Research

Evaluation of a National Training Programme on Use of Oxygen Therapy in Clinical Practice in Zambia

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ABSTRACT

Background: Zambia is a low-income country in sub-Saharan Africa and continues to face challenges in the provision of oxygen therapy in hospitals. While the Covid-19 pandemic increased oxygen availability in some settings it remains limited, ward nurses' knowledge and skills in the safe use of oxygen therapy was unknown.

Aim: To evaluate the impact of the use of oxygen therapy in clinical practice on the trainers' professional practice.

Method: A qualitative study was carried out using focus groups and a descriptive qualitative inquiry approach. Six months after delivery of the train the trainers' workshops,11 participants representing 11 hospitals, representing all provinces in Zambia were invited to attended three focus groups. The semi-structured interview guide which was used was adapted from a previous published study.

Results: The outcome of the evaluation revealed four themes: impact of the training on the trainers, learning to be a trainer, multidisciplinary training and realities of using oxygen. The study also confirmed that oxygen delivery in ward settings is complex due to the limited availability of other healthcare professionals, resources and access to continuing professional development (CPD).

Conclusion: Although progress has been made in enhancing oxygen therapy in Zambia. This study underscores the need for ongoing continuing professional development opportunities particularly for nurses who often administer, monitor, and titrate oxygen therapy and have limited access to other professionals. The study also emphasises the importance of coupling training programmes with dissemination and cascade training activities to maximise effectiveness.

Keywords: COVID-19 pandemic, Low-income country, Oxygen therapy, professional development, Zambia

INTRODUCTION

Medical oxygen insecurity is increasingly being recognised as a challenge in the delivery of high-quality care. In many low-income countries (LIC) hospitals it is still not possible to guarantee a continuous supply of oxygen or electricity to run oxygen concentrators, both of these challenges may result in unnecessary loss of life (WHO, 2023). In addition, healthcare workers' understanding of oxygen remains limited, which has been an ongoing issue for decades (Demilew et al., 2022. Cousins et al., 2016, Moradkhan & Sinoway, 2010). Medical oxygen is classed as an essential drug by the World Health Organisation (WHO) (2023), which is used to treat both acute and chronic conditions (Kitutu et al., 2022). In response to the ongoing oxygen insecurity the Lancet Global Health Commission on medical oxygen security was established in 2022 with a remit to identify the gaps in oxygen research, promote best practice and develop strong oxygen systems (Kitutu et al., 2022).

In Zambia, while efforts have focused on delivering oxygen on a wider basis; to support this it is essential that there is appropriate training for healthcare professionals. This paper presents an evaluation of a national oxygen training initiative for nurses, which used a train the trainer methodology to facilitate cascade training to other nurses across the country. The training consisted of 7 Master trainers, who trained 76 train the trainers, who then disseminated the training to a further 672 nurses in their hospitals.

BACKGROUND

Zambia is a LIC in sub-Saharan Africa. In 2023, a short train the trainers' workshop for nurses in 16 public hospitals in Zambia on the safe use of oxygen therapy was a wider project to strengthen oxygen provision in Zambia (UNOPS, 2025). A train the trainer approach was used in this project, as this approach is well established in Africa and seen as a cost-effective way to cascade context specific healthcare and to extend and sustain their impact on healthcare systems (Mormina & Pinder, 2018). This approach recognises that trainers understand the healthcare system context in which they work. A difference in this project was, that participants who attended the train the trainer session when they returned to their hospitals, they had to deliver the package to peers. The rationale for this was to bridge the theory-practice gap and provide ongoing bedside mentoring, support and guidance for their peers.

A one day train the trainer workshop was developed and delivered by the Master Trainers. Topics included assessment of the acutely ill ward patient, indications of oxygen therapy, types of oxygen therapy commonly used in ward settings, monitoring and oxygen safety. Trainers were given a training manual and pack to support in cascading the training. All trainers were added to a WhatsApp group which allowed trainers to share any queries, photographs and evaluations from the training. The cascade training was designed to be delivered in bite-size micro-teaching depending on clinical workloads or as a one-day training. Trainers were also required to submit an evaluation form and registers.

AIM

The aim was to evaluate the impact of Use of Oxygen Therapy in Clinical Practice workshop on trainers' professional practice.

METHODS

Study design

To evaluate the impact of the use of oxygen therapy in clinical practice workshop on trainers' professional practice, a qualitative study using focus groups and a descriptive qualitative inquiry approach was used (Doyle et al., 2020). Six months after the train the trainers' workshop had been delivered, all trainers were invited to attend a short (45 minute) focus group during the month of June 2024. The semi-structured interview guide was adapted from a previous published study which had ethics approval (Peterson et al., 2022).

Data collection and data analysis

Virtual focus groups were chosen as participants were geographically spread across the country, and it was not possible to conduct face-to-face focus groups and to co-ordinate the availability of participants due to shift work. Also, given the different sizes of hospitals, patient population and province, it was important to ascertain the strategies used to implement and evaluate the training in each hospital. This would allow the researchers to gain insights into participants experiences through their own words and perspectives (Mitchell, 2015. Clarke et al., 2021).

Consent was obtained prior to the focus groups, and they were recorded using MS Teams, as this allowed for transcription. The transcript was then checked with recordings of the interviews to confirm accuracy. During this process all transcripts were anonymised. Focus groups were led by one researcher and then an international team of researchers from Zambia and the UK checked the accuracy and completed the data analysis. Framework analysis was then used to identify themes and patterns (Gale et al., 2013; Parkinson et al., 2016).

Ethics approval

Approval to conduct this study was given by the Ministry of Health (Zambia) as part of the project monitoring and evaluation. Ethics approval was gained from Birmingham City University (UK) who provided technical support for the study.

RESULTS

In June 2024,11 participants representing 11 hospitals in Zambia and all provinces' participants in four focus groups. Four themes were identified: impact of the training on the trainers, learning to be a trainer, multidisciplinary training and realities of using oxygen.

Theme 1: Impact of the training on the trainers

When participants were asked about having attended the Train the Trainers programme. The first answer many of them gave was about how the training had changed them. There was unanimous recognition of the importance of the programme and for some it was *'…the best thing I have ever done…'*. They had enjoyed meeting up for the training and it is important to note, that these nurses came from across the provinces and had few opportunities to meet as a large group to share experiences and train together. For many of the participants this was the first time they had been nominated as Trainers, and they had been happy to attend but did not have high expectations. Participants knew they needed more

information on giving oxygen safely but until the training had started, they had not considered the complexity of the topic. For them oxygen was *'…just giving oxygen…'*. The training changed all that *'…didn't know about giving too much oxygen…' '…the importance of assessment…' '…the different oxygen delivery devices…and when not to use it…'*

The majority had never been the role of a trainer, instead they had been on the receiving end as a participant, as one said *'… I've got the bug now… I want to teach…'*. This led to recognition by peers, management and other members of the multi-disciplinary team. Another participant pointed out initially she had been very anxious and nervous, afraid they would know more about it than she did. However, within a short time, they had limited knowledge and skills and needed her input. In consequence, this project has contributed to raising the profile of ward nursing, demonstrating that these nurses have their own specialist expertise.

Theme 2: Learning to be a trainer and having access to CPD

The Train the Trainer group included a small number of clinical instructors (practice-based educators). As one of them said *'…this is what we do…'*, but she went on to point out to individual students training at the bedside rather than groups of nurses and others who were her peers and others who were not students in the program. With most nurses completing a Diploma level registration programme there had been little or no input on teaching skills, therefore, they had two things to learn, firstly the content and secondly how to train others. The majority recognised that a longer training would have been helpful *'… it was a lot to learn… some of the topics were new and I had to learn to teach…'*. Perhaps, as a result of this many participants reported initially delivering the training as a team, as they needed to gain the confidence to become sole trainers *'…I have changed… I was nervous when I started but now I am happy to teach on my own …'*.

Overall, the feedback was very positive, and trainers found the resources for the training useful particularly the posters and delegate information packs *'…this is the best training I have ever done…' '…love the training and love the teaching…'*. Many trainers reported this was the first time cascade training had taken place, with one participant stated *'…this was different… usually only senior staff get to go and they don't feed it back…'*. They were really pleased they had been given this opportunity and hoped there would be more to follow. Seeing the value of talking to each other and talking about what is actually happening *'…on the ground…'*

The Train the Trainer group recognised the importance of access to continuing professional development (CPD), however, when working in a rural hospital with limited internet connectivity, this was very difficult. As one trainer said *'… eish the internet is bad where I am… so I can't join in online…'*. Therefore, the train the trainer approach used in the project suited them as it was face to face and enabled them to build capacity in the nurses on the ground and in the hospitals. This meant there was less reliance on one individual or external teams.

Theme 3: Multidisciplinary Training

The training was designed by nurses, for ward nurses working in acute ward areas. However, it became apparent during the cascade training there was wider application, with medical students, interns

(doctors) and in some cases senior nurses joining the sessions. Some participants were concerned about teaching doctors, as one trainer reported *'… I was a bit shocked at first… but they asked questions and really wanted to learn…now we advertise the sessions for everyone…'*. Another trainer reported *'…after one session… a junior doctor asked if he could come and talk to me on his own … I said yes… and he came with his colleagues… they seemed to enjoy the session and we work better together…'*. Another trainer said *'… the training resources were useful as we were able to share them with others…'*

Theme 4: Realities of using oxygen

A consistent theme was the realities of using oxygen. For many the oxygen supply was variable, this was compounded because as they were not used to having oxygen *'… sometimes the oxygen runs out but people forget to turn off the tap [oxygen flow regulator] then when we have oxygen it is wasted…'.* One trainer, a critical care nurse identified the realities of working in critical care *'… we have the knowledge… but then sometimes we have challenges because we do not have the necessary equipment… I know a ventilated patient… we need to be monitoring arterial blood gases… but there's no arterial blood gas… so everything that is done is all guesswork… and you're just looking at one parameter as a monitor of an oxygen saturation…'*.

Many trainers reported participants felt frustrated at having limited access to oxygen and devices, for example *'…so it becomes very challenging and frustrating…'* another pointed out *'… we don't have all the devices in the hospital…'*. Trainers also recalled their experiences during Covid-19, one trainer *said '…its important because what happened during COVID … suddenly got oxygen and the more senior nurses were struggling because it… suddenly was there and we were trying to remember your training…'*. The trainers were clear this situation must not occur again.

Overall, trainers reported that one of the most important things they had learned was how to wean patients off oxygen. They said many education and training programmes focused on initiating oxygen therapy but very few explained the importance of weaning oxygen and how to do it. As one trainer reported *'now I see it patients are staying on oxygen too long…' '…it is better for the patients especially if they have had a stroke or cardiac condition and it conserves the oxygen supply…'*. They had gone back with a fundamental change in their approach to oxygen therapy and were totally committed to making sure that all nurses they trained, understood when to use oxygen and when to stop it.

DISCUSSION

Although pre-service nurse education programmes include oxygen therapy. It was identified that over a decade ago that if the knowledge and skills gained in training are not used, there is a risk of decline in technical skills and decision making (General Medical Council, 2014; Cant et al., 2020). The recent Covid-19 pandemic revealed knowledge gaps in healthcare workers in the use of oxygen particularly in LIC (Brown et al., 2025). The reasons for "skill fade", may include oxygen is often available in (e.g. emergency departments, theatres and critical care), therefore, nurses on general wards may have little opportunity to see oxygen therapy in use, let alone deliver it themselves. As a consequence, when Covid-19 occurred there was a rapid influx of oxygen cylinders and devices to hospitals for use in non-critical care areas, plus nurses were re-deployed into high dependency areas resulted in a lack of confidence due to skill fade which led to some instances of miss-use (UNICEF, 2020; Issac et al., 2025). Nurses are often responsible for the monitoring of patients in ward areas requiring oxygen therapy,

this includes recording of vital signs such as pulse oximetry, which can facilitate early recognition of complications, which supports timely interventions (Peterson et al., 2022). This demonstrates the importance of access to CPD.

Reflecting on the findings it was evident that this training had resulted in more than had been expected. Not only had the trainers gained the knowledge, skills and expertise to train their peers, they had found their new role initially challenging but rewarding. They had adapted to their new role and had every intention to continue teaching their peers. With limited doctors, participants recognised the need for a national orientation training package for nurses, and they recommended that the training resources developed as part of this project be used. This fits with the Ministry of Health (2022) National Health Strategic Plan to strengthening nursing and midwifery education and practice.

It is a cause for concern that in many LIC including Zambia, there is a critical shortage of critical care beds. Baker et al (2025) point out that many critically ill patients can be found on the wards, with many deaths being preventable. While the burden of critical illness is not known, data from Tanzania estimated tat one in ten patients presenting to an emergency department are critically ill (Mboya et al., 2023). Similarly, Schell et al (2025) reported one in five inpatients in Malawi are critically ill. In Zambia, Dart et al (2017) conducted a point of prevalence amongst medical and surgical ward patients at the leading tertiary referral hospital, estimated that 7873 adult patients would require admission to critical care annually. This was identified as a major challenge as within the hospital there were only eight critical care beds, and 109 beds nationally. In consequence, there is urgent need to capacity strengthen ward staff with the essential knowledge and skills in the prevention, recognition and management of the deteriorating patient. With limited critical care beds, Zambian critical care nurses often provide support care to deteriorating patients outside of the critical care unit (Macey et al., 2022). Therefore, access to oxygen delivery systems and devices is crucial as oxygen may be initiated as part of the escalation plan and also used if patients are discharged early to create critical care bed capacity. With nurses often spending the most amount of time with patients, this project has illustrated the need for ward nurses to have the knowledge and skills to manage complex patients which includes initiating and responding to acute patient deterioration.

While access to medical oxygen has increased, its supply and use remains fragile in many settings, and this project has highlighted the urgent need to improve oxygen supply and delivery. Therefore, this project has highlighted the realities faced by nurses in Zambia and that is essential that conservation and weaning of oxygen when no longer needed become part of routine practice. The project has also shown the importance of in-service training because nurses need access to CPD opportunities to improve their knowledge and skills in practice.

LIMITATIONS

A limitation to this study was the relatively small sample size. However, all provinces were represented which provided some national perspectives and it has to be noted that their overall achievement of 76 train the trainers completed the programme, with a subsequence 672 nurses completing the training package has to be commended. Internet was a challenge when arranging focus groups which meant that some trainers were unable to join or lost internet during the session.

To mitigate this, the decision was made to hold a face-to-face focus group at the critical care nurses national conference and this proved successful. However, the use of virtual focus groups did allow for a wider data set to be collected.

CONCLUSION

This study evaluated the train the trainers' perceptions of impact of a national training package for ward nurses on safe oxygen delivery in Zambia. The study has confirmed that oxygen delivery in ward settings is complex due to the limited availability of other healthcare professionals, resources, and access to CPD. It has also highlighted the impact that a short training programme can have when it is coupled with a dissemination activity.

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