services. The CPHCs were the sites of contact between the researcher and the respondents. Figure 6 below shows the study area.

Target population for the study

The total population for the study was estimated to be 301,526 pregnant women. It was estimated based on the context that there were 5,198,716 people from the 2006 national census. Rivers State has using a population growth rate of at least 3% per years and a birth rate of 4% . Using the fore mentioned in 2021, the general population would have grown to 7,538,138 (Using the arithmetic as follows: (5,198,716 x (2021-2006) years x 0.03 population growth rate) + 5,198,716). Since the birth rate is 4%, the researcher assumed that 4% of the estimated population is likely to be pregnant at each single time, hence a target population of 301,526 pregnant women in Rivers State.

Design

A cross-sectional design was applied to compare the enteric fever prevention and control measures among pregnant women in rural and urban areas of River State. A cross-sectional study is a kind of observational research that examines data from variables gathered at one moment in time across a pre-defined sample, population, or subgroup. The study involved a sample of pregnant women carefully selected from the urban and rural areas of Rivers State.

Sample size determination

A sample size of 460 (n = 230 in the urban group and n = 230 in the rural group) was calculated for the study using Bolarinwa's (2020) formula $n = [(Z_{1-\alpha/2}+Z_{1-\beta})^2 \times P(1-P) \div (p1 - p2)]$; Where n = minimum sample size; $Z_{1-\alpha/2}$ = Type 1 error at $p < 5\%$ = 1.96; $Z_{1-\beta}$ = power 0.84. P = pooled incidence of enteric fever in pregnant women 63%; p1 = 0.07 and p2 = 0.06 based on pivotal data from Kwala and Asika (2020). Mathmatically, $n = [(1.96+0.84)^2 \times 0.63(1-0.63) \div (0.07-0.06)] = 183$. To guard against the high potential fallout rate in prospective cohort study designs the minimum sample size was increased by 20%, using the non-response adjustment formula $nf = [n \div (1 - \text{attrition})]$; hence $nf = [14 \div (1 - 0.2)]$ was computed and a sample size of 230 for each arm of the study was obtained, hence a total sample size of 460.

Sampling technique

Cluster sampling by lottery was utilized in the selection of participants for the study. A total of 920 plastic tallies labelled YES and NO were put into a lottery bag. The pregnant women were approached and encouraged to blind-pick from the lottery bag. Those who pick a YES tally were selected for this study and those who picked a NO tally were excluded from the study. The use of cluster sampling provided some benefits. It gave an equal chance of selection to the members of the target population, minimize systematic bias, produce a data set suitable for inferential analysis, and will produce a normally distributed sample that approximates the target population. For the urban resident pregnant women, 46 pregnant women was selected from each of Port Harcourt, Obio-Akpor, Ahoada East, Ahoada West, and Oyigbo (n = 230). For the rural resident pregnant women, 23 pregnant women was selected from each of Degema, Emuohua, Etche, Eleme, Gokana, Ikwerre, Khana, Ogba-Egbema-Ndoni, Okirika, and Andoni (n = 230).

3.5.1 Inclusion criteria

The inclusion criteria for enrolment include:

1. Gestation at 20-41weeks
2. Maternal age between 15 and 49 years

3.5.2 Exclusion criteria

The criteria for exclusion from this study include:

1. Visibly sick at the time of commencing this study
2. Women admitted into a health facility for hospital care
3. Incomplete demographic information

Instrument for data collection

A structured questionnaire designed by the researcher was used for data collection. The data extraction sheet comprises a designed to extract information on the prevalence and control measures applied by the pregnant women against enteric fever. It was designed to generate categorical data.

Ethical considerations

An application for ethical approval was obtained from the University Institutional Review Board. Administrative permission was obtained from the Primary Health Care Management Board, the Local Government Councils, and the Community Heads. Participant's responses were kept anonymous throughout the period of data collection. All collected data was protected and used only for the approved academic purpose. The study protocol adhered strictly to the provisions of the Helsinki Declaration.

Statistical analysis

Categorical and discrete-interval data was collected. Test of statistical difference (comparison) between groups was done using Fisher exact test and Odds Ratio inferential statistics at a 5% level of significance. Test of association was done using Chi square inferential statistics at a 5% level of significance. All statistical analysis was done with the aid of SPSS 25 (IBM Chicago, USA).

Results

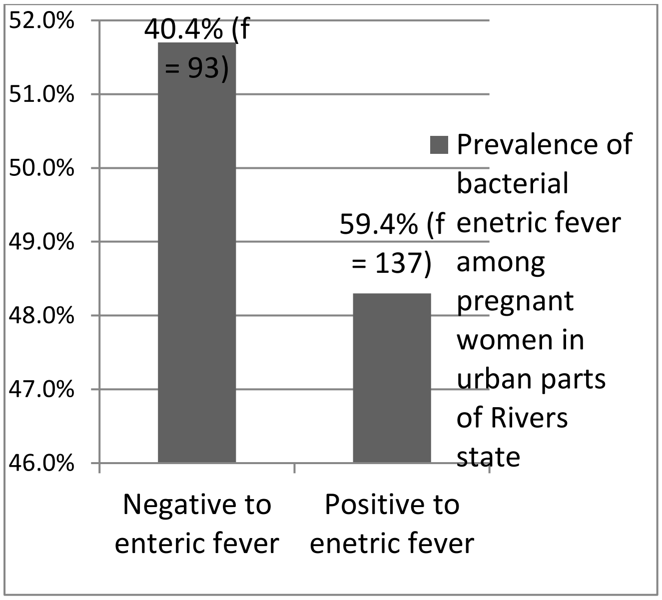
Table 1: Socio-demographic characteristics of the respondents

Variable	Rural, f(%)	Urban, f(%)	χ^2	p
N	230	230		
Age			3.26	0.196
22-28	31 (13.5)	19 (8.3)		
29-35	89 (38.7)	96 (41.7)		
36-42	110 (47.8)	115 (50.0)		
Parity			4.94	0.850
Nullipare	81 (35.2)	68 (29.6)		
1-2	62 (27.0)	84 (36.5)		
3-4	87 (37.8)	78 (33.9)		
Highest educational level			6.01	0.050
Primary	78 (33.9)	60 (26.1)		
Secondary	72 (31.3)	96 (41.7)		
Tertiary	80 (34.8)	74 (32.2)		
Employment			0.035†	0.925
Unemployed	127 (55.2)	129 (56.1)		
Employed	103 (44.8)	101 (43.9)		

n = sample, f = frquency, % = percentage, χ^2 = Chi square, † = Fisher's exact test, p = p value

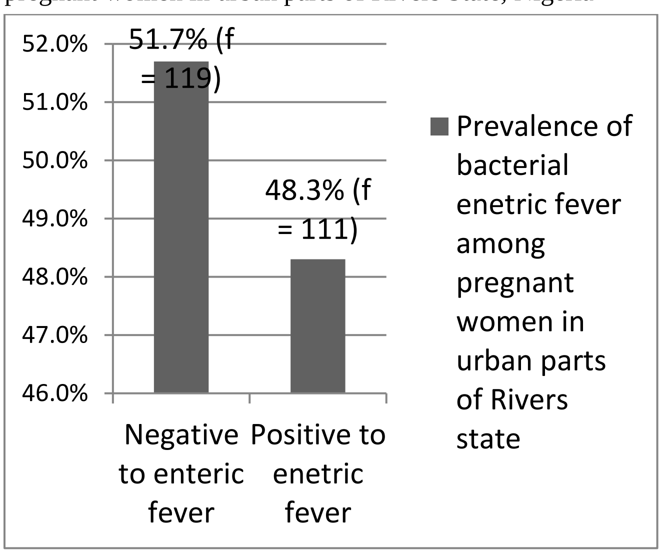
Table 1 showed that the urban resident respondents were similar to the rural resident respondents (p > 0.05). Among the rural resident respondents, the majority were aged 36-42 years (47.8%), with 3-4 childbirth experiences (37.8%), had tertiary education (34.8%), and were unemployed (55.2%). Among the urban resident respondents, the majority were aged 36-42 years (50.0%), with 1-2 childbirth experiences (36.5%), had secondary education (41.7%), and were unemployed (56.1%).

Table 2: the prevalence of bacterial enteric fever among pregnant women in rural parts of Rivers State, Nigeria



Prevalence of bacterial enteric fever among pregnant women in rural parts of Rivers State

Table 3: the prevalence of bacterial enteric fever among pregnant women in urban parts of Rivers State, Nigeria



Prevalence of bacterial enteric fever among pregnant women in urban parts of Rivers State

Table 4: Comparison of prevalence of bacterial enteric fever in rural and urban resident pregnant women n = 460

Variable	Entericfever status		Df	OR(95%CI)	p
	Positive	Negative			
Residence			1	1.58 (1.09-2.28)	0.015
Rural	137	93			
Urban	111	119			

df = degrees of freedom, OR = odds ratio, p = p value

Table 4 above demonstrates that overall, 53.9% (n = 248) of the pregnant women tested poitive to IgM for Enteric fever. About 29.8% were from the rural communities and 24.1% were from the urban communities. The test of hypothesis revealed that the rural resident respondents had 58% greater odds of testing positive to IgM for Enteric fever compared to the urban dweling respondents (OR: 1.58, 95%CI: 1.09-2.28, p = 0.015).

Discussion

This study found that 59.4% of pregnant women living in rural areas had enteric fever. The comparatively lower availability to sanitary infrastructure in Nigeria's rural areas may be the cause of this high incidence level. The risk of fecal-oral transmission of enteric infections is increased in rural regions due to the frequent lack of access to clean water sources and suitable sanitation facilities. Inadequate waste disposal techniques, a lack of restrooms, and open defecation can all lead to fecal matter contamination of water and food sources, which can accelerate the spread of enteric infections. Enteric fever may take longer to diagnose and treat in rural areas due to restricted access to medical services and facilities. Obstacles include distance, expense of transportation, and a lack of proper healthcare infrastructure may prevent pregnant women in rural regions from seeking healthcare, which could result in underutilization of services and poor management of enteric fever.The immune system's capacity to combat enteric infections may be weakened in rural communities due to poor nutritional status and limited access to micronutrients. Undernourished pregnant women are more prone to illnesses, such as enteric fever, which can be harmful to both the mother's and the fetus's health. The risk of exposure to enteric pathogens may be elevated in rural locations due to environmental factors such animal husbandry, agricultural operations, and close proximity to waste disposal sites. Pregnant women who live in rural areas are at risk of contracting enteric fever if they come into contact with polluted soil, water, or food items contaminated with human or animal excrement. In rural regions, socioeconomic variables like poverty, low socioeconomic position, and limited education might increase the risk of enteric fever. Due to their limited access to hygienic food, clean water, and medical treatment, pregnant women from underprivileged families are more likely to have enteric illnesses.

This result was strikingly comparable to that of an Ethiopian investigation [18] that found 52.6% of cases of bacterial enteric fever. The testing strategy employed in the research is connected to the findings' similarity. Serum testing techniques were used in both this investigation and the Ethiopian study.

On the other hand, this result exceeds the 25.7% prevalence of bacterial enteric fever reported in an Ethiopian study by [19]. The study's design may have contributed to the inconsistent results. On the other hand, participants in this study went to the primary healthcare centers. There will inevitably be more people visiting primary healthcare centers because they serve as the health system's initial point of contact with patients.There is a smaller patient load but more serious medical issues in secondary health facilities because they are mostly referred by primary healthcare centers. Additionally, this result was higher than the 10.5% prevalence found in a Nigerian study by [20].

The fact that[21] used a Mono-facility design with just one main healthcare center may help to explain the disparity in findings. This study, on the other hand, combined data from multiple primary healthcare centers to get an indication of the pooled prevalence because it used a multi-facility design. Furthermore, the results of this study were not as high as those of another Nigerian study by [22], which found that pregnant women at Yola Specialist Hospital in Eastern Nigeria had a 66.8% prevalence of bacterial enteric fever. The study's focus may be connected to the disparity in results. While it was carried out in eastern Nigeria, this study was carried out in southern Nigeria [23]. The eating habits, cooking methods, and hygienic culture that differ between eastern and southern Nigeria account for the findings' discrepancies.

Additionally, the results of this study were greater than those of a Nigerian study carried out in the country's north by [24], who discovered that 43% of pregnant women had bacterial enteric fever. Since the analyzed sample in [25] consisted of metropolitan dwellers, the disparity was predicted. Furthermore, the results of this investigation were not as high as those of a Nigerian study carried out in Lagos by [26], which discovered a 63.3% prevalence of bacterial enteric fever in expectant mothers. The differences in sample sizes analyzed for the study account for the variance in results. Moreover, this result was less common than the 62% frequency among pregnant women that [27] reported from India.

The reduced prevalence seen in this study may result from differences in southern Nigerian and Indian hygienic habits and traditions. Furthermore, a prevalence of 67.8% was observed in Niger State, northern Nigeria, which is greater than the study's findings [28]. The types of subjects included in the study may account for the differences in results. According to this study, pregnant women in Rivers State's metropolitan regions had a 48.3% prevalence of enteric fever. This conclusion may be due to the fact that pregnancy hormones already put pressure on a pregnant woman's immune system, making her more susceptible to bacterial enteric fever [29].

Overcrowding and poor sanitation infrastructure are major issues in urban settings, and they can contribute to the spread of enteric diseases like Salmonella typhi and Salmonella paratyphi. The increased occurrence of enteric fever in urban environments could be attributed to inadequate access to potable water, inappropriate disposal of waste, and crowded living arrangements. Urban settings may have a greater concentration of street vendors and unofficial marketplaces with less enforcement of food safety regulations. Taking in tainted food or water from these sources can raise the chance of contracting intestinal illnesses. Urban regions may also see water supply interruptions or contaminated municipal water sources, which would further aid in the spread of enteric infections.

Even though they are urban regions, some villages in Rivers State might not have easy access to medical services or might encounter difficulties getting prompt medical attention. Due to this, pregnant women who contract enteric fever may have delays in identification and treatment, which could allow the virus to continue and spread across the population. The increased frequency of enteric infections seen in metropolitan environments may also be attributed to a lack of knowledge about the signs and preventative actions. Pregnant women who experience urban poverty and socioeconomic inequality may be more susceptible to enteric fever. Vulnerable groups in urban environments may be disproportionately affected by inadequate housing, poor hygiene habits, and limited access to nutrient-dense food, which increases their risk of contracting enteric illnesses.

The risk of transmission can also be increased by variables including unemployment, congested living situations, and a lack of knowledge about good hygiene habits. High rates of migration and population movement are common in urban settings, which can aid in the spread of infectious diseases. People who migrate from rural regions where enteric fever is widespread can bring the disease to urban areas and cause isolated outbreaks. Furthermore, urban regions' high population density and mobility can hasten the spread of gastrointestinal infections, raising their prevalence rates in pregnant women.

This result was strikingly comparable to that of a Nigerian study [30] that found 43% of cases of bacterial enteric fever to be prevalent in Abuja.

Because a similar sample size of urban people was evaluated in both research, the identical findings can be explained. Moreover, this result is less than that of a different Nigerian study carried out in Yola, which found that 66.8% of pregnant women had bacterial enteric fever [31]. The differences in results can be attributed to the single facility design in this study as opposed to the multi-facility approach. According to this study, respondents who lived in rural areas were 58% more likely than those who lived in urban areas to test positive for IgM for enteric fever (OR: 1.58, 95%CI: 1.09-2.28, p = 0.015). The finding that respondents who lived in rural areas were 58% more likely than those who lived in urban areas to test positive for IgM for enteric fever has multiple reasonable explanations.

In comparison to urban regions, rural areas frequently struggle with inadequate sanitary facilities and poor hygiene habits. In rural populations, the danger of exposure to enteric pathogens is increased by the lack of access to sanitary facilities, clean water, and appropriate waste disposal systems.Compared to urban areas, rural communities could have less access to medical services and healthcare facilities. This may cause people to put off getting help for their enteric fever symptoms, which could increase the illness's occurrence in rural areas. Enteric infections may be more prevalent in rural areas due to a number of causes, including agricultural activities, close proximity to animal reservoirs, and poor sewage disposal systems. In rural locations, there may be an increased chance of contracting enteric fever due to certain environmental factors.

Inter-urban and inter-rural socioeconomic differences can also affect the incidence of enteric fever. Due to variables including hunger and congested living situations, enteric infections can be more common in rural communities because of their lower socioeconomic position, restricted access to education, and higher rates of poverty. Rural and urban areas may have different cultural norms around food preparation, water storage, and personal hygiene. In rural communities, there may be a higher prevalence of cultural practices that raise the risk of enteric pathogen contamination, such as drinking untreated water or cooking food incorrectly.

This study's findings indicate more rural residents than urban residents urinate in fields and rivers may help to explain the disparity in the prevalence of bacterial enteric fever among pregnant women in the two populations.

Conclusion

This study found that pregnant women in rural and urban areas of Rivers State, Nigeria, had significantly different prevalence and risk factors for bacterial enteric fever. Compared to urban settings, enteric fever was more common among pregnant women living in rural areas. Both groups' poor hand hygiene habits were noted, with urban women showing poor hand hygiene before eating and after using the restroom and rural women showing lower rates of hand washing before eating and after using the restroom. It's interesting to note that enteric fever was more common in rural women than in urban ones.

References

1.Masuet-Aumatell, C., & Atouguia, J. (2021). Typhoid Fever Infection–Antibiotic Resistance And Vaccination Strategies: A Narrative Review. Travel Medicine And Infectious Disease, 40(1), E101946.

2.Adogo, L., Graba, S., & Abalaka, M. (2015). Sero Prevalence Of Salmonella Typhi Among Pregnant Women In Niger State. *Journal Of Microbiology Research, 5*(3), 118-121. Https://Doi.Org/10.5923/J.Microbiology.20150503.06.

3.Afolaranmi, T., Hassan, Z., Bello, D., Tagurum, Y., Miner, C., Zoakah, A., & Ogbonna, C. (2014). Training: A Vital Tool For Improving The Knowledge And Practice Of Food Safety And Hygiene Among Food Handlers In Boarding Secondary Schools In Plateau State. *Journal Of Medicine In The Tropics, 16*(2), 87-92.

4.Bennett, S., Lowther, S., Chingoli, F., Chilima, B., Kabuluzi, S., Ayers, T., & Mintz, E. (2018). Assessment Of Water, Sanitation And Hygiene Interventions In Response To An Outbreak Of Typhoid Fever In Neno District, Malawi. *Plos One*,

5.Chen, M., Zeng, J., Liu, X., Sun, G., Gao, Y., Liao, J., ... & Qi, H. (2020). Changes In Physiology And Immune System During Pregnancy And Coronavirus Infection: A Review. European Journal Of Obstetrics & Gynecology And Reproductive Biology, 255(1), 124-128.

6.Berhanu, L., Mereta, S. T., Gume, B., Kassa, T., Berihun, G., Dadi, L. S., ... & Bedru, H. (2021). Effect Of Microbial Quality Of Washing Water On Hand Hygiene Status Of Food Handlers In Jimma Town: Implication For Food Hygiene And Safety. *Journal Of Multidisciplinary Healthcare*, 1129-1134.

7.Prasad, N., Jenkins, A., Naucukidi, L., Rosa, V., Sahu-Khan, A., & Kama, M. (2018). Epidemiology And Risk Factors For Typhoid Fever In Central Division, Fiji, 2014–2017: A Case-Control Study. Plos Neglected Tropical Diseases, 12(6), E0006571.

8.Reynolds, L. P., Borowicz, P. P., Caton, J. S., Crouse, M. S., Dahlen, C. R., & Ward, A. K. (2019). Developmental Programming Of Fetal Growth And Development. Veterinary Clinics Of North America: Food Animal Practice, 35(2), 229-247.

9.Bhume, R. J., & Babaliche, P. (2020). Clinical Profile And The Role Of Rapid Serological Tests: Typhifast Igm And Enterocheck Wb In The Diagnosis Of Typhoid Fever. *Indian Journal Of Critical Care Medicine: Peer-Reviewed, Official Publication Of Indian Society Of Critical Care Medicine*, *24*(5), E307.

10.Deksissa, T., & Gebremedhin, E. (2019). A Cross-Sectional Study Of Enteric Fever Among Febrile Patients At Ambo Hospital: Prevalence, Risk Factors, Comparison Of Widal Test And Stool Culture And Antimicrobials Susceptibility Pattern Of Isolates. *Bmc Infectious Diseases, 19*(1), 288-290. Https://Doi.Org/10.1186/S12879-019-3917-3.

11.Akinyemi, K., Oyefolu, A., Mutiu, W., Iwalokun, B., Ayeni, E., Ajose, S., & Obaro, S. (2018). Typhoid Fever: Tracking The Trend In Nigeria. American Journal Of Tropical

Medicine And Hygiene, 99(3), 41-47. Http://Doi.Org/10.4269/Ajtmh.18-0045.

13. Als, D., Radhakrishnan, A., Arora, P., Gaffey, M., Campisi, S., Velummailum, R., & Bhutta, Z. (2018). Global Trends In Typhoidal Salmonellosis: A Systematic Review. American Journal Of Tropical Medicine And Hygiene, 99(3), 10-19.

14.El-Nemr, I., Mushtaha, M., Irungu, P., Asim, H., Tang, P., Hasan, M., & Goktepe, I. (2019). Assessment Of Food Safety Knowledge, Self-Reported Practices, And Microbiological Hand Hygiene Levels Of Produce Handlers In Qatar. *Journal Of Food Protection*, *82*(4), 561-569.

15.Giri, S., Mohan, V., Srinivasan, M., Kumar, N., Kumar, V., Dhanapal, P., & Kang, G. (2021). Case-Control Study Of Household And Environmental Transmission Of Typhoid Fever In India. *The Journal Of Infectious Diseases*, *224*(5), S584-S592.

16.Irena, T. K., & Gakkhar, S. (2022). Optimal Control Of Two-Strain Typhoid Transmission Using Treatment And Proper Hygiene/Sanitation Practices. *Journal Of Computational Analysis & Applications*, *30*(2), 355-369.

17.Jenkins, A. P., Jupiter, S. D., Jenney, A., Rosa, V., Naucukidi, A., Prasad, N., ... & Horwitz, P. (2019). Environmental Foundations Of Typhoid Fever In The Fijian Residential Setting. *International Journal Of Environmental Research And Public Health*, *16*(13), E2407.

18.Kampf, G. (2019). Adaptive Bacterial Response To Low Level Chlorhexidine Exposure And Its Implications For Hand Hygiene. *Microbial Cell*, *6*(7), E307.

19.Brockett, S., Wolfe, M. K., Hamot, A., Appiah, G. D., Mintz, E. D., & Lantagne, D. (2020). Associations Among Water, Sanitation, And Hygiene, And Food Exposures And Typhoid Fever In Case–Control Studies: A Systematic Review And Meta-Analysis. The American Journal Of Tropical Medicine And Hygiene, 103(3), E1020.

19..Kazma, J. M., Van Den Anker, J., Allegaert, K., Dallmann, A., & Ahmadzia, H. K. (2020). Anatomical And Physiological Alterations Of Pregnancy. *Journal Of Pharmacokinetics And Pharmacodynamics*, *47*(4), 271-285.

20.Kim, J.-H., Im, J., Parajulee, P., Holm, M., Espinoza, L., Poudyal, N., & Marks, F. (2019). A Systematic Review Of Typhoid Fever Occurrence In Africa. *Clinical Infectious Diseases*, *69*(Suppl 6), S492-S498.

21.Habibzadeh, H., Shariati, A., Mohammadi, F., & Babayi, S. (2021). The Effect Of Educational Intervention Based On Pender's Health Promotion Model On Quality Of Life And Health Promotion In Patients With Heart Failure: An Experimental Study. Bmc Cardiovascular Disorder, 21(1), 478.

22.Shahapur, P. R., Nimbal, A., Suvvari, T., Silva, R., & Kandi, V. (2021). Traditional Widal Agglutination Test Versus Rapid Immunochromatographic Test In The Diagnosis Of Enteric Fever: A Prospective Study From South India. Cureus, 13(10), E18474.

23.Neupane, D., Dulal, H., & Song, J. (2021). Enteric Fever Diagnosis: Current Challenges And Future Directions. Pathogens, 10(4), 410.

24.Wong, V., Baker, S., Connor, T., Pickard, D., Page, A., & Dave, J. (2016). An Extended Genotyping Framework For Salmonella Enterica Serovar Typhi, The Cause Of Human Typhoid . Nature Communications, 7(1), 12827.

25.Hu, B., Hou, P., Teng, L., Miao, S., Zhao, L., Ji, S., ... & Yue, M. (2022). Genomic Investigation Reveals A Community Typhoid Outbreak Caused By Contaminated Drinking Water In China, 2016. Frontiers In Medicine, 9(1), E753085.

26.Mahagamage, M. G. Y. L., Pathirage, M. V. S. C., & Manage, P. M. (2020). Contamination Status Of Salmonella Spp., Shigella Spp. And Campylobacter Spp. In Surface And Groundwater Of The Kelani River Basin, Sri Lanka. *Water*, *12*(8), 2187.

27.Malan, A., Kumar, V., & Sharma, H. R. (2020). Bacteriological Evaluation Of Groundwater In Open-Defecation-Free Villages Of Kurukshetra District, Haryana, India. *International Journal Of Environmental Studies*, *77*(6), 928-941.

28.Shakya, M., Colin-Jones, R., Theiss-Nyland, K., Voysey, M., Pant, D., & Smith, N. (2019). Phase 3 Efficacy Analysis Of A Typhoid Conjugate Vaccine Trial In Nepal. The New England Journal Of Medicine, 381(23), 2209–2218. 7.

29.Salman, Y., Asim, H., Hashmi, N., Islam, Z., Essar, M. Y., & Haque, M. A. (2022). Typhoid In Bangladesh: Challenges, Efforts, And Recommendations. Annals Of Medicine And Surgery, 80(1), E104261.

30.Yap, K., Gan, H., The, C., Chai, L., & Thong, K. (2014). Comparative Genomics Of Closely Related Salmonella Enterica Serovar Typhi Strains Reveals Genome Dynamics And The Acquisition Of Novel Pathogenic Elements. Bmc Genomics, 15(1), 1007.

31.Pinto-Meza, A., Moneta, M., Alonso, J., Angermeyer, M., Bruffaerts, R., De-Almeida, J., & O'neil, S. (2012). Social Inequalities In Mental Health: Results From The Eu Contribution To The World Mental Surveys Initiative. Social Psychiatry And Psychiatric Epidemiology, 48(1), 173-181.

32murray, S. R., & Reynolds, R. M. (2020). Short-And Long-Term Outcomes Of Gestational Diabetes And Its Treatment On Fetal Development. *Prenatal Diagnosis*, *40*(9),