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ORIGINAL RESEARCH



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Awareness, Knowledge and Attitude of Medical Students to Room Air Use in Neonatal Resuscitation at the Igbinedion University, Okada, Nigeria

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Abstract

Background: A substantial proportion of neonatal deaths is due to preventable causes related to birth asphyxia and inadequate newborn resuscitation, especially in low- and middle-income countries (LMICs). Historically, 100% oxygen was routinely administered during neonatal resuscitation. However, evidence over the past two decades has demonstrated that the use of room air (21% oxygen) during initial resuscitation improves survival.

Objective: To assess the level of awareness, knowledge, and perception regarding the use of room air in neonatal resuscitation among medical students in Nigeria.

Method: A descriptive, cross-sectional survey was conducted among clinical medical students at Igbinedion University, Okada, Nigeria. The questionnaire was offered to all students in the three clinical classes; the participants responded via a self-administered structured questionnaire developed from international guidelines, completed anonymously over one month.

Results: Of the 151 respondents, 84.1% correctly identified 21% oxygen as the recommended concentration to initiate resuscitation. Awareness was significantly associated with educational level (87.2%), clinical rotations (88.9%; 72/81), observation (91.5%; 97/108), and practice (86.4%; 57/66) of neonatal resuscitation. Formal training on neonatal resuscitation was also related to better awareness (90.3%; 56/62).

Conclusion: Most medical students were aware of room air use in neonatal resuscitation, although gaps in this knowledge still exist. Enhanced training and simulation-based learning are required to improve adherence to current established practice guidelines.

***Keywords**: Guideline adherence, Medical education, Neonatal encephalopathy, Oxygen concentration, Perinatal asphyxia.*

Introduction

Neonatal mortality remains a significant global public health challenge, with approximately 2.5 million neonatal deaths occurring annually worldwide, accounting for about 47% of all under-five child deaths.[1–3] A substantial proportion of these deaths are due to preventable causes related to perinatal asphyxia and inadequate newborn resuscitation, especially in low- and middle-income countries (LMICs). [4,5] Effective neonatal resuscitation at birth is critical to reducing mortality and morbidity associated with perinatal asphyxia.[6]

Historically, 100% oxygen was routinely administered to neurologically depressed newborns during resuscitation.[7] However,

evidence over the past two decades has demonstrated that the use of room air (21% oxygen) during initial resuscitation improves survival and reduces oxidative stress and associated complications, such as brain injury and chronic lung disease.[8,9] International guidelines, including those from the World Health Organisation (WHO), the American Academy of Pediatrics' Neonatal Resuscitation Program (NRP), and the European Resuscitation Council, now recommend room air (21% Oxygen) as the preferred initial oxygen concentration in the resuscitation of term and near-term neonates, followed by titration to required oxygen amounts thereafter.[10–12]

Despite these guidelines, knowledge gaps and inconsistent practices persist globally. Studies from various countries report varying levels of awareness and adherence to the recommended use of oxygen during neonatal resuscitation among healthcare providers and trainees.[13–15] In Africa, where neonatal mortality rates remain disproportionately high, estimated at 27 deaths per 1000 live births compared to the global average of 17 per 1000 live births, [1,3] the challenge of implementing evidence-based neonatal resuscitation practices is compounded by resource limitations, training deficits, and knowledge gaps among healthcare workers.[16–18]

Nigeria, with a neonatal mortality rate of approximately 39 per 1000 live births, ranks among the countries with the highest neonatal deaths globally.[19] Birth asphyxia accounts for a significant proportion of neonatal deaths in Nigeria, highlighting the critical importance of effective neonatal resuscitation training and practice.[20] While neonatal resuscitation training programs have been introduced in many Nigerian medical schools and healthcare institutions, limited data exist regarding medical students ' awareness and understanding of updated recommendations on oxygen use during neonatal resuscitation.

This study aimed to assess the awareness of the use of room air in neonatal resuscitation and adherence to the relevant international guidelines among medical students at Igbinedion University, Okada, Nigeria. Understanding these gaps will provide a foundation for improving neonatal resuscitation training and ultimately contribute to reducing neonatal mortality and morbidity in Nigeria.

Methods

Study design

This was a descriptive, cross-sectional survey.

Study setting

The study took place at Igbinedion University, Nigeria. This institution provides undergraduate medical training.

Study population

The participants were clinical medical students in the fifth and sixth years of training (500-Level-a, 500-Level-b, and 600-Level classes). All the participants had undertaken clinical rotations in paediatrics, obstetrics and gynaecology, and surgery. They have also had varying degrees of exposure to neonatal resuscitation while rotating through the paediatrics department through formal and clinical teaching sessions.

Ethical considerations

Ethical approval for the study was obtained from the Human Research and Ethics Committee of Igbinedion University Teaching Hospital, Okada, with reference number IUTH/R.24/VOL.I/166. Informed consent was obtained from all participants, and confidentiality was ensured.

Sample size and sampling technique

A total population (census) approach was used. A structured questionnaire was used to collect relevant information from the students enrolled in

the three clinical classes (500A, 500B, and 600 level). Of the 231 total eligible population, 151 students completed and returned the questionnaire. Non-response was due to absence from school or unwillingness to participate; non-responders were not replaced. As a census approach was used, a formal *a priori* sample size calculation was not required. Therefore, all the eligible students across the three clinical classes constituted the target population.

Data collection

A structured, self-administered questionnaire, based on international neonatal resuscitation guidelines, was used to collect data on demographics, knowledge, experience, and attitudes about neonatal resuscitation. The questionnaire was distributed and completed anonymously over one month.

Data analysis

Data were analysed using IBM SPSS Statistics version 27. Descriptive statistics summarised frequencies and percentages, and Chi-square tests evaluated associations between sociodemographic factors and awareness. Logistic regression was not used due to significant collinearity among the clinical exposure variables (formal training, observation, and practice of neonatal resuscitation). Statistical significance was defined by $p < 0.05$.

Results

Sociodemographic characteristics (Table I)

A total of 151 medical students participated in the study. The majority were aged 18 to 25 years (108, 71.5%), followed by 26 to 30 years (39, 25.8%), and 31 years or older (4, 2.7%). There were 97 (64.2%) males and 54 (35.8%) females. Regarding level of education, 66 (43.7%) were in the 500A-level class, 46 (30.5%) in the 500B-level class, and 39 (25.8%) in the 600-level class. Only 6 (4.0%) participants reported having children. Completion of selected clinical rotations was nearly evenly split, with 75 (49.7%) having completed the rotations and 76 (50.3%) yet to.

Knowledge of oxygen use in neonatal resuscitation (Table II)

One hundred and twenty-seven (84.1%) correctly identified 21% oxygen (room air) as the recommended concentration for initiating neonatal resuscitation. Ninety-seven (64.2%) recognised WHO as one of the organisations endorsing the practice; others identified included NRP (62; 41.1%), NLS (38; 25.2%), and UNICEF (30; 19.9%), while 35 (23.2%) were unsure.

Regarding the reasons for preferring room air, 122 (80.8%) correctly cited prevention of oxidative stress, 85 (56.3%) mentioned reduced risk of brain injury, and 66 (43.7%) opined improved survival rates. For risks associated with 100% oxygen use, 143 (94.7%) identified increased oxidative stress. Finally, 144 (95.4%) acknowledged reduced oxidative stress as the primary benefit of room air in neonatal resuscitation.

Factors associated with awareness of room air for neonatal resuscitation (Table III)

Close to three-quarters (109; 72.2%) demonstrated good awareness of room air use in neonatal resuscitation, while 42 (27.8%) had poor awareness. The level of education was significantly associated with awareness ($\chi^2 = 9.042$, $p = 0.011$), with 33 (84.6%) of 600-level students demonstrating good awareness compared to 26 (56.5%) of 500-level students. Completion of selected clinical rotations also showed a significant association ($\chi^2 = 8.153$, $p = 0.006$), where 62 (82.7%) respondents who completed rotations had good awareness versus 47 (61.8%) who had not.

Table I: Sociodemographic profile of respondents

Variable	Frequency (n = 151)	Percentage (%)
Age group (years)		
18 – 25	108	71.5
26 – 30	39	25.8
≥ 31	4	2.7
Sex		
Male	97	64.2
Female	54	35.8
Level of education		
500B-Level	46	30.5
500A-Level	66	43.7
600-Level	39	25.8
Has children		
Yes	6	4.0
No	145	96.0
Completed selected clinical rotations		
Yes	75	49.7
No	76	50.3

Observing neonatal resuscitation was strongly associated with awareness: 78 (82.1%) of those who had observed the procedure demonstrated good awareness compared to 31 (55.4%) who had not ($\chi^2 = 12.554$, $p < 0.001$). Practising neonatal resuscitation was similarly significant, with 43 (87.8%) of those who had practised showing good awareness versus 66 (64.7%) who had not ($\chi^2 = 8.758$, $p = 0.003$).

Formal training on neonatal resuscitation was significantly associated with awareness; 79 (79.0%) trained respondents had good awareness compared to 30 (58.8%) untrained respondents ($\chi^2 = 6.848$, $p = 0.012$).

Age group ($\chi^2 = 4.152$, $p = 0.153$), sex ($\chi^2 = 0.586$, $p = 0.458$), having children ($\chi^2 = 0.387$, $p = 0.678$), and reading official guidelines ($\chi^2 = 1.496$, $p = 0.253$) were not significantly associated with awareness.

Attitudes towards room air use in neonatal resuscitation and experience in neonatal resuscitation (Table IV)

A total of 121 (80.1%) demonstrated a positive attitude by advocating for room air use in future clinical practice, whereas 30 (19.9%) were either unsure or opposed. One hundred and twenty-eight (84.7%) agreed that room air is safe for neonatal resuscitation, while 17 (11.3%) were unsure and 6 (4.0%) disagreed. A similar proportion (121; 80.1%) would advocate for room air use in future clinical practice, with 24 (15.9%) unsure and 6 (4.0%) opposed. Only 75 (49.7%) respondents expressed confidence in their knowledge of neonatal resuscitation standards, whereas 76 (50.3%) were not confident. The vast majority, 145 (96.0%), agreed that more training on room air use should be included in the medical school curriculum. Additionally, 141 (93.4%) recommended neonatal resuscitation simulation for all medical students.

Table II: Awareness of oxygen use in neonatal resuscitation (N=151)

Oxygen recommendation for neonatal resuscitation	Frequency	Percentage
21%	127	84.1
50%	1	0.7
100%	9	6.0
Not sure	14	9.2
Organisations recommending this concentration*		
WHO	97	64.2
NRP	62	41.1
NLS	38	25.2
UNICEF	30	19.9
Not sure	35	23.2
Reason for preference of room air*		
Prevents oxidative stress	122	80.8
Reduced risk of brain injury	85	56.3
Improves survival rate	66	43.7
No specific reason	1	0.7
Not sure	24	15.9
Risks of 100% oxygen*		
Increased oxidative stress	143	94.7
Reduced survival rates	29	19.2
Improved oxygen delivery	5	3.3
Enhanced thermoregulation	2	1.3
None	1	0.7
Primary benefit of room air for neonatal resuscitation		
Reduced oxidative stress	144	95.4
Promotes early discharge	4	2.6
Increases the cost of care	1	0.7
Not sure	2	1.3

***Multiple responses are allowed**

Experience in neonatal resuscitation

Ninety (73.8%) respondents first learned about neonatal resuscitation through formal lectures. Clinical rotations were the source of knowledge about neonatal resuscitation for 15 (12.3%), while 10 (8.2%) and 5 (4.1%) cited self-study and friends and peers, respectively. A small proportion (4; 3.3%) reported having no previous knowledge before the survey.

Overall, 95 (62.9%) had witnessed neonatal resuscitation, while 56 (37.1%) had not. Only 49 (32.5%) had performed neonatal resuscitation, with the majority (102; 67.5%) not having that experience. Information about the oxygen concentration used during resuscitation was obtained from those who had performed the procedure (n = 49); 33 (67.3%) reported using 21% oxygen (room air), 5 (10.3%) used 100%, 1 (2.0%) used 75%, another 1 (2.0%) used 30%, and 9 (18.4%) were not sure. Of those who

performed resuscitation, 32 (65.3%) were aware of the oxygen concentration used, while 17 (34.7%) were not. Most supervisors (40, 81.6%) encouraged the use of room air, compared to 9 (18.4%) who did not.

A hundred (66.2%) respondents had received formal teaching on room air use during neonatal resuscitation, whereas 51 (33.8%) had not received such teaching. Only 51 (33.8%) had read official neonatal resuscitation guidelines, while 100 (66.2%) had not.

Table III: Factors associated with awareness of room air for neonatal resuscitation

Variable	Good n (%)	Poor n (%)	Chi-Square	p-value
Age group (years)			4.152	0.153
18 – 25	73 (67.6)	35 (32.4)		
26 – 30	33 (84.6)	6 (15.4)		
≥ 31	3 (75.0)	1 (25.0)		
Sex			0.586	0.458
Male	41 (75.9)	13 (24.1)		
Female	68 (70.1)	29 (29.9)		
Level of education			9.042	0.011*
500B-Level class	26 (56.5)	20 (43.5)		
500A-Level class	50 (75.8)	16 (24.2)		
600-Level	33 (84.6)	6 (15.4)		
Has children			0.387a	0.678
Yes	5 (83.3)	1 (16.7)		
No	3 (17.6)	14 (82.4)		
Completed clinical rotations			8.153	0.006*
Yes	62 (82.7)	13 (17.3)		
No	47 (61.8)	29 (38.2)		
Observed neonatal resuscitation			12.554	<0.001*
Yes	78 (82.1)	17 (17.9)		
No	31 (55.4)	25 (44.6)		
Practised neonatal resuscitation			8.758	0.003*
Yes	43 (87.8)	6 (12.2)		
No	66 (64.7)	36 (35.3)		
Received formal training			6.848	0.012*
Yes	79 (79.0)	21 (21.0)		
No	30 (58.8)	21 (41.2)		
Read official guidelines			1.496	0.253
Yes	40 (78.4)	11 (21.6)		
No	69 (69.0)	31 (31.0)		

***Fisher's Exact Test**

When asked how the knowledge of neonatal resuscitation could be improved, 85 (61.6%) suggested more hands-on practice, 20 (14.5%) recommended simulation-based training, 18 (13.0%) favoured increased lectures and tutorials, 8 (5.8%) preferred guideline-based learning, and 7 (5.1%) indicated improved availability of equipment.

Table IV: Attitudes towards room air use and experience in neonatal resuscitation

Variable	Yes n (%)	Not sure n (%)	No n (%)
Room air is safe for neonatal resuscitation	128 (84.7)	17 (11.3)	6 (4.0)
I would advocate the use of room air for future clinical practice	121 (80.1)	24 (15.9)	6 (4.0)
I am confident in my knowledge of neonatal resuscitation standards	75 (49.7)	76 (50.3)	0 (0.0)
More training is necessary on room air for resuscitation in the medical school curriculum	145 (96.0)	2 (1.4)	4 (2.6)
I would recommend neonatal resuscitation simulation for all medical students	141 (93.4)	8 (5.3)	2 (1.3)

Table V: Experience of respondents in neonatal resuscitation

Variable	Frequency (n=151)	Percentage (%)
Ever observed neonatal resuscitation		
Yes	95	62.9
No	56	37.1
Ever performed neonatal resuscitation		
Yes	49	32.5
No	102	67.5
Oxygen concentration used during resuscitation (n=49)		
21% (room air)	33	67.3
100%	5	10.3
Other/Not sure	11	22.4
Supervisor encouraged use of room air (n=49)		
Yes	40	81.6
No	9	18.4
Received formal teaching on room air for resuscitation		
Yes	100	66.2
No	51	33.8
Read official guidelines regarding neonatal resuscitation		
Yes	51	33.8
No	100	66.2
How to improve knowledge of neonatal resuscitation		
More hands-on practice	85	61.6
Simulation-based training	20	14.5
Increased lectures and tutorials	18	13.0
Guideline-based learning	8	5.8
Improved availability of equipment	7	5.1

Discussion

This audit assessed the awareness and attitudes of medical students regarding the use of room air for initiating neonatal resuscitation. It showed that about three-quarters demonstrated good awareness of the recommended 21% oxygen concentration. This finding aligns with studies by Oshine *et al.* in Ethiopia, where the majority of undergraduate medical students had good knowledge of neonatal resuscitation, and Ogunlesi *et al.* in Ogun State, which showed that about three-quarters of nurses had good knowledge of neonatal resuscitation. [21,22] The relatively high awareness may reflect increased dissemination of international guidelines and training on global guidelines, as shown by Briggs *et al.* in Rivers State and Okonkwo *et al.* in Edo State, which suggested that repeated training of healthcare workers in neonatal resuscitation increases knowledge and adherence to updated guidelines and practices in neonatal resuscitation. [23,24]

Significant differences in awareness were observed based on educational level and clinical experience. Students in the senior classes were about one and a half times more likely to demonstrate good awareness than junior students. Similarly, those who had completed selected clinical rotations had nearly one and a half times better awareness compared to those who had not, and students who had observed or practised neonatal resuscitation were about one and a half to two times more likely to show good knowledge. This supports evidence that greater clinical exposure, hands-on experience, and progression in training improve understanding and adherence to updated neonatal resuscitation protocols.[25,26] Despite these positive findings, about one quarter of students exhibited poor awareness, indicating persistent knowledge gaps. Notably, only about one-third of respondents had read official neonatal resuscitation guidelines, highlighting a missed opportunity for guideline-based learning that could enhance understanding and practice. The low proportion of students confident in their knowledge further emphasises the need for strengthened educational strategies.

Formal lectures were the main source of information on neonatal resuscitation for almost three-quarters of the respondents. Other leading opportunities included clinical rotations and self-study. This aligns with typical medical curricula structures; hence, the high demand for more hands-on practice and simulation-based training. These observations may suggest that didactic teaching alone is insufficient to build competence in neonatal resuscitation. Simulation training has been shown to improve neonatal resuscitation skills and knowledge retention effectively.[23] The positive attitude toward room air use, with about four-fifths advocating for its use in future practice, is encouraging and suggests readiness to adopt evidence-based practices. However, only about half of the respondents felt confident about their knowledge, indicating a gap between attitude and self-perceived competence. Nearly all students agreed that more training in room air resuscitation should be incorporated into the medical school curriculum, supporting calls for curriculum reform to include neonatal resuscitation simulation and guideline-focused education.[26,27]

Limitations

The limitations of this audit include its single-centre design, which may limit generalisability to other settings. Although a total population approach was used, non-response from some students introduced potential non-response bias if those who did not participate differed systematically from respondents. Self-reported knowledge and attitudes are subject to social desirability bias. Also, collinearity among clinical exposure variables precluded logistic regression analysis.

Conclusion

Medical students demonstrated high awareness of room air use in neonatal resuscitation, but notable gaps in confidence and practical knowledge persist. Strengthening training through simulation, guideline-based teaching, and structured neonatal resuscitation modules is vital to improving competence and adherence to best practices. Structured neonatal resuscitation training should be incorporated into the medical school curriculum at both pre-clinical and clinical levels, with emphasis on current guidelines regarding room air use. Mandatory simulation-based resuscitation workshops should be implemented to bridge the gap between theoretical knowledge and practical competence. Periodic refresher courses should also be made available for students and healthcare workers to ensure sustained proficiency and confidence in neonatal resuscitation.

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