Original Article

Knowledge, Attitudes And Practices Regarding The Use Of Nebulizer Therapy Among Healthcare Professionals In South-South Nigeria: A Cross-Sectional Study

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ABSTRACT

Nebulizer therapy is a widely employed modality for aerosol drug delivery in the acute and chronic management of obstructive airway diseases. Despite its clinical ubiquity in Nigerian healthcare settings, significant variability exists among healthcare professionals in knowledge of appropriate indications, medication selection, administration practices and infection control considerations. This study assessed the knowledge, attitudes and practices regarding nebulizer therapy among healthcare professionals in a community in Nigeria.

A descriptive cross-sectional study was conducted among 210 healthcare professionals recruited through purposive sampling from tertiary, secondary and private health facilities across Benin city, Edo state, Nigeria. Data were collected using a structured, pre-tested, self-administered questionnaire comprising four thematic sections: respondent sociodemographics; knowledge of nebulizer indications and medications; attitudes towards clinical utility and patient training; and nebulizer therapy practices. Data were entered and analyzed using IBM SPSS Statistics version 27.0. Descriptive statistics such as frequencies, percentages, means and standard deviations ,were computed for all variables. Multiple-response analysis was applied to items permitting selection of more than one option.

The majority of respondents (95.7%) rated nebulizers as very effective for acute bronchospasm and 82.9% considered them very appropriate for outpatient asthma management. Self-assessed knowledge of nebulizer use was rated good by 73.8% of respondents, with medical school as the principal knowledge source (84.3%). Salbutamol was correctly identified by 200 respondents (95.2%), budesonide by 165 (78.6%) and ipratropium by 156 (74.3%); however, 53 respondents (25.2%) incorrectly endorsed antibiotics as a nebulizable agent. Nurses were identified as the primary nebulizer therapy administrators (93.3%). Formal protocols were available in only 19.0% of respondents' facilities. Cost (51.0%) and patient non-compliance (36.7%) were the most frequently cited barriers. Consistent follow-up to assess treatment response was performed by 51.0% of respondents.

Healthcare professionals in Benin-city demonstrate broadly positive attitudes and generally adequate knowledge regarding nebulizer therapy, but exhibit significant gaps in antibiotic misconceptions, protocol availability, supervision consistency and systematic treatment follow-up. Targeted continuing medical education and institutional protocol development are urgently required.

Keywords: Aerosol therapy; Attitudes; Healthcare professionals; Knowledge; Nebulizer therapy; Nigeria; Practices; Respiratory diseases

INTRODUCTION

Nebulizer therapy refers to the delivery of medications in aerosolized form to the respiratory tract through a device that converts liquid drug solutions or suspensions into a fine mist suitable for inhalation.[1] It represents one of the most widely employed modalities for the acute management of bronchospasm in conditions such as asthma and chronic obstructive pulmonary disease (COPD) and is also used in the outpatient setting for maintenance therapy in patients unable to use pressurized metered-dose inhalers or dry powder inhalers effectively.[2,3] The principal medications delivered via nebulizer include short-acting beta-2 agonists such as salbutamol, anticholinergic agents such as ipratropium bromide and inhaled corticosteroids such as budesonide, each with defined indications and administration protocols supported by current evidence and international guidelines from the Global Initiative for Asthma (GINA) and the Global Initiative for Chronic Obstructive Lung Disease (GOLD).[4–7]

In sub-Saharan Africa, where access to advanced respiratory diagnostics and modern inhaler devices remains constrained by cost and availability, nebulizers occupy a particularly important role in respiratory disease management.[8,9] Nigeria bears a substantial burden of obstructive airway diseases driven by environmental

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exposures to biomass fuel combustion products, tobacco smoke and occupational dusts, alongside a growing prevalence of allergic respiratory conditions across all age groups.[10–12] Against this background, the appropriate use of nebulizer therapy by healthcare professionals constitutes a critical determinant of patient outcomes, particularly in settings where emergency bronchodilator delivery must be rapid and reliable.

Despite the widespread availability of nebulizers in Nigerian health facilities, important concerns exist regarding the quality and consistency of their use. Medication selection errors, including the inappropriate nebulization with agents not formulated for this route, carry risks of treatment failure and patient harm. Variation in administration technique, infrequent patient education, inconsistent infection control practices and the absence of institutional protocols are documented challenges in low- and middle-income country settings that may compromise the therapeutic benefits of nebulizer therapy. Furthermore, the question of who administers nebulizer therapy, how rigorously patients are supervised during treatment and how systematically adverse effects and treatment responses are monitored remain largely unexplored in the Nigerian context.

This study was therefore designed to assess the knowledge, attitudes and practices regarding nebulizer therapy among healthcare professionals in Nigeria; to identify specific competency gaps and inform the development of targeted training and quality improvement interventions.

MATERIALS AND METHODS

Study Area

This study was conducted in Benin City, Edo State, Nigeria. Benin City is the state capital and hosts several healthcare institutions including the University of Benin Teaching Hospital (UBTH), which serves as the primary tertiary referral centre for Edo State and the broader South-South geopolitical zone. Respondents were recruited from healthcare facilities spanning tertiary, secondary and private sectors within Benin City, reflecting the concentration of trained physician cadres in this urban health system.

Study Design, Sampling Technique and Data Collection

A descriptive cross-sectional study design was employed. Participants were recruited using purposive sampling, targeting healthcare professionals actively involved in the clinical management of patients with respiratory conditions. A structured, pre-tested, self-administered questionnaire was used for data collection. The instrument was developed based on a review of existing literature and validated tools for assessing healthcare professionals' knowledge of aerosol therapy. The questionnaire was pre-tested on a convenience sample of ten healthcare professionals not included in the main study and minor amendments were made to improve clarity before data collection commenced.

Study Population, Selection Criteria and Sample Size

The study population comprised medical officers, registrars and consultants or senior registrars actively practicing in healthcare facilities in Benin City, Edo State. Inclusion criteria were: possession of an MBBS degree or equivalent medical qualification; current active clinical practice with direct patient care responsibilities at a participating facility; and willingness to provide written informed consent. Exclusion criteria included healthcare workers not involved in direct patient care, such as administrative and non-clinical staff and those who declined participation. A total of 210 eligible respondents were recruited over the study period.

Data Analysis

Data were coded, entered and analyzed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were computed for all study variables: frequencies and percentages for categorical data; and means with standard deviations (SD) for continuous variables. All analyses were conducted at the 95% confidence level; a p-value of less than 0.05 was considered statistically significant where applicable.

Ethical Considerations

Ethical approval was obtained from the Health Research and Ethics Committee of the University of Benin Teaching Hospital, Benin City, before commencement of data collection. All participation was entirely voluntary and written informed consent was obtained from each respondent before questionnaire administration. Respondents were assured that their identities would remain anonymous and that all data would be treated with strict confidentiality, used solely for research purposes and reported only in aggregate form. No incentives were provided for participation.

RESULTS

Sociodemographic and Practice Characteristics of Respondents

A total of 210 healthcare professionals participated. The mean age was 41.3 ± 9.4 years, with 115 male (54.8%) and 95 female (45.2%) respondents. The mean years of clinical practice was 11.8 ± 7.8 years. Registrars constituted the largest cadre (120; 57.1%), followed by medical officers (48; 22.9%) and consultants or senior registrars (42; 20.0%). The majority were attached to tertiary hospitals (127; 60.5%) in urban locations (199; 94.8%). (Table 1)

Knowledge of Nebulizer Therapy Among Respondents

The overwhelming majority of respondents (201; 95.7%) rated nebulizers as very effective for treating acute bronchospasm, with the remaining 9 (4.3%) rating them as fairly effective. For outpatient asthma management, 174 respondents (82.9%) considered nebulizers very appropriate, 25 (11.9%) fairly appropriate and 8 (3.8%) not appropriate. Nebulizer use for COPD exacerbation was rated very appropriate by 192 respondents (91.4%) and fairly appropriate by 16 (7.6%), with only 2 (1.0%) rating it not appropriate.

Regarding medications deliverable via nebulizer, salbutamol was correctly identified by 200 respondents (95.2%), budesonide by 165 (78.6%) and ipratropium bromide by 156 (74.3%). Notably, 53 respondents (25.2%) incorrectly mentioned antibiotics as a nebulizable agent. Self-assessed knowledge was rated good by 155

respondents (73.8%) and fair by 52 (24.8%), with only 3 (1.4%) rating it poor. Medical school remained the dominant knowledge source (177; 84.3%), with textbooks and journals (88; 41.9%), online resources (67; 31.9%) and CME programmes (62; 29.5%) as supplementary sources. The suitability of nebulizer therapy for paediatric patients was affirmed by 182 respondents (86.7%). Knowledge of nebulizer cleaning and maintenance was rated fairly knowledgeable by 112 (53.3%) and very knowledgeable by 72 (34.3%). (Table 2, Figure 1)

Attitudes Towards Nebulizer Therapy

The importance of training patients on correct nebulizer technique was rated very important by 188 respondents (89.5%) and fairly important by 22 (10.5%). Regarding frequency of use, 100 respondents (47.6%) used nebuliser therapy occasionally, 66 (31.4%) rarely and 44 (21.0%) very often. Nebulizer therapy was reported as always available in the facilities of 153 respondents (72.9%), sometimes available in 42 (20.0%) and rarely available in 15 (7.1%). (Table 3)

Nebulizer Therapy Administration and Supervision Practices (Table 4, Figures 2, Figure 3)

Patient instructions on nebulizer technique were always provided by 87 respondents (41.4%), sometimes by 86 (41.0%) and never by 29 (13.8%). Nurses were identified as the primary administrators of nebulizer therapy by 196 respondents (93.3%), followed by doctors (65; 31.0%), respiratory therapists (44; 21.0%) and patients or guardians (23; 11.0%) (Figure 2). Formal protocols or institutional guidelines for nebulizer use were available in the facilities of only 40 respondents (19.0%), absent in 73 (34.8%) and unknown to 97 (46.2%).

Supervision of patients during nebulizer therapy was always performed by 67 respondents (31.9%), sometimes by 89 (42.4%), rarely by 43 (20.5%) and never by 11 (5.2%). Adverse effects were rarely reported by the majority (132; 62.9%), never by 31 (14.8%), occasionally by 38 (18.1%) and very often by 9 (4.3%). Consistent follow-up to assess treatment response was performed by 107 respondents (51.0%), sometimes by 88 (41.9%) and not at all by 15 (7.1%) (Figure 3).

Factors Associated with Good Nebulizer Therapy Practice

Professional cadre (χ^2=9.015, p=0.011) and frequency of nebulizer use in practice (χ^2=54.242, p<0.001) were significantly associated with practice classification. Medical officers (68.8%) and consultants or senior registrars (73.8%) demonstrated higher rates of good practice compared with registrars (50.8%). Respondents who used nebulizer therapy very often in practice had the highest rate of good practice (93.2%), compared with 67.0% among those who used it occasionally and 25.8% among those who used it rarely. Sex (p=0.877), age group (p=0.520), years of practice group (p=0.488), hospital type (p=0.425), knowledge category (p=0.552) and nebulizer availability (p=0.877) were not significantly associated with practice classification. (Table 5, Figure 4)

Predictors of Good Nebulizer Therapy Practice

In univariate analysis, registrar cadre (OR 0.420, 95% CI 0.235–0.750, p=0.003), consultant or senior registrar cadre (OR 2.219, 95% CI 1.046–4.707, p=0.038) and very frequent nebulizer use in practice (OR 13.341, 95% CI 3.974–44.789, p<0.001) were significantly associated with good practice. In the multivariate model adjusting for all variables simultaneously, very frequent nebulizer use in practice remained the sole independent predictor of good practice (aOR 14.732, 95% CI 4.267–50.864, p<0.001). Registrar cadre was independently associated with lower odds of good practice (aOR 0.393, 95% CI 0.160–1.965, p=0.082), suggesting that registrars were significantly less likely to demonstrate good nebulizer therapy practice compared with medical officers after adjustment. Age, years of practice, sex, hospital type and knowledge category were not independently predictive of practice quality. (Table 6)

Table 1: Sociodemographic and practice characteristics of the respondents (N = 210)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
< 30	18	8.6
30 – 39	84	40.0
40 – 49	84	40.0
50 – 59	18	8.6
, , ,	6	2.9
Mean ± SD	41.3 ± 9.4 years	
Sex		
Male	115	54.8
Female	95	45.2
Years of practice		
< 5	42	20.0
5 – 9	58	27.6
10 – 19	79	37.6
≥ 20	31	14.8
Mean ± SD	11.8 ± 7.8 years	
Current position		
Medical Officer	48	22.9
Registrar	120	57.1
Consultant/Senior Registrar	42	20.0
Type of hospital		
Tertiary	127	60.5
Secondary	41	19.5
Primary	16	7.6
Private	26	12.4
Location of hospital		
Urban	199	94.8
Rural	11	5.2

Table 2: Knowledge of nebulizer therapy among the respondents (N = 210)

Variable	Frequency (n)	Percentage (%)
Effectiveness for acute bronchospasm		
Very effective	201	95.7
Fairly effective	9	4.3
Appropriateness — outpatient asthma management		
Don't know	3	1.4
Not appropriate	8	3.8
Fairly appropriate	25	11.9
Very appropriate	174	82.9
Appropriateness — COPD exacerbation		
Not appropriate	2	1.0
Fairly appropriate	16	7.6
Very appropriate	192	91.4
Medications deliverable via nebulizer*		
Salbutamol	200	95.2
Budesonide	165	78.6
Ipratropium bromide	156	74.3
Antibiotics (incorrect)	53	25.2
Self-assessed knowledge of nebulizer use		
Poor	3	1.4
Fair	52	24.8
Good	155	73.8
Suitability for paediatric patients		
Yes	182	86.7
No	15	7.1
Don't know	13	6.2
Knowledge of cleaning and maintenance		
Not knowledgeable	26	12.4
Fairly knowledgeable	112	53.3
Very knowledgeable	72	34.3

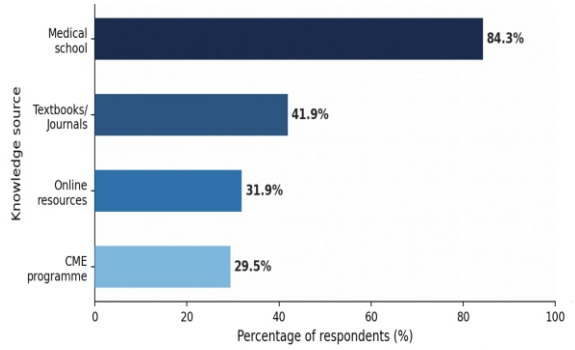

Figure 1: Sources of knowledge on nebulizer therapy — multiple response (N = 210)

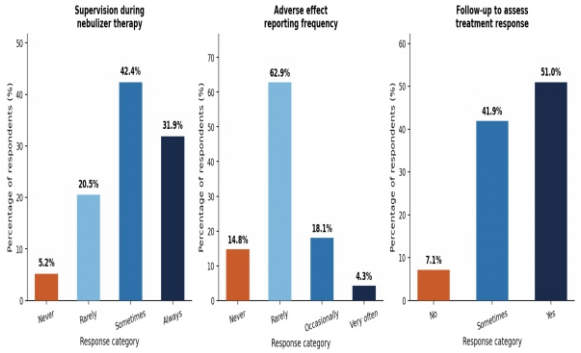

Figure 3: Supervision, adverse effect reporting and follow-up to assess treatment response (N = 210)

Table 3: Attitudes towards nebulizer therapy (N = 210)

Variable	Frequency (n)	Percentage (%)
Importance of training patients on nebulizer technique		
Fairly important	22	10.5
Very important	188	89.5
Frequency of nebulizer use in practice		
Rarely	66	31.4
Occasionally	100	47.6
Very often	44	21.0
Availability of nebulizer therapy in facility		
Rarely	15	7.1
Sometimes	42	20.0
Always	153	72.9

Table 4: Nebulizer therapy administration and supervision practices (N = 210)

Variable	Frequency (n)	Percentage (%)
Instructions provided to patients on technique		
Never	29	13.8
Yes — always	87	41.4
Sometimes	86	41.0
Who administers nebulizer therapy*		
Nurse	196	93.3
Doctor	65	31.0
Respiratory therapist	44	21.0
Patient/guardian	23	11.0
Protocols/guidelines available in facility		
Yes	40	19.0
No	73	34.8
Don't know	97	46.2
Supervision during nebulizer therapy		
Never	11	5.2
Rarely	43	20.5
Sometimes	89	42.4
Always	67	31.9
Frequency of adverse effect reporting		
Never	31	14.8
Rarely	132	62.9
Occasionally	38	18.1
Very often	9	4.3
Follow-up to assess treatment response		
No	15	7.1
Yes — always	107	51.0
Sometimes	88	41.9

Percentages exceed 100% due to multiple responses

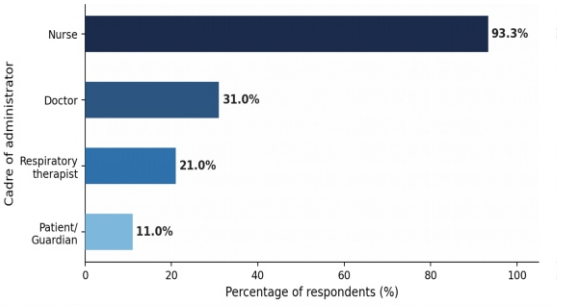

Figure 2: Healthcare professionals who administer nebulizer therapy — multiple responses (N = 210)

Table 5: Factors associated with good nebulizer therapy practices (N = 210)

Variable / Category	Good practice n (%)	Poor practice n (%)	[illegible]	p-value
Sex				
Male (n=115)	69 (60.0)	46 (40.0)	0.023 (1)	0.877
Female (n=95)	56 (58.9)	39 (41.1)		
Age group (years)				
[illegible]	60 (58.8)	42 (41.2)	1.307 (2)	0.520
40–49 (n=83)	47 (56.6)	36 (43.4)		
[illegible]	18 (69.2)	8 (30.8)		
Years of practice				
<10 years (n=97)	54 (55.7)	43 (44.3)	1.435 (2)	0.488
10–19 years (n=79)	51 (64.6)	28 (35.4)		
≥20 years (n=34)	20 (58.8)	14 (41.2)		
Current position				
Medical Officer (n=48)	33 (68.8)	15 (31.2)	9.015 (2)	0.011*
Registrar (n=120)	61 (50.8)	59 (49.2)		
Consultant/SR (n=42)	31 (73.8)	11 (26.2)		
Type of hospital				
Tertiary (n=127)	71 (55.9)	56 (44.1)	2.791 (3)	0.425
Secondary (n=41)	27 (65.9)	14 (34.1)		
Primary (n=16)	9 (56.3)	7 (43.8)		
Private (n=26)	18 (69.2)	8 (30.8)		
Knowledge category				
Good knowledge (n=201)	121 (60.2)	80 (39.8)	0.354 (1)	0.552
Poor knowledge (n=9)	4 (44.4)	5 (55.6)		
Nebulizer use frequency				
Rarely (n=66)	17 (25.8)	49 (74.2)	54.242 (2)	<0.001*
Occasionally (n=100)	67 (67.0)	33 (33.0)		
Very often (n=44)	41 (93.2)	3 (6.8)		
Nebulizer availability				
Rarely (n=15)	8 (53.3)	7 (46.7)	0.262 (2)	0.877
Sometimes (n=42)	25 (59.5)	17 (40.5)		
Always (n=153)	92 (60.1)	61 (39.9)		

***Statistically significant ($p < 0.05$). χ^2, chi-square statistic; df, degrees of freedom.**

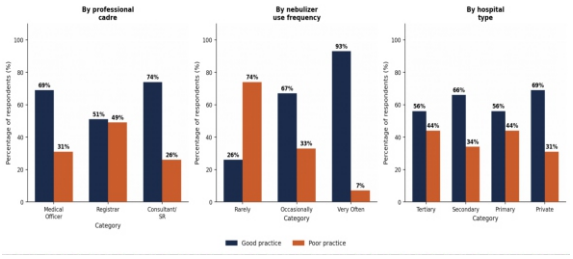

Figure 4: Distribution of good and poor nebulizer practice by professional cadre, nebulizer use frequency and hospital type

Table 6: Predictors of good nebulizer therapy practice

Variable	Univariate OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age (per year)	0.998 (0.969–1.028)	0.903	0.991 (0.957–1.028)	0.638
Years of practice	1.014 (0.978–1.051)	0.460	0.996 (0.952–1.041)	0.851
Male sex	1.045 (0.601–1.817)	0.877	1.516 (0.786–2.926)	0.215
Registrar (ref: MO)	0.420 (0.235–0.750)	0.003*	0.393 (0.160–1.965)	0.082
Consultant/SR (ref: MO)	2.219 (1.046–4.707)	0.038*	0.979 (0.336–2.855)	0.969
Tertiary hospital	0.681 (0.385–1.205)	0.187	0.708 (0.327–1.533)	0.381
Good knowledge score	1.891 (0.493–7.255)	0.353	2.153 (0.489–9.483)	0.311
Very frequent nebulizer use	13.341 (3.974–44.789)	<0.001*	14.732 (4.267–50.864)	<0.001*

*Statistically significant ($p < 0.05$). OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval; ref,

DISCUSSION

This study assessed the knowledge, attitudes and practices regarding nebulizer therapy among 210 healthcare professionals in Nigeria. The principal finding is that while respondents demonstrated broadly favourable knowledge and positive attitudes, significant gaps persist in medication knowledge accuracy, institutional protocol availability, supervision consistency and systematic treatment follow-up practices. Over half of respondents were classified as having good nebulizer therapy practice, with very frequent nebulizer use in clinical practice emerging as the sole independent predictor of good practice.

The near-universal recognition of nebulizer effectiveness for acute bronchospasm and broad endorsement of its appropriateness for COPD exacerbation management reflects alignment with current GOLD and GINA guideline recommendations. These findings are consistent with those reported by Refiloe et al.[13] and Ozoh et al.[14] from Lagos, who documented generally positive attitudes towards bronchodilator therapy delivery in sub-Saharan African settings. The strong acceptance of nebulizer appropriateness for paediatric patients is clinically relevant given that inhaler device handling poses significant challenges in younger children, making nebulizer therapy a pragmatic delivery option in acute settings in Nigeria.

The finding that over a quarter of respondents incorrectly endorsed antibiotics as a nebulizable medication represents the most clinically significant knowledge gap identified in this study. Nebulization of systemic antibiotic formulations not designed for inhalation delivery risks airways irritation, bronchospasm and treatment failure and is unsupported by evidence-based guidelines. This misconception is consistent with findings by Obaseki et al.[15], who documented considerable variability in inhaled therapy prescribing knowledge among Nigerian hospital physicians. Importantly, good knowledge score was not independently predictive of good practice in the multivariate model, suggesting that knowledge acquisition alone is insufficient to drive practice improvement, a finding consistent with the knowledge-attitude-practice gap framework extensively documented in health professional education research.[16,17]

The dominance of very frequent nebulizer use as the independent predictor of good practice strongly implicates experiential learning as the primary driver of practice quality in this context. Respondents who administered nebulizer therapy very often were nearly 15 times more likely to demonstrate good practice, likely reflecting the cumulative development of practical skill, attentiveness to patient response and confidence in protocol application that accompanies frequent procedural exposure. This finding has direct educational implications: simulation-based training, supervised clinical rotations in respiratory medicine and structured competency-based assessments may be more effective in improving practice than knowledge-based didactic CME alone.

The identification of nurses as the primary nebulizer therapy administrators emphasizes the critical role of nursing staff in aerosol therapy delivery, yet the low rates of consistent patient instruction (41.4% always) and supervision (31.9% always) highlight gaps that cannot be attributed to knowledge deficits alone. Institutional protocol availability, reported by only 19.0% of respondents, is a structural determinant of practice consistency that operates independently of individual knowledge or attitude. Facilities with formal protocols provide standardized procedural guidance that reduces practice variability, supports junior staff competence and creates accountability frameworks for supervision and documentation. The high rate of adverse effect under-reporting is a patient safety concern that warrants dedicated quality improvement attention, given the well-established risk of tachycardia and bronchospasm with repeated salbutamol nebulization.

This study provides a comprehensive characterization of nebulizer therapy knowledge, attitudes and practice among Nigerian healthcare professionals, demonstrating that practice improvement is principally driven by clinical exposure frequency rather than knowledge acquisition and that institutional protocol development and structured competency training are the most promising levers for system-wide improvement.

LIMITATIONS

Responses regarding knowledge, attitudes and practices are self-reported and may be subject to recall bias and social desirability bias, potentially leading to overestimation of knowledge and practices. The sample was drawn predominantly from urban tertiary institutions, which may limit generalizability to rural or primary care settings where nebulizer practices may differ substantially.

CONCLUSION

Healthcare professionals in Nigeria hold broadly positive attitudes and demonstrate generally adequate knowledge regarding nebulizer therapy, but exhibit specific knowledge gaps, most critically the antibiotic misconception, alongside limited protocol availability, inconsistent patient supervision and incomplete treatment follow-up. Medical school remains the dominant knowledge source while CME engagement remains suboptimal. A coordinated response incorporating targeted CME redesign, institutional protocol development, nursing competency training and health system investment in medication subsidy is required to standardize nebulizer therapy practices and improve respiratory disease outcomes across Nigerian health facilities.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed: (1) Health facility

administrators should develop and disseminate standardized, evidence-based protocols for nebulizer therapy covering medication selection, device preparation, administration technique, patient education, cleaning and decontamination and adverse effect monitoring. (2) Postgraduate medical and nursing training programmes should incorporate structured competency assessments in nebulizer therapy, specifically addressing correct medication selection and excluding inappropriate agents such as systemic antibiotics. (3) CME providers should develop targeted nebulizer therapy training modules aligned with current guidelines, incorporating objective knowledge assessment rather than attendance-based credit units alone. (4) Institutional quality improvement programmes should establish routine monitoring of patient instruction provision, supervision practices and follow-up documentation as indicators of nebulizer therapy standard of care.

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