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Ten years of newborn respiratory support, six years of surfactant replacement training in Nigeria; opportunities and partnerships for saving newborn lives

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Abstract: Background

Newborn respiratory support (NRS) is desirable in Nigerian healthcare delivery system. Respiratory support is associated with increase newborn survival in high-income countries. NRS capacity was an uncommon skill set in Nigeria healthcare system. The interventions available were newborn resuscitation, oxygen administration and improvised CPAP. NRS service is the missing link to saving newborn lives. The capacity gap for NRS was noted in 2012 by the Benin working group. A modular approach with hand-on demonstration on selected topics were developed and used for simulation-based training (SBT) of newborn healthcare workers leading to the commencement of respiratory support services.

Aim and objectives: Ten-year audit of the trainings and activities of the newborn RSG Group

Results: In ten years and 30 trainings, 1240 newborn care providers (consultant paediatricians, senior registrars, registrars, medical officers, nurses, paramedics) were trained. There were 18 (60%) public and 12 ((40%) private (solicited) trainings at Lagos (6), Abuja (5) Port Harcourt (3), Kaduna, Benin, Ibadan (2), Asaba (2), Okija, Birnin Kebbi, Akure, Uyo, Kano, Enugu (1) and Cotonou, Benin Republic (1). The SRT (master class) trained 201 newborn healthcare practitioners in its first year at Abuja, Lagos and Port

Harcourt on MIST/LISA surfactant administration techniques, subsequently became part of the respiratory support trainings. Surfactant uptake increased from 300 doses in 2019 to 7,535 doses by 2024

Conclusion: Newborn respiratory support and SRT trainings using novel methods and SBT increased the uptake and provision of respiratory support services and surfactant uptake in Nigeria and the sub region for saving newborn lives.

Résumé: *Contexte:* Le soutien respiratoire néonatal (SRN) constitue une composante essentielle des soins néonataux et est fortement associé à la survie des nouveau-nés dans les pays à revenu élevé. Au Nigéria, la capacité en SRN était initialement limitée. Les interventions disponibles se résument à la réanimation néonatale, l'administration d'oxygène et la mise en place de CPAP improvisée. Le service de SRN représentait alors un maillon manquant pour la réduction de la mortalité néonatale. Ce déficit de capacité a été identifié en 2012 par le *Benin Working Group*. Une approche modulaire incluant des démonstrations pratiques sur des thématiques sélectionnées a été développée pour former les professionnels de santé néonataux par simulation (*simulation-based training*, SBT), permettant ainsi le lancement progressif des services de soutien respiratoire.

Objectif: Réaliser un audit des dix années de formations et d'activités du Groupe de soutien respiratoire du nouveau-né.

Méthodes et résultats: Au cours des dix dernières années, 30 sessions de formation ont permis de former 1 240 prestataires de soins néonataux (pédiatres consultants, médecins résidents seniors, médecins résidents, médecins généralistes, infirmiers, techniciens). Parmi ces formations, 18 (60 %) ont été réalisées dans le secteur public et 12 (40 %) dans le secteur privé à Lagos (6), Abuja (5), Port Harcourt (3), Kadu-

na, Benin, Ibadan (2), Asaba (2), Okija, BirninKebbi, Akure, Uyo, Kano, Enugu (1) et Cotonou, Bénin (1).

Le *Master Class* sur l'administration de surfactant a formé 201 professionnels de santé néonataux dès sa première année à Abuja, Lagos et Port Harcourt sur les techniques MIST/LISA d'administration de surfactant, intégrées par la suite dans les formations de soutien respiratoire. L'utilisation du surfactant est passée de 300 doses en 2019 à 7 535 doses en 2024.

Conclusion: Les formations au soutien respiratoire néonatal et l'administration de surfactant, combinant méthodes innovantes et SBT, ont contribué à l'augmentation de la capacité de prise en charge respiratoire et de l'utilisation du surfactant au Nigéria et dans la sous-région, participant ainsi à la sauvegarde des vies de nouveau-nés.

Mots-clés: Soutien respiratoire, administration de surfactant, formation.

Introduction

Newborn respiratory support (mechanical ventilation [MV], Continuous positive airway pressure [CPAP] and surfactant replacement therapy [SRT]) is desirable in the Nigerian healthcare delivery system.¹⁻² Respiratory support is associated with increased newborn survival in high-income countries.^{1,3} The development, evolution and deployment of respiratory support solutions have been ongoing with middle and low-income countries lagging in the availability of these solutions for service.¹ Infant mechanical ventilators with CPAP have been available since the early nineteen seventies but the earliest known use in Nigeria was in 1978 by the indigenous neonatologist Prof Jackson Omene.⁴ The determinants of newborn morbidity and mortality in Nigeria over the past four decades have remained largely unchanged mainly from preventable diseases requiring respiratory support for their management.⁵⁻⁶ There has been interventions and programs aimed at making newborn respiratory support services available in Nigeria hospitals in the past few decades. Foremost amongst them was the provision of newborn respiratory support devices to six university teaching hospitals in 2006 by the Vamed group and twelve more teaching hospitals some years later.⁷ These efforts however did not translate to improved newborn care in most of the facilities due to capacity or the clinical training gap.

Newborn respiratory support capacity was an uncommon skill set as it has not been incorporated into undergraduate and postgraduate medical training curriculum. Those having newborn respiratory support skill set were either trained abroad or had part of their training outside the country. The clinical training interventions available for newborn care providers were mainly basic newborn resuscitation (Neonatal resuscitation programme [NRP] & Helping babies breathe [HBB]); oxygen use, and improvised CPAP as these were the prevalent service intervention for newborn care in Nigeria before 2013.^{8,9}

Newborn respiratory support has been the missing link to saving newborn lives in Nigeria. The capacity gap for

newborn respiratory support was noticed in 2012 by the Benin working group consisting of Prof Angela Okolo, Prof Austine Omoigberale, Dr Readon Ideh and Dr Ikehukwu Okonkwo. The dearth of clinical capacity was obvious as non functional newborn respiratory support devices dotted several university teaching hospitals.^{10,11} Following a series of strategy meetings with the goal of commencing respiratory support services at the University of Benin Teaching hospital, a modular approach was adopted, and the training topics and hand-on demonstrations were selected and developed. The same simulation-based training modules were reviewed, revised and used for the training of the newborn healthcare workers leading to the commencement of newborn respiratory support services.^{12,13} The first set of modules were seven and the training was for a day but over time eight more modules were developed and the training became a two-day programme.

The respiratory support trainings began in 2014 as a pre-conference workshop of the neonatal association and in 2017 as the preconference of the paediatric association. The surfactant master classes or SRT trainings was developed in 2018 as a standalone training in three locations and eventually continued as part of the newborn respiratory support modules. The training modules have been published as the manual of newborn respiratory support since December 2016 and currently has three editions in print.¹⁴

The aim of the trainings was to provide newborn respiratory support and surfactant administration training and skills laboratory using simulation-based techniques to newborn healthcare providers. This home-grown training intervention has been conducted in several towns and cities in Nigeria and Cotonou, Benin Republic. This is an impact report of the first ten years of the training programme.

Methods

The prospectively kept records of the number of training attendees in all training locations during the period under review were collated and analysed after being

entered into an excel spreadsheet. Descriptive variables like the training type, professional status of the training attendees both medical and nursing were analysed. The number of times the training was held at the different locations and according to the geopolitical zones were also reviewed, entered for analysis. The training events were also highlighted, and the yearly training trend were reviewed and analysed with the same software.

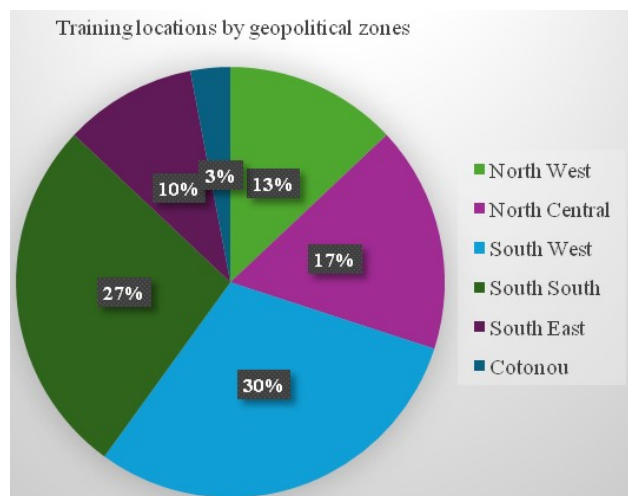
Results

In ten years and 30 trainings, 1240 newborn healthcare providers were trained. The trainees consisted of paediatricians, senior registrars, registrars, medical officers, nurses and paramedics. Table 1 shows the distribution of neonatal healthcare workers trained by the RSG program in the first ten years. The trainings were either open to the public in 18 (58.6%) or private and solicited trainings in 12 (41.4%). The locations of the trainings were Lagos 6 (20%), Abuja 5 (16.7%) Port Harcourt 3 (10%), Kaduna 2 (6.7%), Benin 2 (6.7%), Ibadan 2 (6.7%), Okija, Birnin Kebbi, Asaba, Akure, Uyo, Kano, Enugu 1 ((3.3%) respectively and Cotonou, Benin Republic 1 (3.3%). The RSG training locations by geopolitical zones in Nigeria and Cotonou, Benin Republic is shown in Figure 1.

Table 1: distribution of neonatal healthcare workers trained by the RSG program

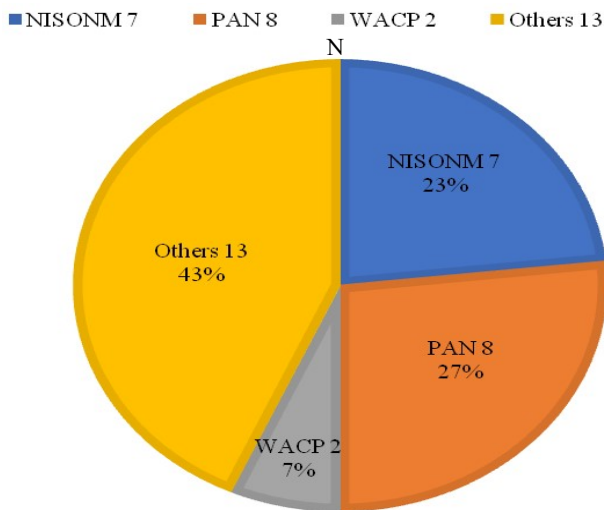
Healthcare worker category	Range (%)	Mean range (%)
Consultants	16 - 45.9	26.4
Senior Registrar	8.6 – 27.6	18.4
Registrar	0 - 28.9	12.0
Medical Officers	0 – 13.5	7.92
Nurses	16.3 – 53.3	34.5
Paramedics	0 – 4.5	0.68

Fig 1: RSG Training locations by geopolitical zone



The trainings were held either as the preconference workshop of the paediatric association of Nigeria (PAN), Nigerian society for neonatal medicine (NISONM) annual general scientific meetings, the West African college of physicians’ special update course and others as shown in Figure 2.

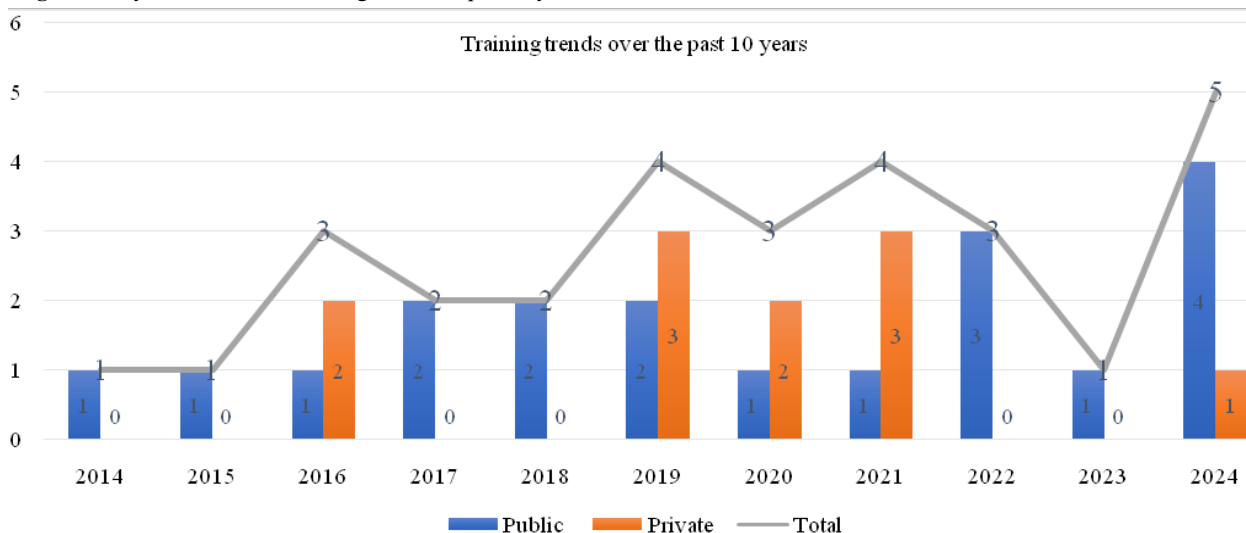
Fig 2: Distribution of organisations, associations or groups that hosted RSG meetings



The Surfactant replacement therapy trainings (SRT Master class) began in 2018 as a standalone meeting training 201 newborn healthcare practitioners in the first year at Abuja, Lagos and Port Harcourt on MIST/LISA surfactant administration methods. They consist of 108 (53.7%) doctors, 91(45.3%) nurses and 2 (1%) unspecified. Fifty-nine (54.6%) of attending doctors are Consultants, 27 (25%) Senior registrars and 22 (20.4%) Medical officers. Out of the trained HCP, 69(34.5%) were in Lagos state, 50 (25%) in Abuja, 32 (16%) in Port Harcourt. Up to 300 doses of Bles surfactant has been delivered during the period. The SRT Master class subsequently became part of the respiratory support trainings. Surfactant up take increased from 300 doses in 2019 to 7,535 doses by 2024.

The yearly distribution of the public and private trainings by the number of trainings in the past 10years is represented in the Figure 3. Newborn respiratory support services have been on the increase since the start of this project, above 15 newborn health care facilities have been directly mentored to provide full newborn respiratory support and surfactant replacement services.

Fig 3: Yearly distribution of trainings over the past 10years



Discussion

One of the key accomplishments of the RSG is the uninterrupted simulation-based training on newborn respiratory support for the past ten years. The number of persons trained is remarkable for a home-grown training programme from a middle and low-income country. This feat is accompanied by other landmark accomplishments like creating a training platform for the amplification of the novel principle of surfactant administration MIST/LISA increasing the uptake of surfactant by over 2500 % in 10years. This is a lesson for other MLICs for the development and implementation of targeted neonatal intervention and solutions. A similar training intervention may be targeted to save more newborn lives in other frontline African countries with high neonatal mortality. There are several simulation-based trainings available in most MLICs like helping babies breathe (HBB), Essential newborn care course (ENCC), Neonatal resuscitation training (NRT) for different categories of newborn healthcare workers.^{15,16} These training modules are for basic newborn resuscitation with positive pressure ventilation. Different cadre of newborn healthcare workers have been trained but the scope of the training does not cover advanced resuscitation (SRT, MV and CPAP) as the RSG training. The RSG trainings were initially held during neonatal and paediatric conferences as preconference training but later held both during the conferences and as a standalone training due to increased demand for trainings.

The need for advanced newborn resuscitation training in Nigeria has been long desired, many sought trainings abroad so much that the neonatal association in 2010 collaborated with their Egyptian counterparts for training. Up to 24 members of the association attended a two-week advanced resuscitation training in Mounsona, Egypt. The group returned to Nigeria with exposure, skills and competence to drive the respiratory support

service in Nigeria. That was the beginning of the process of accomplishment of the desired training program in the country with the RSG trainings beginning from 2014. The RSG trainings answers the question of what happens at the end of basic resuscitation with bag, valve and mask device. From a one-day training of seven modules between 2014 to 2017, it evolved to a two-day training of 12 modules and 2 supplementary modules. The commitment to train the frontline newborn healthcare workers and provide them with necessary skills and competence to save more newborn babies has remained unchanged.

The surfactant story in Nigeria has changed dramatically with the inaugural trainings termed the surfactant master classes and incorporation into the RSG training program, The 2500% increase in surfactant uptake is testament to the training strategy and introduction of a novel method of administration which is LISA/MIST. This method has made SRT the norm rather the exception and many newborn HCW are skilled and competent in SRT. The surfactant myth was broken with the understanding that MIST/LISA is associated with CPAP and other non-invasive respiratory support modalities rather than INSURE which was thought to be more related to mechanical ventilation. SRT is now practised in peripheral hospitals without ventilators saving more newborn lives.

The Covid pandemic led to expansion in the respiratory support landscape of Nigeria with a surge in provision and procurement of respiratory support devices for adult ICU's, PICUS and NICUs. While many of the devices were not specifically procured for the NICU's, some had the neonatal settings hence an increased demand for more public and private trainings. Many newborn healthcare workers are now better poised to make the most of these respiratory solutions for the care of the paediatric population especially the newborn babies. Other key accomplishments of the RSG include upgrade of neonatal services through the provision of advanced

neonatal equipment grant (NICU Incubators, patented CPAP devices, ventilators) to the University of Benin Teaching Hospital UBTH in partnership with international faculty and University alumnus. The introduction of CPAP trainings for both patented and improvised CPAP for newborn healthcare workers around the country and Benin republic. The group has been providing traditional neonatal laryngoscopes for SRT service to key hospitals during trainings.

The LISA or surfactant and CPAP project in six federal tertiary health institutions in association with international faculty, partners and industry. This project provided video laryngoscopes to these facilities for intubation training and skills development. The provision of the ultra-low-cost CPAP device was also one of the high points of the project.

The publication and distribution of over three thousand manuals of newborn respiratory care to participants during training and participating institutions. Above 15 newborn health care facilities have been directly mentored to provide full newborn respiratory support and surfactant replacement services and others to provide other levels of respiratory support with available devices.

Advanced newborn resuscitation and respiratory support trainings has become part of the in-service training of newborn healthcare workers. It is expected to become part of the pre-service (undergraduate) training of both medical and nursing healthcare workers in Nigeria and other middle- and low-income countries as a strategy to continue saving newborn lives.

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