

# Bacterial Contamination and Public Health Risks Associated with the Use of Baby Weighing Scales in Selected Healthcare Facilities in Rivers State, Nigeria

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## ARTICLE INFO

**Citation:** Agi Vivian Nkemkanma, Nathaniel, Ojochide Patience, and Giami Lynda Kadi (2026). Bacterial Contamination and Public Health Risks Associated with the Use of Baby Weighing Scales in Selected Healthcare Facilities in Rivers State, Nigeria.

*Microbiology Archives, an International Journal.*

**DOI:** <https://doi.org/10.51470/MA.2026.8.1.156>

Received 08 February 2026

Revised 11 March 2026

Accepted 10 April 2026

Available Online May 15, 2026

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## ABSTRACT

Baby weighing scales are essential devices used in neonatal care for monitoring infant growth and development. However, inadequate cleaning and disinfection may allow these devices to serve as reservoirs for pathogenic microorganisms. This study assessed bacterial contamination of baby weighing scales and evaluated the associated public health risks in healthcare facilities across Rivers State, Nigeria. A cross-sectional descriptive study was conducted involving swab samples collected from forty baby weighing scales in selected public and private healthcare facilities. Samples were obtained from tray surfaces, control buttons, and side edges using sterile swab sticks and transported to the laboratory for microbiological analysis. Bacterial isolation and identification were performed using standard microbiological and biochemical techniques, while antimicrobial susceptibility testing was conducted using the Kirby-Bauer disk diffusion method according to Clinical and Laboratory Standards Institute (CLSI) guidelines. The results revealed notable bacterial contamination of baby weighing scales. Predominant isolates included *Staphylococcus epidermidis* (40%), *Escherichia coli* (25%), *Staphylococcus aureus* (20%), and *Klebsiella* spp. (15%),

and *Pseudomonas aeruginosa* (15%). Antibiotic susceptibility testing showed high resistance to ampicillin among most isolates, whereas ciprofloxacin and gentamicin demonstrated high sensitivity. *Staphylococcus aureus* remained susceptible to vancomycin, while *E. coli* and *Klebsiella* spp. were susceptible to ceftazidime. *Pseudomonas* spp. also showed good susceptibility to imipenem. The findings indicate that baby weighing scales may act as potential reservoirs for bacterial pathogens and could contribute to cross-contamination and healthcare-associated infections among neonates. Regular disinfection of weighing scales after each use, improved infection prevention training for healthcare workers, and periodic microbiological surveillance are recommended to minimize contamination risks and improve neonatal safety.

**Keywords:** Bacterial contamination, baby weighing scales, neonatal infection, hospital equipment, antimicrobial resistance.

## INTRODUCTION

Healthcare-associated infections (HAIs) remain a major global public health challenge, particularly among vulnerable populations such as neonates and infants. Due to immature immune systems and frequent exposure to medical devices, newborns are highly susceptible to infections in healthcare environments [1, 2]. Contaminated hospital surfaces and medical equipment have been identified as potential sources of pathogen transmission in clinical settings. Baby weighing scales are routinely used in neonatal and pediatric units to monitor infant growth and development. Accurate birth weight measurement is essential for guiding clinical management, including nutritional support, medication dosage calculations, and growth monitoring [3]. Global initiatives such as the Every Newborn Action Plan emphasize accurate birth weight measurement as a key strategy for improving neonatal survival worldwide.

Despite their importance in neonatal care, baby weighing scales may become contaminated with microorganisms if appropriate cleaning and disinfection procedures are not consistently followed. Several studies have reported the presence of pathogenic microorganisms on frequently handled medical devices and hospital surfaces [4,5]. These contaminated surfaces can serve as reservoirs for pathogens capable of causing healthcare-associated infections. In neonatal care settings, bacterial pathogens such as *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* spp., and *Pseudomonas aeruginosa* are frequently implicated in hospital-acquired infections and neonatal sepsis [6]. The presence of such organisms on medical equipment used across multiple patients may facilitate cross-contamination. In many low- and middle-income countries, infection prevention and control practices are often challenged by limited resources, inadequate training, and inconsistent monitoring of hygiene protocols [7].

These challenges may increase the likelihood of microbial contamination of medical devices, including baby weighing scales. In Rivers State, Nigeria, healthcare facilities provide essential maternal and child health services, including routine monitoring of infant growth using baby weighing scales. However, limited data exist regarding microbial contamination of these devices within healthcare facilities in the region. Therefore, this study assessed bacterial contamination of baby weighing scales in selected healthcare facilities in Rivers State, Nigeria, and evaluated the potential public health risks associated with their use.

## MATERIALS AND METHODS

### Study Area

This study was conducted in selected healthcare facilities across Rivers State, Nigeria. Laboratory analysis of collected samples was carried out at xxx. Port Harcourt is a major urban center located in the Niger Delta region with an estimated population of approximately 3.9 million residents [8].

### Study Design

A cross-sectional descriptive study design was adopted to assess bacterial contamination associated with the use of baby weighing scales in healthcare facilities.

### Sample Size and Sampling Technique

A total of forty (40) baby weighing scales were sampled from selected healthcare facilities across Rivers State after ethical approval was obtained from the xxx ethics committee. A multistage stratified sampling technique was used to ensure representation of different categories of healthcare facilities, including tertiary hospitals, general hospitals, primary healthcare centers, and private clinics. One weighing scale was sampled from each selected facility.

### Sample Collection

Data were collected using structured questionnaires administered to healthcare providers and caregivers involved in infant care at the selected healthcare facilities. The questionnaires were designed to obtain information on participants' demographic characteristics, frequency of baby weighing scale usage, cleaning practices, and perceptions regarding contamination risks associated with the use of the scales. In addition, Swab samples were collected from frequently touched surfaces of baby weighing scales, including the tray surface, control buttons, and side edges. Sterile swab sticks moistened with sterile normal saline were used for sample collection. The swabs were immediately transported to the microbiology laboratory for analysis.

### Isolation and Identification of Bacteria

Samples were cultured on Nutrient Agar and MacConkey Agar plates and incubated at 37°C for 24–48 hours. Colony morphology was examined, and isolates were identified using Gram staining and standard biochemical tests, including catalase, coagulase, oxidase, and indole tests.

### Antimicrobial Susceptibility Testing

Antimicrobial susceptibility testing was performed using the Kirby–Bauer disk diffusion method according to CLSI guidelines. Antibiotics tested included ampicillin(10 µg), ciprofloxacin(5µg), gentamicin(10 µg), tetracycline(30 µg), ceftazidime(30 µg), vancomycin(30 µg), and imipenem(10 µg).

Zones of inhibition were measured and interpreted as sensitive, resistant, or intermediate.

### Data Analysis

Data obtained from questionnaires and laboratory analyses were analyzed using the Statistical Package for Social Sciences (SPSS) version 26 and presented as frequencies and percentages.

## RESULTS

### Socio-Demographic Characteristics of Respondents

Table 1 presents the socio-demographic characteristics of the respondents, including gender, age, occupation, type of healthcare facility, and years of professional experience. Females constituted the majority of respondents (87.2%), while males accounted for 12.8%. The largest age group was 25–34 years (33.3%), followed by respondents below 25 years (25.6%) and those aged 36–45 years and above (20.5%). In terms of occupation, healthcare providers represented the highest proportion (48.7%), while administrators and support staff accounted for 25.6%. Regarding the type of healthcare facility, government hospitals constituted the largest proportion (28.2%), followed by clinics and maternity centers, each representing 20.5%. With respect to professional experience, more than half of the respondents (51.3%) had 10 years or more of experience, while 17.9% had 1–5 years of experience. Respondents with 6–10 years and less than one year of experience each accounted for 15.4%.

Table 1: Socio-Demographic Data of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Female	34	87.2
	Male	5	12.8
Age	<25 years	10	25.6
	25-34 years	13	33.3
	35-44 years	8	20.5
	45-above	8	20.5
Facility Type	Government Hospital	11	28.2
	Primary Health care	9	23.1
	Maternity/Clinic	8	20.5
	Private Hospital	10	25.6
Profession	Health care provider	19	48.7
	Support staff	10	25.6
	Administrator	10	25.6
Years of Experience	<1 year	6	15.4
	1-5 years	7	17.9
	6- 10 years	6	15.4
	>10 years	20	51.3

### Knowledge and Hygiene Practices Related to Baby Weighing Scale Contamination

Table 2 presents respondents' knowledge and hygiene practices regarding bacterial contamination of baby weighing scales. All respondents (100%) were aware of the possibility of bacterial contamination associated with the use of baby weighing scales. The major perceived causes of contamination included contaminated environments (30.8%), infrequent cleaning or disinfection of weighing scales (28.2%), unclean hands (23.1%), and contact with infant skin or body fluids (17.9%). Regarding disinfection methods, the majority of respondents (58.9%) reported using Dettol or other antiseptic solutions, while 35.9%

used alcohol-based sanitizers and only 5.2% used bleach (sodium hypochlorite). In terms of cleaning frequency, 48.7% reported cleaning the scales after every use, 30.8% cleaned them once daily, and 20.5% cleaned them weekly. Protective covers were always used by 66.6% of respondents, sometimes used by 28.2%, and never used by 5.1%. Most respondents (76.9%) had received infection control training, while 10.3% had not received any training and 12.8% reported occasional exposure to such training.

**Table 2: Knowledge and Hygiene Practices Practices Related to Baby Weighing Scale**

Variable	Category	Frequency	Percentage (%)
Knowledge of Bacterial Contamination	Yes	39	100
	No	0	0
Commonly Identified Causes	Unclean Hands	9	23.1
	Contaminated environment	12	30.8
	Contact with skin/fluids	7	17.9
	Un-frequent cleaning/disinfection	11	28.2
Disinfectant Used	Dettol/antiseptic	23	58.9
	Alcohol based sanitizer	14	35.9
	Bleach (NaOCl)	2	5.2
Frequency of Cleaning	After every use	19	48.7
	Once daily	12	30.8
	Weekly	8	20.5
Use of Protective Covers	Always	26	66.6
	Sometimes	11	28.2
	Never	2	5.1
Training on Infection Control	Yes	30	76.9
	No	4	10.3
	Occasionally	5	12.8

**Perceived Infection Risk and Institutional Infection Control Policies**

Table 3 presents respondents' perceptions of infection risks associated with the use of baby weighing scales and the presence of institutional infection prevention policies. A total of 43.6% of respondents reported instances where infections developed following the use of baby weighing scales, while 25.6% reported no known cases and 30.8% were unsure. Regarding perceived infection risk, the majority of respondents (59.0%) rated the risk as moderate, while 33.3% considered it low. Only 5.1% rated the risk as very high and 2.6% as high. In relation to institutional infection prevention policies, 71.8% of respondents confirmed the presence of such policies in their facilities, whereas 15.4% reported that no policies existed and 12.8% were uncertain.

**Table 3: Perceived Infection and Risk and Institutional Infection Control Policies**

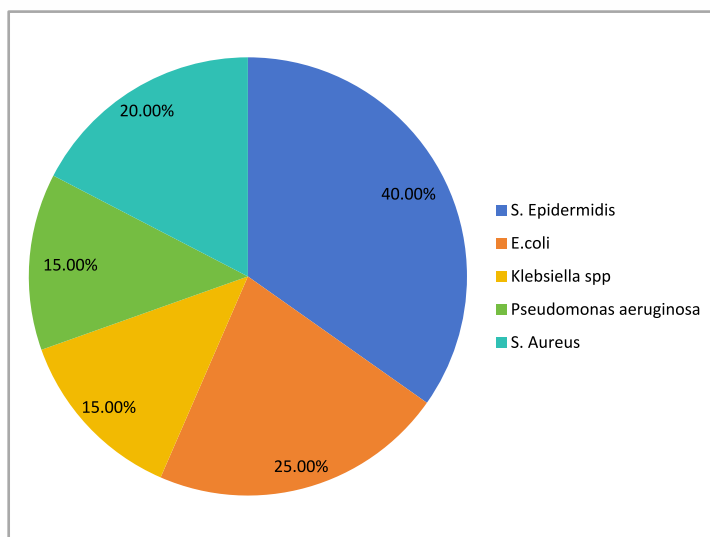
Variable	Category	Frequency	Percentage (%)
Developed infection	Yes	17	43.6
	No	10	25.6
	Not sure	12	30.8
Risk of infection	Very high	2	5.1
	High	1	2.6
	Moderate	23	59.0
	Low	13	33.3
Prevention/control policy in place	Yes	28	71.8
	No	6	15.4
	Not sure	5	12.8

**Bacterial Isolates Identified on Baby Weighing Scale before Use**

Table 4. and Fig 1 presents the bacterial isolates recovered from baby weighing scales before use in the healthcare facilities studied. The isolates identified included *Staphylococcus epidermidis* (40.0%), *Escherichia coli* (25.0%), *Staphylococcus aureus* (20.0%), *Klebsiella* spp. (15.0%), and *Pseudomonas aeruginosa* (15.0%).

**Table 4: Bacterial Isolates Identified on Baby Weighing Scale before Use**

Organisms	Frequency	Percentage (%)
<i>S. Epidermidis</i>	8	40.0
<i>E.coli</i>	5	25.0
<i>Klebsiella spp</i>	3	15.0
<i>Pseudomonas aeruginosa</i>	3	15.0
<i>S. Aureus</i>	4	20.0



**Fig 1: Percentage of Bacterial Isolate Identified on Baby Weighing Scale before Use**

**Bacterial Isolates Identified on Baby Weighing Scales after Use**

Table 5 and Fig 2 showed that the bacterial isolates recovered from baby weighing scales after use was persistent with slight variations compared with pre-use findings. *Staphylococcus epidermidis* remained the predominant organism (45.0%), increasing slightly from 40.0% before use. *Escherichia coli* decreased from 25.0% to 20.0%, while *Klebsiella* spp. declined from 15.0% to 10.0%. *Pseudomonas aeruginosa* maintained a prevalence of 15.0% before and after use, and *Staphylococcus aureus* remained stable at 20.0%.

Table 5: Bacterial Isolate Identified on Baby Weighing Scale after Use

Organisms	Frequency	Percentage (%)
<i>S. Epidermidis</i>	9	45.0
<i>E.coli</i>	4	20.0
<i>Klebsiella spp</i>	2	10.0
<i>Pseudomonas aeruginosa</i>	3	15.0
<i>S. Aureus</i>	4	20.0

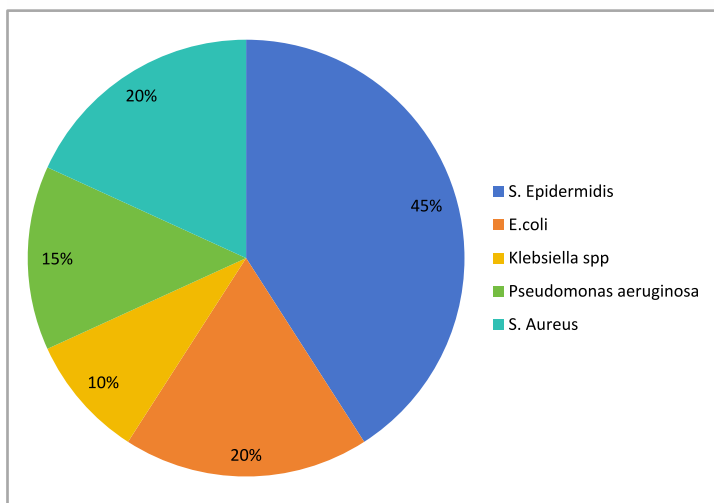


Fig 2: Percentage Bacterial Isolate Identified on Baby Weighing Scale after Use

**Antibiotic Susceptibility Pattern of the Bacterial Isolates**

The antibiotic susceptibility patterns of bacterial isolates recovered from baby weighing scales are presented in Tables 6 and 7. *Staphylococcus aureus* showed resistance to Ampicillin and Erythromycin but remained highly susceptible to Vancomycin, Ciprofloxacin, and Gentamicin, with intermediate response to Tetracycline. *Staphylococcus epidermidis* was resistant to Ampicillin and Erythromycin but sensitive to Oxacillin, Ciprofloxacin, and Gentamicin, while showing intermediate susceptibility to Tetracycline. *Escherichia coli* and *Klebsiella spp.* demonstrated resistance to Ampicillin but remained susceptible to Ciprofloxacin, Gentamicin, and Ceftazidime, with intermediate susceptibility to Tetracycline. *Pseudomonas spp.* showed intermediate response to Ampicillin and Tetracycline but were susceptible to Ciprofloxacin, Gentamicin, Erythromycin, and Imipenem. Overall, the isolates exhibited the highest resistance to Ampicillin (80%). In contrast, Ciprofloxacin (100%) and Gentamicin (100%) showed the highest overall sensitivity among the isolates. *Staphylococcus aureus* remained susceptible to Vancomycin, while *Escherichia coli* and *Klebsiella spp.* retained susceptibility to Ceftazidime. Imipenem also showed good activity against *Pseudomonas spp.*, indicating no evidence of carbapenem resistance.

Table 6: Antibiotic Susceptibility Pattern of the Bacterial Isolates Recovered from Baby Weighing Scales

Isolate	AMP	OX	VA	CIP	CN	E	TE	IPM	CAZ
<i>Staphylococcus aureus</i>	R	-	S	S	S	R	I	-	-
<i>Staphylococcus epidermidis</i>	R	S	-	S	S	R	I	-	-
<i>Escherichia coli</i>	R	-	-	S	S	-	I	-	S
<i>Klebsiella spp.</i>	R	-	-	S	S	-	I	-	S
<i>Pseudomonas spp.</i>	I	-	-	S	S	S	I	S	-

Key: R= RESISTANT, S= SENSITIVE, I= INTERMEDIATE, - = NOT TESTED, AMPICILLIN (AMP), OXACILLIN (OX), VANCOMYCIN (VA), CIPROFLOXACIN (CIP), GENTAMICIN (CN), ERYTHROMYCIN (E), TETRACYCLINE (TE), CEFTAZIDIME (CAZ), IMIPENEM (IPM)

Table 7: Overall Antibiotic Susceptibility Profile of Bacterial Isolates from Baby Weighing Scales

Antibiotic	Sensitive n (%)	Resistant n (%)	Intermediate n (%)
Ampicillin (AMP)	0	80	20
Ciprofloxacin (CIP)	100	0	0
Gentamicin (CN)	100	0	0
Tetracycline (TE)	0	0	100
Ceftazidime (CAZ)	100	0	0
Imipenem (IPM)	100	0	0
Vancomycin (VA)	100	0	0

**DISCUSSION**

The socio-demographic profile of respondents showed a predominance of females (87.2%), which reflects the gender distribution commonly observed in maternal and neonatal healthcare services where nurses and midwives are primarily responsible for infant care. The majority of participants were within the 25–34-year age group, indicating a relatively young workforce actively engaged in neonatal healthcare delivery [9]. Although all respondents reported awareness of bacterial contamination associated with baby weighing scales, variations in hygiene practices were observed. Factors such as contaminated environments, infrequent cleaning, and poor hand hygiene were identified as major contributors to contamination. Despite the high proportion of respondents who had received infection control training (76.9%) and reporting knowledge (100%), inconsistencies in cleaning frequency and disinfectant use indicate a gap between knowledge and actual practice. Only approximately 49% of respondents reported cleaning the scales after each use, and commonly used disinfectants included antiseptic solutions and alcohol-based sanitizers, while chlorine-based disinfectants such as sodium hypochlorite were rarely used. This discrepancy between knowledge and practice has been widely documented in infection prevention studies, where the existence of IPC guidelines does not always translate into consistent implementation at the facility level [1]. Contributing factors may include limited availability of disinfectants, inadequate supervision, time constraints, and insufficient monitoring of compliance with cleaning protocols. Evidence from intervention studies has shown that the implementation of standardized cleaning protocols, staff training, regular audits, and feedback mechanisms can significantly reduce environmental contamination and improve adherence to infection control practices [10]. Similar discrepancies between awareness and compliance with infection prevention guidelines have been reported in healthcare settings globally [11]. The perception of infection risk among respondents was generally moderate, with 43.6% reporting previous instances where infections were suspected to occur following the use of baby weighing scales. While most facilities reported the existence of infection prevention policies, gaps in policy awareness and implementation were also observed. These findings suggest that the mere presence of institutional policies may not guarantee consistent adherence to infection control practices [12]. Microbiological analysis revealed that baby weighing scales were contaminated with several bacterial species, including *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella spp.*, and *Pseudomonas aeruginosa*. The predominance of *S. epidermidis* is consistent with previous environmental studies that identified coagulase-negative staphylococci as common contaminants of hospital surfaces due to their presence as part of normal human skin flora [5, 13].

Their presence on weighing scales suggests frequent transfer through direct contact with healthcare workers and caregivers. The detection of Gram-negative organisms such as *E. coli*, *Klebsiella* spp., and *Pseudomonas aeruginosa* indicates possible environmental or fecal contamination. These organisms are commonly associated with hospital environments and have been implicated in neonatal infections, including sepsis [1, 4]. Their recovery from baby weighing scales highlights the potential role of shared medical equipment as reservoirs for healthcare-associated infections. A slight increase in *S. epidermidis* after scale use suggests rapid re-contamination following patient contact. Similar observations have been reported in hospital environmental studies where frequently touched surfaces become re-contaminated shortly after cleaning due to repeated human contact [14, 15]. These findings emphasize the importance of combining environmental cleaning with strict adherence to hand hygiene practices.

The antibiotic susceptibility results revealed high resistance to ampicillin among most isolates, while ciprofloxacin and gentamicin demonstrated high effectiveness. The observed resistance to ampicillin is consistent with reports from sub-Saharan Africa indicating widespread resistance to older  $\beta$ -lactam antibiotics (Godman et al., 2022). However, the preserved activity of ciprofloxacin, gentamicin, and imipenem suggests that these antibiotics remain effective treatment options against the isolated organisms.

Overall, the findings highlight the potential role of baby weighing scales as reservoirs for bacterial transmission within healthcare facilities. Considering the vulnerability of neonates to infections, strict adherence to infection prevention and control practices, including routine disinfection of medical equipment and proper hand hygiene, is essential to reduce the risk of healthcare-associated infections [11].

This study demonstrated that baby weighing scales used in healthcare facilities in Rivers State were contaminated with several bacterial species, including *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* spp., and *Pseudomonas aeruginosa*. Although healthcare workers showed a high level of awareness regarding contamination risks, inconsistencies in cleaning practices and disinfectant use were observed.

The presence of potentially pathogenic organisms on baby weighing scales highlights the importance of proper infection prevention and control practices. Regular cleaning and disinfection of weighing scales after each use, improved training of healthcare workers, and routine monitoring of hygiene practices are essential to reduce contamination risks and protect neonates from healthcare-associated infections.

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