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Bacterial Assessment and Public Health Risk Associated With Baby Weighing Scale Usage in Primary Healthcare Facilities

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ABSTRACT

Baby weighing scales, commonly used in healthcare facilities to monitor infant growth and development, can serve as potential reservoirs for pathogenic microorganisms if not properly sanitized. This study aimed to assess the bacterial contamination of baby weighing scales in six (6) selected rural healthcare facilities across Obio/Akpor Local Government Area of Rivers State, Nigeria. Using sterile swab sticks, samples were collected from the top and base of weighing scales, stored in cool condition and immediately transported to the laboratory for microbiological analyses using standard techniques. Results of average values of total bacteria counts ranged from 24.0 × 10^2CFU/ml to 73.0 × 10^2CFU/ml. Order of decreasing bacteria in facilities was; Eliparanwo > Eneka > Rumuokoro > Rumuepirikom > Rumukwurushi > Rumueme. The isolated bacteria identified were; *Acinetobacter baumannii*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Proteus mirabillis*, methicillin Resistant *Staphylococcus aureus*, *Salmonella typhii*, and *Enterococcus* which are indicators of poor hygiene practices and probable cross infection of infants. Antibiotics susceptibility testing of these bacteria to antibiotics viz- Imipenemm Cefuroxime, Augmentin, Cefotaxime, Ceftriaxone, Linezolid, Aztreonam, Ciprofloxacin, Gentamicin, Azithromycin, Erythromycin and Oflaxoxin revealed that, *Acinetobacter baumanni* recorded 83.3% resistance to the 12 antibiotics tested, *Pseudomonas aeruginosa* had 75% resistance, *Staphylococcus aureus* had 50% resistance while *Escherichia coli* had 41.6% resistance. The presence of these bacteria some of which are known to cause infections in infants with underdeveloped immune systems in Baby weighing scales, poses a serious public health concern. This study underscores the need for strict and regular implementation of thorough sanitization of and the use of disposable barriers on baby weighing scales. These will mitigate the risk of infections associated with the use of baby weighing scales to vulnerable populations, particularly infants from preventable infections.

Keywords: Baby Weighing Scale, *A. baumannii*, Methicillin-Resistant *S. aureus*, Antibiotic Resistance, Public Health Risk.

Introduction

Bacterial contamination in healthcare facilities is a persistent and significant global challenge that poses risks to patient safety and public health; presenting substantial health hazards to patients, healthcare personnel, and visitors. Understanding the origins and types of bacterial contamination is crucial for implementing effective infection prevention and control measures in healthcare settings (Bonadonna *et al.*, 2021; Cave *et al*., 2021). Healthcare personnel also play a critical role in the transmission dynamics of bacterial contaminants within facilities, emphasizing the importance of rigorous hand hygiene practices and the use of personal protective equipment (Owen and Laird, 2020).

Addressing these challenges requires a comprehensive understanding of the sources and types of bacterial contaminants, as well as evidence-based strategies aimed at enhancing infection prevention practices and promoting patient safety in healthcare settings. The presence of bacteria in healthcare facilities poses significant public health risks, particularly in environments where vulnerable populations such as infants, are frequent. Baby weighing scales are essential tools used to monitor infant growth and development in healthcare settings (Chou *et al*., 2020). Although necessary for monitoring infant growth, baby weighing scales can unintentionally become reservoirs for pathogenic bacteria if not properly cleaned and maintained and can contribute to hospital-acquired infections.

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Healthcare-associated infections (HAIs) are a significant global challenge, leading to increased morbidity, mortality, and healthcare costs. Infants, especially those in neonatal intensive care units and pediatric wards, with compromised or immature immune systems or prolonged hospital stays are particularly susceptible to infections transmitted through contaminated medical devices (Shepard *et al*., 2020). Baby weighing scales, often used multiple times a day without thorough cleaning, can harbor harmful bacteria, including *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas* species. This presents a potential risk to the health and safety of infants and young children visiting these facilities (Forrester *et al*., 2022).

Understanding the prevalence and types of bacteria found on these Baby weighing scales is crucial for implementing effective infection prevention strategies tailored to local conditions (Adut, 2022). Additionally, in resource-constrained settings where access to basic amenities such as clean water and disinfectants may be limited, maintaining hygiene standards can be challenging. It is important to assess the prevalence and types of bacterial contamination on baby weighing scales in these healthcare settings to develop targeted interventions and infection control strategies (Ajegbile, 2023). By increasing awareness about the public health hazards linked with baby weighing scales and other medical devices, the study contributes to ongoing efforts to prioritize patient safety in healthcare settings. Infants and young children, who are particularly susceptible to infections, stand to benefit significantly from improved hygiene protocols and more rigorous cleaning practices in healthcare facilities (Emmanuel and Michael, 2020).

The transmission and spread of multidrug-resistant organisms (MDROs) or multiple antibiotic resistant (MAR) bacteria within healthcare facilities can occur through direct contact with contaminated surfaces, medical equipment, or healthcare personnel, highlighting the importance of rigorous infection control measures. Beyond direct patient outcomes, bacterial contamination also affects broader healthcare systems and public health (Waddington *et al*., 2022). Outbreaks of healthcare-associated infections linked to bacterial pathogens can strain hospital resources, disrupt patient care services, and require costly outbreak control measures.

Additionally, the potential for community spread of resistant bacteria originating from healthcare settings underscores the link between hospital-acquired infections and public health surveillance and containment efforts. Effective management of health risks associated with bacterial contamination requires a comprehensive approach that integrates surveillance, infection prevention protocols, antimicrobial stewardship, and patient education (O'Toole, 2021).

Understanding the extent and nature of bacterial contamination on baby weighing scales is crucial for implementing targeted interventions aimed at reducing the risk of HAIs among pediatric patients and improving infection control practices in healthcare settings (Bhura *et al*., 2020; Kennedy *et al*., 2023). Proactively addressing these issues will help minimize the spread of infections and improve the quality of care provided to infants, who are the most vulnerable patients.

Rural communities where healthcare resources may be limited, factors such as inadequate cleaning practices, resource constraints, and environmental conditions may heighten the risk of bacterial contamination on baby weighing scales (Wammanda *et al*., 2020). There is the need to fill a critical void in existing literature pertaining to healthcare-associated infections (HAIs) in rural Nigerian healthcare settings, with an emphasis on vulnerable demographics such as infants (Asfaw, 2021). Communities such as Rumuepirikom, Eliparanwo, Rumueme, Rumuokoro, Eneka, and Rumukwurishi are all rural communities in Obio/Akpor Local Government Area in Rivers State, Nigeria are faced with the unique challenges in healthcare infrastructure and resource allocation, potentially impacting hygiene practices and infection control measures in healthcare facilities. Studies on the prevalence of antibiotic resistance in bacteria isolated from Baby weighing scales are also scarce. Hence, this study aims to investigate the extent of microbial contamination on baby weighing scales in rural healthcare settings in Communities such as Rumuepirikom, Eliparanwo, Rumueme, Rumuokoro, Eneka, and Rumukwurishi in Obio/Akpor LGA of Rivers State, Nigeria and to determine the susceptibility and hence the antibiotic resistance profile of the bacteria isolated from baby weighing scale to commonly use antibiotics for possible antibiotic resistant bacteria.

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The findings will unravel the potential public health implications of such contamination, including the risk of infection transmission to vulnerable newborns and healthcare workers. By identifying common pathogens and evaluating the adequacy of current cleaning protocols, the findings will provide valuable insights to local healthcare practitioners and policymakers.

Materials and Methods

Study Area

This study focuses on assessing bacterial contamination specifically related to baby weighing scales in healthcare facilities located in six (6) rural communities namely; Rumuepirikom, Eliparanwo, Rumueme, Rumuokoro, Eneka and Rumukwurishi across Obio/Akpor Local Government Area (LGA) of Rivers State, Nigeria. The geographical scope includes selected healthcare institutions within these rural communities, considering factors such as facility size, patient demographics, and healthcare practices relevant to infection prevention and control.

Research Design

The research was conducted using a descriptive cross-sectional design to assess bacterial contamination and public health risks associated with baby weighing scale usage in healthcare facilities in Obio/Akpor LGA Rivers State. This design was chosen to gather data at a single point in time, allowing for a snapshot of contamination levels and associated factors. The descriptive nature of the design facilitated the examination of variables such as bacterial presence on scales, cleaning practices, and infection prevention protocols within the study area. This approach will provide a comprehensive overview of the current state of contamination risks and inform subsequent recommendations for infection control measures.

Materials/ Apparatus

Electronic weighing balance, Baby weighing scale, Nutrient agar, Blood agar, samples, Petri dish, sterile swab sticks, cotton wool, ethanol, masking tape, inoculating wire loop, conical flasks, Autoclave, Incubator, Refrigerator, syringe, normal saline, Bunsen burner, distilled water, and Gram staining reagents. Others were, Biochemical test reagents, GN24 kit is also known as gram negative (GN) identification kit, GP24 kit is also known as gram positive (GP) identification kit, and antibiotics sensitivity test kit.

Sampling Techniques for Sample Collection and Rehydration of Sample

Sterile swab sticks were taken to the various primary healthcare facilities (Sampling locations) in the pediatrics and post- natal units that do make use of baby weighing scales.

On arrival at the each sampling location, each weighing scale were swabbed using a sterile swab stick on the top and base of the machine. This was done on both sanitized and dusty baby weighing scales, and the procedure was repeated at each sampling location.

After sample collection, the swab sticks were rehydrated with 1ml of sterile normal saline for 10mins using a sterile syringe. A total of thirty (30) samples were collected in total health facilities of the six (6) communities in Obio/Akpor local government area of River State Nigeria.

Media Preparation

Two types of medium were used in this study, nutrient agar and blood agar. About 5.7grams of nutrient agar was measured with a weighing balance and poured into a conical flask. 200ml of distilled water was then added into the same comical flask and stirred gently to ensure adequate mixture and solubility.

The comical flask containing the mixture was sealed properly and sterilized in an Autoclave at 121°C for 15 minutes. The mixture was then allowed to cool and was dispensed aseptically into sterile Petri dishes and allowed to solidify.

Nine (9) grams of blood agar was measured with an electronic weighing balance and poured into a conical flask. 250ml of distilled water was added into the conical flask and stirred gently to ensure appropriate mixture and solubility. The conical flask was sealed properly and put into an autoclave at 121°C for 15 minutes for sterilization. The mixture was allowed to cool and was poured into sterile Petri dishes and allowed time to solidify.

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Cultivation and isolation of bacteria from Samples (Streak plate)

Direct streaking was done for each of the samples on different plates of nutrient agar culture medium. This was done by aseptically swabbing directly on each plate of prepared culture media using the swab sticks used for sample collection after rehydrating them for 10mins. The Quadrant Streaking technique was employed here.

The plates were labeled appropriately after culturing and incubated in inverted position for 18-24hours at 37°C. After 24 hours of incubation the plates were examined for development/growth of bacteria colonies. The colonies which developed were counted, as colony forming units (CFU). Distinct colonies were isolated and identified, and sub-cultured onto sterile blood agar. The cultured blood agar plates were subsequently incubated in inverted positions at 37°C for 18-24 hours.

Gram staining and Biochemical Characterization of isolates

Gram staining is a laboratory technique used to categorize bacteria into two broad categories - Gram positive and Gram negative. The technique was developed by Hans Christian Gram in 1884. It is a fundamental technique in microbiology that helps us understand bacteria, diagnose diseases and develop effective treatment. A little portion of the inoculum was scoped and put on a grease free glass slide and a smear was made. The smear on the grease free glass slide was passed through flame for about three to four times to heat fix. A drop of Crystal violet just enough to cover the smear was added and left for 1-2minutes. It was then rinsed off with distilled water. The smear was covered with iodine for 1 minute. It was then rinsed off with distilled water. The smear was then decolorized with 90% alcohol for 30 seconds and rinsed with distilled water. A counter stain was added to the smear for 1-2 minutes and rinsed with distilled water. The smear was allowed to air dry. It was then observed under the microscope and recorded as required.

Catalase test

Catalase test is a biochemical test used to identify bacteria that produce catalase enzyme. Catalase breaks down Hydrogen peroxide (H_2O_2) into H_2O and O_2.

A drop of hydrogen peroxide is added to a grease free glass slide. A small amount of bacteria culture from a fresh culture was added to the hydrogen peroxide solution. The mixture was observed for bubbles which indicated a positive result. The results were recorded as required.

Oxidase test

The Oxidase test is a biochemical test used to identify bacteria that produce cytochrome c Oxidase enzyme. This enzyme is involved in the electron transport chain and helps bacteria generate energy. A small amount of bacteria culture from a fresh culture was added onto a filter paper and a drop of the oxidase reagent was added to the culture. The test was observed for reaction. A colour change to blue, purple or black indicates a positive result.

GN24 kit for Biochemical Reactions

GN24 kit is also known as gram negative (GN) identification kit. It is used to identify gram negative bacteria, based on their biochemical characteristics. A MacFaland 2(McF2) with an absorbance of 0.451 at a wave length of 600nm was prepared to be used immediately. A suspension with the same absorbance and wave length with McF2 was prepared by scooping pure culture from unselective media (nutrient agar) with a sterile wire loop and adding it to distilled water, 0.1ml of the well homogenized suspension was inoculated into each well of strip marked with members of the cultures to be examined using a micropipette test from URE (urease) to LYS (lysine) (well from H to C) was covered with four drops of paraffin oil. The kit was then incubated at a temperature of 35ºC for 24hours. Results were then recorded by comparing the changes in color using a color charts. Test that could not be elevated were left empty.

GP24 KIT for Biochemical Reactions

GP24 kit is a gram positive test kit used for identification of bacteria isolates based on their biochemical characteristics. A MacFaland 3(McF3) with an absorbance of 0.582 at same wave length of 600nm was prepared to be used immediately. A suspension with the same absorbance and wave length with the McF3 was prepared by scooping pure culture from unselective media, with a sterile wire loop and added to distilled water; 0.1ml aliquot of the

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Homogenized suspension was inoculated into each well of strip marked with the numbers of cultures to be examined using a micropipette. The test URE (urease) and ARG (arginine) (well H1 and H2) were covered with three drops of paraffin oil. The kit was then incubated at a temperature of 35ºC for 24 hours. Results were then recorded by comparing the color changes using a color charts. Test that could not be elevated were left empty.

Antibiotic Susceptibility testing

Antibiotic susceptibility testing was performed using Kirby Bauer disk diffusion method. A bacterial suspension equivalent to 0.5 McFarland turbidity standard was prepared for inoculation. A sterile swab stick was dipped into the prepared bacterial suspension and inoculated onto a Mueller-Hinton agar plate by swabbing the suspension evenly across the surface of the plate. Sterile forceps were then used to place Gram positive antibiotic disks onto the inoculated agar plate. The discs contained the following antibiotics: Ampicillin/Sulbactam - AS (20µg) Co-Trimoxazole - BA (25µg), Cefotaxime - CF (30µg), Piperacillin/Tazobactam - PT (110µg), Chloramphenicol - C (30µg), Ciprofloxacin - CP (30µg), Ciftriaxone - CR (30µg), Tetracycline - TE (30µg), Ofloxacin - OFX (5µg), Gentamicin - GM (10µg), Azithromycin - AT (15µg), Levofloxacin - LE (5µg). The discs were gently pressed down to ensure they have contact with the agar. The plates were then incubated for 16 to 24 hours to allow bacterial growth at 37ºC. After incubation, the plates were observed for zones of inhibition (clear zones). The zones of inhibition around each disc (which indicates the effectiveness of the antibiotic on the bacteria) were measured using a meter rule, and recorded in millimeters. The zone of inhibition were then compared to standard reference chart criteria provided by Clinical and Laboratory Standards Institute (CLSI, 2017), and the results classified as Susceptible, Intermediate, or Resistant based on the sizes of the zones of inhibition and the specific antibiotic.

Results

The results of the mean values of total aerobic heterotrophic bacteria counts of the Baby weighing scales in the various primary healthcare facilities are as presented in Figure 1. The bacteria counts ranged from 24.0 × 10^2CFU/ml of the swaped samples in Rumueme to 73.0 × 10^2CFU/ml in Eliparanwo. The order of decreasing bacteria count in the Baby weighing scales of the primary healthcare facilities was; Eliparanwo > Eneka > Rumuokoro > Rumuepirikom > Rumukwurushi > Rumueme.

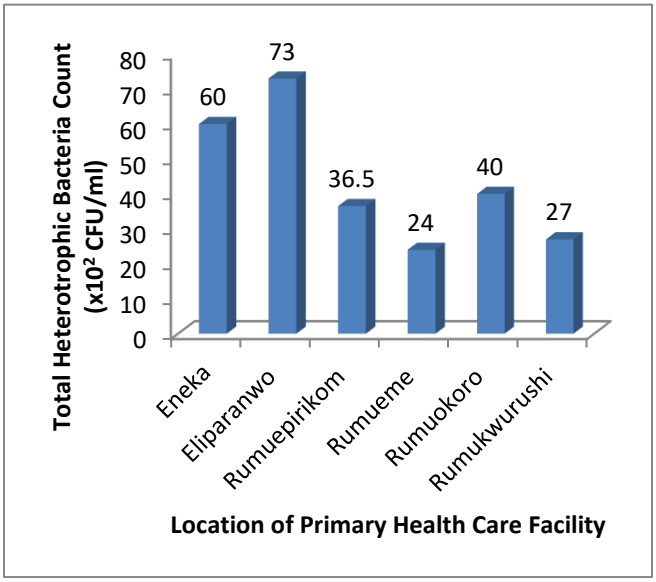

Fig. 1: Mean values of total aerobic heterotrophic bacteria counts in the primary healthcare facilities

The results of the morphological characteristics of bacteria isolates were analyzed based on their colony appearances are presented in Table 1. Isolate G exhibited circular, flat, small, smooth, and translucent colonies, which are consistent with the characteristics of *Acinetobacter baumannii*. Isolate C exhibited circular, flat, pinhead-sized, smooth, and creamy colonies, which likely represent *Proteus mirabilis*. Isolate B was identified with rhizoid, larger, rough, and translucent colonies, indicating the presence of *Enterococcus*. Isolate I showed circular, entire, flat, pinhead-sized, smooth, and translucent colonies, suggesting the presence of *Methicillin-resistant Staphylococcus aureus* (MRSA). Isolate ES was characterized by rod-shaped, flat, entire, small, rough, and dark blue colonies, which are typical of *Escherichia coli*. Isolate SPE exhibited irregular, opaque, small, and entire colonies, representing *Salmonella typhi*, while isolate Ps displayed irregular, flat, lobed, medium-sized, dark green, smooth colonies, consistent with *Pseudomonas aeruginosa*. Finally, isolate S showed circular, raised, smooth, golden-yellow, and opaque colonies, which are typical of *Staphylococcus aureus*.

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Table 1: Morphological characteristics of bacteria isolated from Baby weighing scales

Sample Code	Morphology	Probable organism
G	Circular, flat, small, smooth, translucent, entire colonies	*Acinetobacter baumannii*
C	Circular, flat, pin head, smooth, entire creamy	*Proteus mirabilis*
B	Rhizoid, larger, rough, filliform, translucent colonies	*Enterococcus*
I	Circular, entire, flat, pin head, smooth, translucent colonies	Methicillin resistant *Staphylococcus aureus*
ES	Rod, flat, entire, small, rough, dark blue colonies	*Escherichia coli*
SPE	Irregular, opaque, small, entire colonies	*Salmonella typhi*
Ps	Irregular, flat, lobed, medium, dark green, smooth colonies.	*Pseudomonas aeruginosa*
S	Circular, raised, smooth, golden-yellow, opaque	*Staphylococcus aureus*

Table 2: Biochemical test of bacteria isolated from Baby weighing scales

Biochemical Tests/Activity	Isolate Codes of Bacteria from Baby Weighing Scales							
	G	**C**	**B**	**I**	**ES**	**SPE**	**Ps**	**S**
Gram reaction	-	-	+	+	-	-	-	+
Oxidase					-	-	+	
Catalase					+	+	+	
Urease	+	+	+	+	-	-	-	-
Glucose fermentation	+	+			+	+	-	
Hydrogen sulphide production	+	+			-	+	-	
Arginine decarboxylase	+	+	+	+	-	-	+	-
Ornithine decarboxylase	+	+			+	-	-	
Lysine decarboxylase	+	+			+	+	-	
Scicariine hydrolysis	+	+			-	-	-	
Beta-glucosidase	+	+	+	+	-	-	-	-
Endo-beta-N-acetylglucosaminidase	+	+	+	+	-	-	-	-
Dulcitol fermentation	-	+			+	-	+	
N-acetylglucosaminidase	+	+	+	+	-	-	+	+
Sucrose fermentation	+	+	+	+	+	-	-	+
Trehalose fermentation	+	+	-	-	+	+	-	+
Mannitol fermentation	+	+	-	-	+	+	+	+
Lactose fermentation	-	+	+	+	+	-	-	-
Cellobiose fermentation	+	+	+	+	-	-	-	-
Malonate utilization	-	+			-	-	+	
Gamma-glutamyl transferase	+	+			+	+	+	
Sorbitol fermentation	-	-	+	+	+	+	-	-
Rhamnose fermentation	+	+			+	-	-	
Inositol fermentation	-	-			-	-	-	
Beta-galactosidase activity	+	+	+	+	+	-	-	+
Adonitol fermentation	-	-			-	-	+	
Raffinose fermentation	+	+	+	+	+	-	-	+
Fructose fermentation			-	+				+
Maltose fermentation			+	-				+
Arabinose fermentation			+	+				-
Mannose fermentation			+	+				

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Ribose fermentation			+	+				+
Melibiose fermentation			-	-				+
Beta-glucuronidase			+	+	+	-	-	+
Nitrate reduction			-	-	+	+	+	-
Malachite green utilization			+	+				+
Galactose fermentation			+	+				+
Xylose fermentation			+	+				
Phenylalanine deaminase					-	-	-	
Indole production					+	-	-	
Phosphatase activity					+	+	-	
Probable Organism	*Acinetobacter baumannii*	*Proteus mirabilis*	*Enterococcus*	Methicillin resistant *Staphylococcus aureus*	*Escherichia coli*	*Salmonella typhi*	*Pseudomonas aeruginosa*	*Staphylococcus aureus*

The results of the different biochemical tests used to characterize and identify bacteria isolated from the baby weighing scales are presented in Table 2. The resulrs revealed that, for *Acinetobacter baumannii* (sample G), the organism was a Gram-negative urease positive, glucose, hydrogen sulfide production, arginine, ornithine, lysine, and several sugars such as sucrose, trehalose, mannitol, cellobiose, and raffinose positive. It was also positive for several other enzymes, including gamma-glutamyl transferase and beta-glucosidase, but negative for dulcitol and sorbitol. *Proteus mirabilis* (sample C) was also Gram-negative and showed positive results for urease, glucose fermentation, hydrogen sulfide production, and a variety of sugars, including sucrose, trehalose, mannitol, lactose, cellobiose, and xylose. This isolate was also positive for enzymes such as gamma-glutamyl transferase, beta-galactosidase, and beta-glucosidase, indicating its strong metabolic activity across different substrates. *Enterococcus* (sample B) was Gram-positive and exhibited positive results for urease, glucose fermentation, hydrogen sulfide production, and sugar fermentation tests, including sucrose, lactose, cellobiose, and raffinose. It was also positive for several enzymes, including beta-galactosidase, beta-glucosidase, and N-acetylglucosaminidase, demonstrating a broad metabolic profile. *Methicillin-resistant Staphylococcus aureus* (MRSA) (sample I) was Gram-positive, catalase-positive, urease-positive, and positive for several sugar fermentation tests, including sucrose, lactose, and mannose. It also exhibited positive results for enzymes such as N-acetylglucosaminidase and beta-galactosidase. However, it was negative for dulcitol, trehalose, and mannitol. *Escherichia coli* (sample ES) was Gram-negative, oxidase-negative, catalase-positive, and positive for glucose fermentation, sucrose, trehalose, mannitol, and lactose. The organism was also positive for beta-glucuronidase and beta-galactosidase, but negative for hydrogen sulfide production and several other sugars, including dulcitol and sorbitol. *Salmonella typhi* (sample SPE) was Gram-negative, catalase-positive, and produced hydrogen sulfide. The isolate was positive for glucose fermentation, trehalose, and mannitol but negative for lactose. Additionally, *S. typhi* exhibited positive results for beta-galactosidase and N-acetylglucosaminidase. *Pseudomonas aeruginosa* (sample Ps) was Gram-negative, oxidase-positive, and catalase-positive. It tested positive for arginine, glucose fermentation, and several sugars, including mannitol and dulcitol. This organism also exhibited strong metabolic activity, as indicated by positive results for beta-glucuronidase, beta-glucosidase, and gamma-glutamyl transferase. However, it was negative for lactose, sucrose, and trehalose. *Staphylococcus aureus* (sample S) was Gram-positive, catalase-positive, and tested positive for several sugars, including sucrose, trehalose, and mannitol. It was also positive for beta-glucosidase and raffinose, further confirming its metabolic profile. However, it was negative for dulcitol, sorbitol, and hydrogen sulfide production. The summary of the total bacteria counts and types of bacteria isolated from the primary healthcare facilities in the six (6) rural communities in Obio/Akpor Local Government Area of Rivers State, Nigeria is presented in Table 3.

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Table 3: Summary of total bacteria counts and types of bacteria isolated from the Baby weighing scales

Sample/Scale Location	No. of baby weighing scale	No. of samples collected	Total colony count	Mean value of total count	No. of distinct colony	Isolated organisms
Eneka	3	6	120	60	2	*Enterococcus* sp., *Escherichia coli*
Eliparanwo	2	6	146	73	2	*Pseudomonas aeruginosa, Staphylococcus aureus*
Rumuepirikom	4	8	138	36.5	2	*Acinetobacter baumanii, Proteus mirabilis*
Rumueme	1	2	24	24	—	—
Rumuokoro	2	4	80	40	1	*Methicillin Resistant Staphy aureus (MRSa)*
Rumukwurushi	2	4	54	27	1	*Salmonella typhil*

Presented in Table 4 is the antibiotics sensitivity of Gram-positive bacteria isolates which revealed that *Enterococcus* exhibited resistance to Imipenem, Cefuroxime, Augmentin, Cefotaxime, and Aztreonam, while it was sensitive to Ceftriaxone, Linezolid, Erythromycin, and Ofloxacin. It showed intermediate susceptibility to Ciprofloxacin and Azithromycin. The organism also exhibited 50% resistance to tested antibiotics Methicillin-resistant *Staphylococcus aureus* (MRSA) was resistant to Imipenem, Cefuroxime, Augmentin, Cefotaxime, Ceftriaxone, Aztreonam, Gentamicin, Azithromycin, and Erythromycin. It was sensitive to Linezolid and Ciprofloxacin and exhibited Intermediate susceptibility to Ofloxacin. *Staphylococcus aureus* demonstrated resistance to Imipenem, Cefuroxime, Augmentin, Ceftriaxone, Aztreonam, Azithromycin, and Erythromycin. It showed intermediate susceptibility to Cefotaxime and Erythromycin and was sensitive to Linezolid, Ciprofloxacin, Gentamicin, and Ofloxacin. The organism also exhibited 50% resistance to tested antibiotics. *Methicillin-resistant Staphylococcus aureus* had the highest resistance to all tested antibiotics at 75% while *Enterococcus* and *Staphylococcus aureus* had the lowest resistance at 50% each.

Table 4: Antibiotics sensitivity of Gram-positive bacteria isolates

Antibiotics	*Enterococcus*	Methicillin resistant *Staphylococcus aureus*	*Staphylococcus aureus*
Imipenem	R	R	R
Cefuroxime	R	R	R
Augmentin	R	R	R
Cefotaxime	R	R	I
Ceftriaxone	S	R	R
Linezolid	S	S	S
Aztreonam	R	R	R
Ciprofloxacin	I	S	S
Gentamicin	R	R	S
Azithromycin	I	R	R
Erythromycin	S	R	I
Ofloxacin	S	I	S
Resistance	**50%**	**75%**	**50%**

Key: R= Resistant, S = Sensitivity, I = Intermediate susceptibility.

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Table 4: Antibiotics sensitivity of Gram-negative bacteria isolates

Antibiotics	***Acinetobacter baumannii***	***Proteus mirabilis***	***Salmonella typhi***	***Escherichia coli***	***Pseudomonas aeruginosa***
Bacitracin	R	R	R	R	R
Ampicillin/Sulbactam,	R	R	R	R	I
Cefuroxime	R	R	S	I	R
Piperacillin/Tazobactam	R	I	S	S	S
Ciprofloxacin	R	S	S	S	R
Chloramphenicol	R	R	S	S	R
Ceftriaxone	R	R	R	I	I
Tetracycline	R	S	R	S	R
Aztreonam	R	R	S	R	R
Levofloxacin	S	R	I	R	R
Ofloxacin	S	R	I	I	R
Gentamicin	R	R	R	R	R
Resistance	**83.3%**	**75.6%**	**41.6%**	**41.6%**	**75%**

Key: R = Resistant, I = Intermediate susceptibility, S = Susceptible.

The antibiotics sensitivity of Gram-negative bacteria isolates is shown in Table 4. The result showed that *Acinetobacter baumannii* exhibited high resistance to several antibiotics. Specifically, it was resistant to Bacitracin, Ampicillin/Sulbactam, Cefuroxime, Piperacillin/Tazobactam, Ciprofloxacin, Chloramphenicol, Ceftriaxone, Tetracycline, Aztreonam, and Gentamicin. However, it was susceptible to Levofloxacin and Ofloxacin. The overall resistance rate for *Acinetobacter baumannii* was 83.3%. *Proteus mirabilis* showed resistance to Bacitracin, Ampicillin/Sulbactam, Cefuroxime, Chloramphenicol, Ceftriaxone, Aztreonam, Levofloxacin, Ofloxacin, and Gentamicin, with intermediate susceptibility to Piperacillin/Tazobactam. It was susceptible to Ciprofloxacin and Tetracycline. The overall resistance rate for *Proteus mirabilis* was 75.6%. *Salmonella typhi* was resistant to Bacitracin, Ampicillin/Sulbactam, Ceftriaxone, Tetracycline, and Gentamicin. It was susceptible to Cefuroxime, Penicillin/Tetracycline, Ciprofloxacin, and Aztreonam, with intermediate susceptibility to Levofloxacin and Ofloxacin. The overall resistance rate for *Salmonella typhi* was 41.6%. *Escherichia coli* demonstrated resistance to Bacitracin, Ampicillin/Sulbactam, Aztreonam, and Gentamicin, with intermediate susceptibility to Cefuroxime, Ceftriaxone, and Ofloxacin It was susceptible to Piperacillin/Tazobactam, Ciprofloxacin, Chloramphenicol, and Tetracycline. The overall resistance rate for *Escherichia coli* was 41.6%. *Pseudomonas aeruginosa* was resistant to Bacitracin, Cefuroxime, Ciprofloxacin, Chloramphenicol, Tetracycline, Aztreonam, Levofloxacin, Ofloxacin, and Gentamicin, with intermediate susceptibility to Ampicillin/Sulbactam and Ceftriaxone. It was susceptible to Piperacillin/Tazobactam. The overall resistance rate for *Pseudomonas aeruginosa* was 75%. *Acinetobacter baumannii* had the highest resistance to all tested antibiotics at 83.3%, while *Salmonella typhii* and *Escherichia coli* had the lowest resistance at 41.6% each.

Discussion

The findings of this study have revealed the level of and types of bacterial contamination of Baby weighing scales in six (6) rural communities in Obio/Akpor Local Government Area of Rivers State, Nigeria. The bacterial contamination of the baby weighing scales varied across the six rural communities, with the average or mean values of colony counts ranging from 24.0×10^2CFU/ml of the swapped sample in Rumueme to 73.0×10^2CFU/ml of swapped sample in Eliparanwo.

The order of decreasing bacteria count in the Baby weighing scales in the rural community primary healthcare facilities was; Eliparanwo > Eneka > Rumuokoro > Rumuepirikom > Rumukwurushi > Rumueme. Each location also showed distinct organisms that reflect hygiene practices, environmental exposure, and the level of contact the scales receive during infant care.

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At Eneka, the moderately high count (60 × 10^2 CFU/ml of swapped sample) and two distinct colonies *Enterococcus* spp. and *Escherichia coli* indicate fecal contamination, most likely introduced through unwashed caregiver hands, contaminated weighing cloths, or inadequate cleaning of the scale surfaces. Eliparanwo had the highest burden (73 × 10^2 CFU/ml of swapped sample) with *Pseudomonas aeruginosa* and *Staphylococcus aureus*. This combination suggests both moisture related contamination *(Pseudomonas)* and transfer of skin flora (S. *aureus*) from caregivers or health workers, pointing to inconsistent disinfection of high-touch surfaces.

At Rumuepirikom, the high count (36.5 × 10^2 CFU/ml of swapped sample) with *Acinetobacter baumannii* and *Proteus mirabilis* reflects environmental contamination from dust, soil, or organic matter. Both organisms survive well on poorly cleaned or frequently handled surfaces, indicating hygiene lapses around the weighing area.

Rumueme recorded the lowest count (24 × 10^2 CFU/ml of swapped sample) and no distinct isolates, suggesting better cleaning practices, resulting in fewer recoverable bacteria. It is also worth noting that the weighing scale here was new and hasn't seen much action and had also just undergone proper sanitation

Rumuokoro showed a moderate count (40 × 10^2 CFU/ml of swapped sample) but only one organism MRSA which is concerning because its presence indicates transfer of antibiotic resistant skin flora from caregivers in a busy clinic environment and highlights the need for consistent surface disinfection. In Rumukwurushi, the count (27 × 10^2 CFU/ml of swapped sample) and isolation of *Salmonella typhi* point strongly to fecal contamination, likely from contaminated hands or cloths used during weighing. This represents a serious public health risk due to the pathogenic nature of S. *typhi*.

Overall, the distinct colonies observed across communities reflect differences in environmental cleanliness, scale usage frequency, and sanitation practices. Higher colony diversity corresponded with poorer hygiene, while fewer isolates were seen where cleaning appeared more effective.

The findings from this study identified eight bacteria, *Acinetobacter baumannii*, *Proteus mirabilis*, *Enterococcus* spp., Methicillin-resistant *Staph aureus*, *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, and *Pseudomonas aeruginosa*; from baby weighing scales. These organisms are notable for their role in hospital-acquired infections (HAIs), particularly in maternity wards, where high patient turnover and the use of medical equipment contribute to microbial contamination and multidrug-resistant organisms (MDROs) (Otter et al., 2020). This study reveled that, all the bacteria isolated from the Baby weighing scales exhibited multiple drug resistance to the antibiotics tested in this study.

The antibiotic resistance patterns observed in Gram-positive bacteria revealed that *Enterococcus* spp was resistant to Imipenem, Cefuroxime, Augmentin, Cefotaxime, and Aztreonam, but sensitive to Ceftriaxone, Linezolid, Erythromycin, and Ofloxacin, with intermediate susceptibility to Ciprofloxacin and Azithromycin. Similar resistance profiles in Enterococcus spp., including vancomycin-resistant Enterococcus (VRE), have been documented in clinical and environmental isolates (Fiore et al., 2019).

Methicillin-resistant *Staphylococcus aureus* (MRSA) showed resistance to Imipenem, Cefuroxime, Augmentin, Cefotaxime, Ceftriaxone, Aztreonam, Gentamicin, Azithromycin, and Erythromycin, while being sensitive to Linezolid and Ciprofloxacin, with intermediate susceptibility to Ofloxacin. These findings align with documented MRSA resistance patterns in healthcare settings (Lakhundi and Zhang, 2018).

Staphylococcus aureus demonstrated resistance to Imipenem, Cefuroxime, Augmentin, Ceftriaxone, Aztreonam, Azithromycin, and Erythromycin, with intermediate susceptibility to Cefotaxime and Erythromycin, and sensitivity to Linezolid, Ciprofloxacin, Gentamicin, and Ofloxacin. Similar resistance trends in *S. aureus* have been reported globally, particularly in equipment-associated contamination in healthcare units (Rebolledo et al., 2021; An et al., 2024).

The persistence of these pathogens on medical equipment highlights the need for strict infection-control measures. Equipment-associated contamination has been linked to poor sanitation, inadequate sterilization, and irregular disinfection practices (Otter et al., 2020; CDC, 2022).

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Effective cleaning and disinfection protocols are essential to prevent HAIs, especially among newborns and postpartum mothers who are more vulnerable to infections. Earlier studies on antimicrobial resistance focused more on environments and samples considered to be antibiotic resistance hotspots, which include sewage, dairy effluent, municipal wastewater, hospital effluents from medical environments, and municipal waste streams or effluents (Harwood *et al.*, 2001; Li *et al.*, 2001; Brown *et al.*, 2006; Murray *et al*., 2022).

All the bacteria which were *Acinetobacter baumannii*, *Proteus mirabilis*, *Enterococcus spp.*, Methicillin-resistant *Staphylococcus aureus*, *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, and *Pseudomonas aeruginosa* isolated from the baby weighing scales in the rural communities of Obio/Akpor during this study exhibited multiple antibiotic resistance to the entire antibiotic tested. The presence of such multiple antibiotic resistant bacteria strains in Baby weighing scales poses a serious public health risk, particularly in rural communities where adequate medical is lacking.

Notably, the World Health Organization (WHO) has identified antimicrobial resistance as one of the top ten global public health threats, emphasizing the need for continuous surveillance and preventive strategies (WHO, 2021). Compounding these challenges is the role of climate change, which is introducing new stressors into the environment, potentially accelerating the spread, evolution, and ecological persistence of resistant microorganisms. Climate variability may exacerbate the ecological impacts of contamination and accelerate the spread of antimicrobial resistance (Schiermeier, 2020; Doney *et al.*, 2012).

Considering these growing concerns, it is crucial to monitor and assess the microbial diversity, abundance, and antibiotic susceptibility profiles of bacteria isolated from Baby weighing scales. The rapid increase and spread of microorganisms and antibiotic-resistant and the unappealing manifestation of this situation, which is the increasing persistence of bacterial infections among members of a population in communities, is a public health concern (Berendonk *et al.*, 2015; Frieri *et al.*, 2017). This development requires urgent attention from health policymakers and authorities.

Conclusion

This study has revealed presence of significant bacterial contamination on baby weighing scales, including pathogens such as *Acinetobacter baumannii*, *Proteus mirabilis*, *Enterococcus* spp, MRSA, *Escherichia coli*, *Salmonella typhi*, and *Pseudomonas aeruginosa*. These bacteria exhibited high levels of multidrug antibiotic resistance, which poses a considerable risk in healthcare settings, particularly in maternity wards. The findings underscore the critical need for stringent cleaning and disinfection protocols for baby weighing scales to prevent the spread of hospital-acquired infections and safeguard the health of newborns and other vulnerable patients. Ensuring effective sterilization practices is essential to mitigate these risks and maintain a safe healthcare environment.

References

Adut, C. (2022). Bacterial Contamination of Surfaces and Equipment and Antimicrobial Susceptibility Pattern of Potentially Pathogenic Bacteria in Newborn Unit at Kenyatta National Hospital. *University of Nairobi*, Kenya.

Ajegbile, M. L. (2023). Closing the gap in maternal health access and quality through targeted investments in low-resource settings. *Journal of Global Health Reports*, *7*, e2023070.

An, N.V., Hai, L.H.L., Luong, V.H., Vinh, N.T.H., Hoa, P.Q., Hung, L.V., Son, N.T., Hong, L.T., Hung, D.V., Kien, H.T., Le, M.N., Viet, N.H., Nguyen, D.H., Pham, N.V, Thang, T.B., Tien, T.V. & Hoang, L.H. (2024). Antimicrobial Resistance Patterns of *Staphylococcus aureus* Isolated at a General Hospital in Vietnam Between 2014 and 2021. *Infect Drug Resist*, *17*, 259-273.

Asfaw, N. (2021). Knowledge and practice of nurses towards prevention of hospital acquired infections and its associated factors. *International journal of Africa nursing sciences*, *15*, 100333.

Berendonk, T.U., Manaia, C.M., Merlin, C., Fatta-Kassino, D., Ctryn, E., Walsh, F., Burgmann, H., Sorum, H., Nostrom, M., Pons, M., Kreuzinger, N., Huovinen, P., Stefani, S., Schwartz, T., Kisano, V.,

Citation: Akani *et al.* (2026). Bacterial assessment and public health risk associated with baby weighing scale usage in primary healthcare facilities. *International Journal of Microbiology and Applied Sciences*. *5(1)*: 1 – 13.

Baquero, F. & Martinez, J. L. (2015). Tackling antibiotic resistance: the environmental framework. *Nature Review in Microbiology*, *13*, 310–317.

Bhura, M., Ariff, S., Qazi, S. A., Qazi, Z., Ahmed, I., Nisar, Y. B. & Soofi, S. B. (2020). Evaluating implementation of "management of Possible Serious Bacterial Infection (PSBI) when referral is not feasible" in primary health care facilities in Sindh province, Pakistan. *PLoS One*, *15(10)*, e0240688.

Bonadonna, L., Briancesco, R., Coccia, A. M., Meloni, P., Rosa, G. L. & Moscato, U. (2021). Microbial air quality in healthcare facilities. *International Journal of Environmental Research and Public Health*, *18(12)*, 6226.

Brown, K.D., Kulis, J., Thomson, B. & Mawhinney, D. B. (2006). Occurrence of antibiotics in hospital, residential and dairy effluent, Municipal Wastewater and Rio Grande in New Mexico. *Science of the Total Environment*, *366*, 772–783.

Cave, R., Cole, J. & Mkrtchyan, H. V. (2021). Surveillance and prevalence of antimicrobial resistant bacteria from public settings within urban built environments: Challenges and opportunities for hygiene and infection control. *Environment international*, *151*, 106836.

Centers for Disease Control – CDC. (2022). Infection control in healthcare facilities. Center for Disease Control and Prevention. USA.

Chou, J. H., Roumiantsev, S. & Singh, R. (2020). PediTools electronic growth chart calculators: applications in clinical care, research, and quality improvement. *Journal of Medical Internet Research*, *22(1)*, e16204.

Clinical and Laboratory Standards Institute. – CLSI. (2017). *Performance Standards for Antimicrobial Susceptibility Testing, 27th ed., Clinical Laboratoty Standards Institute Supplement M100, PA*, USA.

Doney, S. C., Ruckelshaus, M., Emmett Duffy, J., Barry, J. P., Chan, F., English, C. A. & Talley, L. D. (2012). Climate change impacts on marine ecosystems. *Annual Review of Marine Science*, *4*, 11–37.

Emmanuel, O. T. & Michael, A. A. (2020). Forensic accounting: breaking the nexus between financial cybercrime and terrorist financing in Nigeria. *Journal of Auditing, Finance, and Forensic Accounting, 8(2)*, 55-66.

Fiore, E., van Tyne, D. & Gilmore, M. S. (2019). Pathogenicity and antibiotic resistance of Enterococci. *Microbiology Spectrum, 7(4), 10.*

Forrester, J. D., Maggio, P. M. & Tennakoon, L. (2022). Cost of health care–associated infections in the United States. *Journal of patient safety*, *18(2)*, e477–e479.

Frieri, M., Kumar, K. & Bouhn, A. (2017). Antibiotic Resistance. *Journal of Infection and Public Health*, *10*, 369– 378.

Harwood, V.J., Brownell, M., Perusek, W. & Whitlock, J. E. (2001). Vancomycin resistant *Enterococcus* spp. isolated from wastewater and chicken feces in the United States. *Journal of Applied Environmental Microbiology*, *10*, 4930– 4933.

Kennedy, K. M., de Goffau, M. C., Perez-Muñoz, M. E., Arrieta, M. C., Bäckhed, F., Bork, P., ... & Walter, J. (2023). Questioning the fetal microbiome illustrates pitfalls of low-biomass microbial studies. *Nature*, *613(7945)*, 639-649.

Lakhundi, S., & Zhang, K. (2018). Methicillin-resistant Staphylococcus aureus: molecular characterization, evolution, and epidemiology. *Clinical Microbiology Reviews*, *31(4)*, e00020-18.

Li, C. Y., Zhao, Z.X., Lin, S. & Meng. A.M. (2001). Characterization and expression pattern of poull1, a novel class II POU gene in Zebra fish. *Chinese Science Bulletin Kexue Tongbao*. *46(18)*, 1523– 1527.

Owen, L. & Laird, K. (2020). The role of textiles as fomites in the healthcare environment: a review of the infection control risk. *PeerJ*, 10 – 35.

Rebolledo, R. M., et al. (2021). Antimicrobial resistance patterns of *Staphylococcus aureus* from hospital environments. *International Journal of Environmental Research and Public Health*, *18(9)*, 4521.

Schiermeier, Q. (2020). Climate change and infectious disease spread. *Nature*, *584(7822)*, 336–338.

Citation: Akani *et al.* (2026). Bacterial assessment and public health risk associated with baby weighing scale usage in primary healthcare facilities. *International Journal of Microbiology and Applied Sciences*. *5(1)*: 1 – 13.

Shepard, J., Frederick, J., Wong, F., Madison, S., Tompkins, L. & Hadhazy, E. (2020). Could the prevention of health care–associated infections increase hospital cost? The financial impact of health care–associated infections from a hospital management perspective. *American journal of infection control, 48(3),* 255-260.

Waddington, C., Carey, M. E., Boinett, C. J., Higginson, E., Veeraraghavan, B., & Baker, S. (2022). Exploiting genomics to mitigate the public health impact of antimicrobial resistance. *Genome medicine*, *14(1),* 15.

Wammanda, R. D., Adamu, S. A., Joshua, H. D., Nisar, Y. B., Qazi, S. A., Aboubaker, S. & Bahl, R. (2020). Implementation of the WHO guideline on treatment of young infants with signs of possible serious bacterial infection when hospital referral is not feasible in rural Zaria, Nigeria: Challenges and solutions. *PloS one*, *15(3),* e0228718.

Citation: Akani *et al.* (2026). Bacterial assessment and public health risk associated with baby weighing scale usage in primary healthcare facilities. *International Journal of Microbiology and Applied Sciences*. *5(1)*: 1 – 13.