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Fidelity of health care providers on adhering to guidelines for managing neonates with respiratory distress using Silverman Anderson Severity (SAS) score tool in limited resource settings: a case study at Amana Regional Referral Hospital

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Abstract

Background This case study was conducted at Amana Regional Referral Hospital, a referral hospital of Ilala District in Dar es Salaam Region, Tanzania. The aim is to assess the adherence of healthcare providers to guidelines when providing health services to neonates with respiratory distress and how supportive the health system is in limited resource settings.

Methods This is a case study that used a qualitative approach to data collection and analysis. A total of 16 participants participated in this study, of which the sample size was reached by the principle of information saturation in the field. The study population was healthcare providers (pediatricians, general medical doctors, and nurses) working in the neonatal ward who were selected purposively depending on their experience in the neonatal ward. In-depth interviews (IDI) and an observation checklist were used for data collection from key informants, and content analysis was used to analyze the data.

Results The findings revealed that healthcare providers had partially adhered to guidelines in managing neonates with respiratory distress. The Silverman-Anderson Severity (SAS) score tool is recommended for decision-making in prioritizing neonates with respiratory distress to Continuous Positive Airway Pressure (CPAP) treatment in limited-resource health settings with low laboratory technology. Healthcare providers know the importance of using the SAS score tool, but this study shows partial adherence to the use of it. Understaffing, inadequate training, heavy workloads, and lack of motivation emerged as significant deterrents to adherence which are within the health system, and they negatively impact healthcare provider's adherence. These challenges hindered proper monitoring, documentation, and decision-making processes for CPAP initiation and monitoring.

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Conclusion Partial adherence to guidelines for managing neonates with respiratory distress in the context of consistent use of the SAS score tool by healthcare providers was impacted by challenges like understaffing, heavy workloads, and low motivation. Improving staffing, providing comprehensive training, and ensuring adequate equipment are recommended to enhance guideline adherence and improve neonatal care in resource-limited settings.

Keywords Silverman Anderson Severity (SAS) score, Respiratory distress syndrome (RDS), Continuous Positive Airway Pressure (CPAP), Standard treatment guideline

Background

Neonatal mortality remains a significant global health concern, particularly in low and middle-income countries. Each year, the neonatal period, encompassing the first 28 days of life, is responsible for approximately 2.9 million infant deaths worldwide, contributing to more than half of under-five child fatalities globally [6]. In 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, including 17 Sustainable Development Goals (SDGs). The third SDG aims to "ensure healthy lives and promote well-being for all ages" by eliminating preventable infant and child deaths, with a target to reduce neonatal mortality to 12 per 1,000 live births and under-five mortality to 25 per 1,000 live births by 2030 [3, 5]. Despite substantial global progress in child survival since 1990, neonatal fatalities have decreased from 5 million in 1990 to 2.4 million in 2020, yet the reduction in neonatal deaths has been slower compared to post-neonatal under-five mortality. In 2020, nearly half (47%) of under-five deaths occurred during the neonatal period, in contrast to 1990, when 40% of under-five mortality was attributed to neonatal mortality [12]. Approximately 99% of newborn deaths take place in low- and middle-income countries, with the highest deaths in south-central Asian and sub-Saharan African nations, but most research and epidemiological studies are focused on high-income countries with low neonatal and under-five mortality rates [7]. Tanzania has a high newborn mortality with a neonatal mortality rate of 20.1 per 1,000 live births in 2020, which slightly increased from the 2015 neonatal mortality rate of 19 per 1,000 live births [1, 13]. Currently, in 2024, Tanzania has an Infant Mortality Rate of 33.021 deaths per 1,000 live births, marking a 3.36% decline from 2023, which had an Infant Mortality rate of 34.168 deaths per 1,000 live births [10].

Efforts to reduce global neonatal mortality require immediate and effective newborn care as they significantly impact under-five child mortality. Over 50% of neonates born before 31 weeks of gestation develop respiratory distress syndrome (RDS), which may be a result of factors such as a deficiency of pulmonary surfactant, infections, meconium aspiration, birth asphyxia, or fluid-filled lungs. Continuous Positive Airway Pressure (CPAP) is the primary respiratory support for neonates

with RDS in both global and Tanzanian healthcare settings. The availability of sufficient CPAP machines for all RDS-affected neonates in low-resource settings remains a challenge. Medical practitioners often face dilemmas in deciding which neonate should be prioritized for CPAP intervention at that point in time due to the limited available CPAP machines that can suffice the number of neonates who need and will benefit from the CPAP treatment. To address these limitations, it is required to do peripheral blood gas test and making a decision based on which neonate has abnormal test results showing distress severity, but yet this is another challenge as most of the hospitals and health centers do not have such technology and machines to do peripheral blood gas left alone the expense to do it regularly for follow up and management. Silverman Anderson Severity (SAS) Score tool is recommended to assess the severity of RDS in neonates in these limited healthcare settings. SAS Score, introduced in 1956, is commonly used as a diagnostic tool in healthcare facilities with limited laboratory technology and inadequate respiratory support machines to assess and manage neonates with respiratory distress as it is easy to use, fast, does not require a blood sample, and is cost-free since it only needs a physical examination of the neonate with RDS and scores their distress severity[11]. The health care provider will decide which neonate to prioritize for the CPAP machine using the scores and make follow-up after initiating CPAP by doing the score every 2 to 4 h since the initiation of CPAP. In other developing countries, alternative guidelines, like the TRY CPAP Algorithm in Malawi (T for Tone, R for Respiratory, and Y for Yes), are employed to identify neonates who would benefit from CPAP [4]. It is essential to ensure healthcare workers consistently adhere to using the SAS score tool to assess RDS severity in all neonates, thereby making informed decisions on CPAP treatment and enhancing effective management and monitoring of neonates with RDS. This practice contributes to increased recovery rates and a reduction in avoidable neonatal deaths. This study aims to assess healthcare provider's adherence to using the SAS score tool for decision-making in prioritizing neonates with RDS for CPAP treatment in resource-limited settings. Specific objectives for this study are exploring health care provider's adherence, examining health care provider's experiences with using the SAS

Score tool for making decisions, and identifying factors influencing their adherence to using the tool effectively as recommended.

Methods and materials

Study design

This study employed a process evaluation qualitative case study design. The case study design was chosen for its ability to provide in-depth knowledge of the intervention evaluated, allowing the use of multiple data collection techniques. The intervention under evaluation was the decision-making process by healthcare providers using the SAS score tool to initiate CPAP treatments for neonates with respiratory distress syndrome (RDS) and monitor their progress on CPAP treatment until they are weaned off from CPAP.

Study population

The study population included doctors, who are the decision-makers, and nurses, who are the implementers of those decisions, working in the neonatal ward of Amana Regional Referral Hospital. These healthcare providers included pediatricians, registered general medical doctors, and registered nurses with experience in providing neonatal care.

Study area

The study was conducted at Amana Regional Referral Hospital, which is the Regional Referral Hospital of the Ilala District in Dar es Salaam, Tanzania. The hospital receives referred patients with various diagnoses, including neonates in need of respiratory support and intensive care. The hospital has an authorized bed capacity of 362, with the pediatric ward, including the neonatal ward, having a bed capacity of 72. The neonatal ward is equipped with five CPAP machines, and the High Dependency Unit (HDU) where RDS neonates are admitted is equipped with five CPAP machines, 15 neonatal beds, three warmers, one emergency trolley, three monitors, two phototherapy machines, and two oxygen cylinders.

Sampling technique

Purposive sampling was used for this study to select healthcare workers (registered doctors and nurses) assigned to practice in the neonatal ward and trained in using the SAS score for managing RDS and CPAP.

Sample size

A total of 16 participants were involved in this study out of 22 healthcare workers working in the neonatal ward of Amana Regional Referral Hospital. This included doctors (Pediatricians and registered general practitioners) and nurses practicing in the neonatal ward. The final sample size was determined in the field by the principle

of information saturation, whereby no new information emerged from informants.

Data collection tools

Data were collected using an observation checklist and in-depth interviews. The observation checklist was formulated from The Silverman-Anderson Severity score tool, Tanzania's standard treatment guidelines, literature, and study objectives. The in-depth interview guide was developed with open-ended questions to gather information about healthcare provider's adherence to using the SAS score tool, their experience, and factors influencing adherence.

Data collection methods

Data collection was conducted in June 2023 through in-depth interviews and participant observation. In-depth interviews were conducted with healthcare workers in the neonatal ward of Amana Regional Referral Hospital. The interviews were audio-recorded, transcribed, and translated into English. Participant observation was conducted by the researcher in the neonatal ward over one week, observing healthcare providers' adherence to using the SAS score tool for neonates with RDS.

Data management and analysis

The triangulation approach was used to enhance the trustworthiness of the findings of this study by integrating data from In-depth interviews (IDIs) and an observation checklist. IDIs were analyzed using content analysis with NVivo software version 12, whereby data organization, administration, and analysis were performed. Transcripts and observation notes were coded inductively to generate codes from reading transcripts. Recurring patterns and concerns from the data were found through the coding of respondents. Observation checklists were analyzed manually, documenting the adherence of healthcare providers to using the SAS Score tool in real-time. Each checklist item was assessed for adherence or deviation from the tool and guidelines, providing an objective summary of the observed healthcare provider practice. By triangulating these two data sources, convergence and divergence were identified, which minimized biases associated with self-reported data and allowed a more credible assessment, providing a well-rounded and trustworthy understanding of the healthcare provider's adherence (Table 1).

Ethical issues

Ethical clearance was obtained from the Muhimbili University of Health and Allied Sciences (MUHAS) Institutional Review Board (IRB), with reference number DA282/298/01.C/1721. Informed consent was obtained from all participants, and they were informed of their

Table 1 Content analysis codes inclusion, developed by the authors

Categories	Codes	Selected quotes
Decision making	Informant No. 16, Pediatrician, 49 years, Amana RRH	<i>"Decisions to put a child on CPAP are often correct, the problem is in the follow-up. For example, a patient set on CPAP should be monitored after every fifteen minutes for the first hour, and after that should be monitored after every four hours. It should be so until the day that CPAP is taken off where he or she has to be reassessed for SAS score."</i>
	Informant no. 08, Pediatrician, 36 years, Amana RRH	<i>"What I mean is, sometimes babies are many and the machines are inadequate, sometimes you have to decide who is in more need than the other. The one with higher SAS score grade is the one prioritized and gets initiated before the other"</i>
	Informant no. 4, Assistant nursing officer, 43 years, Amana RRH	<i>"We use experience by checking the signs and the doctor will score himself later when he comes. The first person to see admission is a nurse, so when I receive a baby with respiratory distress symptoms, I see that it is not necessary to wait for the doctor, because the more you wait for the doctor, the more the patient gets hurt and the situation worsens"</i>
	Informant no. 06, Registered medical doctor, 27 years, Amana RRH	<i>"I may find it simple to use SAS score but another person may see it as a burden to assess all parameters so may just go direct to CPAP and continue with other duties so it's a bit subjective from person to person"</i>
	Informant no. 14, Registered medical officer, 29 years, Amana RRH	<i>"The challenge is that there is not enough equipment so sometimes causing a delay of some decision"</i>
	Informant no. 01, Nursing officer, 57 years, Amana RRH	<i>"In my opinion, I think SAS score is used correctly as we do not have any other way to determine whether a neonate requires only oxygen supplementation or CPAP"</i>
	Informant no. 07, Nursing Officer, 29 years, Amana RRH	<i>"SAS SCORE is a tool that guides us on the management of a particular patient, non-adherence may lead to mismanagement that causes death or longer hospital stay"</i>
Utilization of SAS score tool by health care workers	Informant No. 06, Registered medical doctor, Amana RRH	<i>"We rely on severity, we do use the SAS score, others will continue with oxygen therapy and other important medications and supportive management, there is nothing much you can do"</i>
	Informant no. 12, Registered assistance medical officer, 48 years Amana RRH	<i>"It is very easy and you seem to make faster and more accurate decisions"</i>
	Informant no. 10, Registered medical doctor, 49 years Amana RRH	<i>"Ever since we started using the SAS score tool, I see there is an improvement in decision making to these babies put on CPAP in contrary to previously when babies were referred blindly to Muhimbili, nowadays the baby with 1.5 kg is put on CPAP after some time they improve and gets discharged."</i>
	Informant no. 15, Registered medical doctor, 30 years, Amana RRH	<i>"It is very helpful, in practice we do rely on the SAS score to make decisions, because we do not have other things like arterial blood gases and electrolytes that could help us to have a better diagnosis"</i>
	Informant no. 11, Registered medical doctors, Amana RRH	<i>"I know the SAS score tool which we use to assess neonates with distress and the score has four parameters. If the score is between one to three we do give oxygen supplementation and if the score is above that we initiate CPAP"</i>
	Informant no. 10, Registered medical doctor, 49 years, Amana RRH	<i>"Concerning CPAP, we basically assess the ability to breathe by using Silverman Score. If the baby scores 4 and above we put him/her on CPAP. For babies with low birth weight, born before time, and those below 1.5 kg we also put them on CPAP. Even if the SAS score doesn't support, we initiate supportive CPAP for breathing"</i>
	Informant no. 12, Registered assistant medical officer, 48 years, Amana RRH	<i>"Their placement on CPAP also depends on whether the neonate has spontaneous breathing so we check the SAS score and put them on CPAP, but those who were born before 32 weeks GA are put on CPAP regardless of the SAS score"</i>
	Informant no. 11, Registered medical doctors, Amana RRH	<i>"They use the SAS score tool as per guidelines, but I personally find it subjective. This is because you may find a neonate with the SAS score of 1 or 2 on CPAP and when weaned off one day after the SAS score rises to 3 or 4. So it is subjective"</i>

Table 1 (continued)

Categories	Codes	Selected quotes
Proper Documentation	Informant no. 12, Assistant medical officer, 48 years, Amana RRH	<i>"If you were on night shift and you attend a neonate with respiratory distress, you might be asked in the morning meetings if you did the SAS score and what were the scores. So to avoid inconvenience you keep doing the SAS score to every neonate presenting with distress and this leads to building that habit"</i>
	Informant no. 05, Assistant nursing officer, 26 years, Amana RRH	<i>"They are using the tool because the ward round includes the specialist doctor and the registrar, of which the registrars are asked by the specialist to score the babies with distress"</i>
	Informant no. 12, Assistant medical officer, 48 years, Amana RRH	<i>"SAS scores are posted on the wall, so when a baby appears, we study and score him and make decisions based on the SAS score we got"</i>
	Informant no. 16, Pediatrician, 49 years, Amana RRH	<i>"Documentation is done by most of the doctors although not everyone writes everything"</i>
	Informant no. 10, Registered medical doctor, 49 years, Amana RRH	<i>"I can forget or get overwhelmed but we really insist to write them down but are mostly done"</i>
	Informant no. 03, Nursing officer, 33 years, Amana RRH	<i>"If there is no supervisor, registrars might leave without writing SAS score grade in the patient file"</i>
Healthcare worker's experience in using SAS score tool	Informant no. 07, Nursing officer, 29 years, Amana RRH	<i>"Everything is fine with specialist's doctors"</i>
	Informant no. 09, Pediatrician, 51 years, Amana RRH	<i>"In general, it is difficult for beginners to use the tool because it confuses a little on scoring parameters such as upper and lower chest wall indrawing while on the other side, it is very easy for experienced doctors like me to use SAS score"</i>
Factors influencing adherence to the use of the SAS score tool for neonatal CPAP prioritization among healthcare providers	Informant no. 14, Registered medical doctor, 29 years, Amana RRH	<i>"I recommend doing the SAS score quickly and early then setting the baby on CPAP, just because early CPAP has served a lot of new-borns"</i>
	Informant no. 03, Nursing officer, 33 years, Amana RRH	<i>"Having a lot of patients than service providers means that the baby won't be scored accordingly as required, it is like wastage of time"</i>
	Informant no. 13, Pediatrician, Pediatric HOD, 37 years, Amana RRH	<i>"There is a problem of unstable budget so performance payments can be given 3 to 4 times a year"</i>
	Informant no. 16, Pediatrician, 49 years, Amana RRH	<i>"There is no motivation, you may find someone working in the hot premature unit, and the ward is busy hoping that maybe he will be motivated, but there is nothing he or she gets apart from salary"</i>
	Informant no. 03, Nursing officer, 33 years, Amana RRH	<i>"Someone might not be aware of the score but they are fearful to ask for assistance"</i>
	Informant no. 3, Nursing officer, 33 years, Amana RRH	<i>"When new staffs arrive, they are educated and constantly reminded on the use of the SAS score"</i>
	Informant no. 09, Pediatrician, 51 years, Amana RRH	<i>"Those who have been here for years now do know, but those who came recently from school do not"</i>
	Informant no. 07, Nursing officer, 29 years, Amana RRH	<i>"We were trained two years ago at Muhimbili Hospital to operate CPAP and phototherapy machines. We were also taught on criteria for CPAP initiation and oxygen supplementation using the SAS score tool"</i>

right to withdraw from the study at any time. Participant anonymity and confidentiality were ensured throughout the study.

Results

Social demographic characteristics of the study population

The study population involved 16 healthcare providers, among which are ten doctors and six nurses. Among the doctors, there are four pediatric specialists and six general medical practitioners. Among the nurses, three are registered nurses (with a diploma in nursing), and three are nursing officers (with a degree in nursing). The age range was between 26 to 57 years old, with a mean age of 38.4 years (SD = 10.1) and the majority being between

29 to 49 years. Years of experience range was between 1 to 16 years, with a mean of approximately 5.6 years (SD = 5.24) working in the neonatal ward at Amana Regional Referral Hospital.

Utilization of the SAS score tool by healthcare workers

Issues emerged with the adherence of healthcare workers to implement the SAS score tool in both observational findings and interview findings. Results suggest that healthcare workers do partially adhere to the use of the SAS score tool for neonates presenting with respiratory distress due to some issues with decision-making and documentation of the SAS score. These issues are presented below.

Decision making

In this study, it is seen from in-depth interviews that decisions on prioritizing neonates to CPAP machines are made based on distress severity, which is determined using the SAS score tool. This was also reported using the observation checklist that doctors do use the SAS score tool to assess neonate's distress severity and make decisions on using CPAP. However, monitoring these neonates after they have been kept on CPAP was a challenge, which was both seen in the In-depth interviews and was also observed from the observation checklist. This is due to some different factors that are explained in the Factors Influencing Adherence section. One of the informants had this to say.

"Decisions to put a child on CPAP are often correct; the problem is in the follow-up. For example, a patient set on CPAP should be monitored every fifteen minutes for the first hour and, after that, should be monitored every four hours. It should be so until the day that CPAP is taken off, where he or she has to be reassessed for SAS score."

(Informant No. 16, Pediatrician, 49 years, Amana RRH)

The decision-makers are the registered doctors, but due to the high workload, decisions are also made by intern doctors together with nurses alone, and later on, the registered doctors come to review the decisions made. Most informants mentioned the importance of using the SAS score tool in decision making, and they even mentioned that it is posted on the neonatal ward walls for all the practitioners to use it effectively since there is no access to peripheral blood gas laboratory investigations hence, they have to abide to use the SAS score tool to know the distress severity prior CPAP initiation and monitoring.

"We rely on severity, we do use the SAS score, others will continue with oxygen therapy and other important medications and supportive management, there is nothing much you can do."

(Informant No. 06, Registered medical doctor, Amana RRH)

SAS score is not used for decision-making alone when having premature neonates with or without distress for initiating CPAP treatment. It is reported through in-depth interviews that all neonates born prematurely with less than 1.5 kg birth weight should be kept on CPAP as prophylaxis for respiratory distress regardless of the neonate's SAS score grade. One of the informants had this to say:

"Concerning CPAP, we assess the ability to breathe by using the Silverman Score. If the baby scores four and above, we put him/her on CPAP. For babies with low birth weight, born before time, and those below 1.5 kg, we also put them on CPAP. Even if the SAS score doesn't support, we initiate supportive CPAP for breathing"

(Informant no. 10, Registered medical doctor, 49 years, Amana RRH)

Proper documentation

It is reported in this study, with both observations and in-depth interviews (IDI), that there is a challenge with proper documentation after using the SAS score tool. The biggest challenge is the documentation of all the SAS score tool parameters that the doctor has assessed in the patient's file. This is evidenced by one of the informants who had this to say:

"Documentation is done by most of the doctors although not everyone writes everything"

(Informant no. 16, Pediatrician, 49 years, Amana RRH)

However, informants mentioned poor documentation is mostly caused by a high workload due to understaffing. Doctors are overwhelmed with lots of serious sick neonates and lots of admissions, especially during the night shifts hence, they do not properly document the SAS score to all files of neonates with respiratory distress.

"I can forget or get overwhelmed, but we really insist on writing them down but are mostly done."

(Informant no. 10, Registered medical doctor, 49 years, Amana RRH)

The informant's report on the interviews is supported by the observation results, which show they are adhering to the use of the SAS score tool to assess distress severity in neonates with respiratory distress, but there was poor documentation of all SAS score tool parameters accurately. On the observation results, most of them missed one or two parameters in the SAS score tool and one parameter in the vitals.

Discussion

The study's findings indicate that medical practitioners somewhat adhere to the employment of the SAS score tool for decision-making when it comes to prioritizing neonates for CPAP treatment. This approach aligns with the established guidelines for children and adolescent's standard treatment, mandating doctors to evaluate

neonatal respiratory distress before initiating CPAP. This evaluation includes the utilization of a physical examination, as recommended, in conjunction with the SAS score tool and arterial blood gas analysis [8]. Moreover, the guidelines necessitate continuous monitoring of neonates receiving CPAP, with assessments performed every 15 min during the first hour and every 4 h after that until CPAP discontinuation. These assessments involve scoring the infant's distress using the SAS score tool along with vital signs. The SAS score comprises five parameters: upper chest movement, lower chest retraction, xiphoid retraction, nares dilatation, and expiratory grunt [2]. The study illustrates that doctors' adherence to the SAS score tool results in better decision-making regarding CPAP initiation and monitoring for neonates with RDS. This is particularly valuable in settings where access to peripheral blood gas testing is limited, which is vital for determining blood oxygenation levels. Study participants reported that the SAS score tool is easy and simple to use once healthcare workers know its application. These findings corroborate results from other studies advocating the use of the SAS score tool to assess the severity of respiratory distress in resource-limited settings without access to laboratory investigations [9]. A study in Malawi emphasized the importance of using scoring systems, including the SAS score, to assess neonatal respiratory distress for sound decision-making regarding CPAP initiation [4]. Despite healthcare workers' adherence to the SAS score tool, the study identifies issues related to poor documentation of these scores. This is primarily attributed to an imbalanced patient-to-doctor ratio, leading to lapses in appropriate documentation. The guidelines stipulate that neonates with respiratory distress should undergo an assessment to determine the severity of their condition before initiating CPAP. Subsequently, they should be continuously monitored, with a 15-min interval for the first hour and subsequent four-hour intervals encompassing the evaluation of vital signs and SAS scores [8, 11]. The findings from this study highlight the practicality of employing the SAS score tool for neonates with respiratory distress. It is perceived as an uncomplicated and cost-effective tool that can be used effectively even by inexperienced healthcare workers. This aligns with the outcomes of a study evaluating the SAS score tool's performance in predicting the need for respiratory support in neonates, emphasizing its suitability for application in resource-limited settings, even by relatively inexperienced staff [2].

This study aimed to evaluate the utilization of the SAS score tool for prioritizing neonates with respiratory distress syndrome (RDS) for continuous positive airway pressure (CPAP) treatment in resource-constrained settings. The study observed that healthcare providers

generally adhere to the application of the SAS score tool for decision-making when prioritizing neonates with RDS for CPAP, which is crucial for the allocation of limited CPAP resources based on the severity of the condition. However, it is essential to acknowledge that challenges related to adherence could affect the quality of decisions and the competency of healthcare workers.

Conclusions

In conclusion, this study highlights the challenge of partial adherence among healthcare providers to the use of the SAS score tool for decision-making to initiate and monitor neonates with respiratory distress to CPAP in resource-limited settings. The impact of this partial adherence on neonatal outcomes is significant as it contributes to the high neonatal mortality rate in Tanzania as death due to poor decision-making and adherence to using the SAS Score tool as recommended in guidelines may lead to avoidable neonatal deaths and longer hospital stays. Challenges such as staff shortage and a high patient load lead to partial adherence, including poor documentation and inadequate monitoring post-CPAP initiation. We study authors recommend addressing these challenges as they are crucial to improving neonatal care quality and reducing neonatal mortality in developing countries by avoiding preventable deaths. Supportive work environments, comprehensive training, and effective supervision are needed to enhance adherence to guidelines and ultimately improve outcomes for neonates with respiratory distress.

Abbreviations

CPAP	Continues Positive Airway Pressure
HDU	High Dependency Unit
IDI	In-depth Interview
IRB	Institutional Review Board
MUHAS	Muhimbili University of Health and Allied Science
NICU	Neonatal Intensive Care Unit
RDS	Respiratory Distress Syndrome
RRH	Regional Referral Hospital
SAS	Silverman Anderson Severity
SDG	Sustainable Developmental Goals
WHO	World Health Organization

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Authors' contributions

FS.S. prepared the study proposal, conducted data collection, and prepared the study report and manuscript. AT.N. and M.A. supervised and guided the whole process and participated in writing the study proposal methods and conceptual framework, study report, and manuscript. All authors revised the manuscript to address all reviewer's comments.

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Data availability

The datasets used and analyzed during this study are available and provided together with this manuscript in the supplementary files.

Declarations

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Muhimbili University of Health and Allied Sciences Institutional Review Board (IRB), with reference number DA282/298/01.C/1721. All participants provided written informed consent before participating in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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